Necessary and sufficient conditions for the existence of solution of generalized fuzzy relation equations A ⇔X = B

In 2013 Li and Jin studied a particular type of fuzzy relational equations on finite sets, where the introduced min-bi-implication composition is based on Łukasiewicz equivalence. In this paper such fuzzy relation equations are studied on a more general level, namely complete residuated lattice valued fuzzy relation equations of type $\wedge_{y\in Y}(A(x,y)\leftrightarrow X(y)=B(x)$ are analyzed, and the existence of solutions S is studied. First a necessary condition for the existence of solution is established, then conditions for lower and upper limits of solutions are given, and finally sufficient conditions for the existence of the smallest and largest solutions, respectively, are characterized. If such general or global solutions do not exist, there might still be partial or point wise solutions; this is a novel way to study fuzzy relation equations. Such point wise solutions are studied on Łukasiewicz, Product and Gödel t-norm based residuated lattices on the real unit interval.

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Contributors: Turunen, E.
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Research output: Contribution to journal › Article › Scientific › peer-review

Soft robotic gripper with compliant cell stacks for industrial part handling

Robot object grasping and handling requires accurate grasp pose estimation and gripper/end-effector design, tailored to individual objects. When object shape is unknown, cannot be estimated, or is highly complex, parallel grippers can provide insufficient grip. Compliant grippers can circumvent these issues through the use of soft or flexible materials that adapt to the shape of the object. This letter proposes a 3D printable soft gripper design for handling complex shapes. The compliant properties of the gripper enable contour conformation, yet offer tunable mechanical properties (i.e., directional stiffness). Objects that have complex shape, such as non-constant curvature, convex and/or concave shape can be grasped blind (i.e., without grasp pose estimation). The motivation behind the gripper design is handling of industrial parts, such as jet and Diesel engine components. (Dis)assembly, cleaning and inspection of such engines is a complex, manual task that can benefit from (semi-)automated robotic handling. The complex shape of each component, however, limits where and how it can be grasped. The proposed soft gripper design is tunable by compliant cell stacks that deform to the shape of the handled object. Individual compliant cells and cell stacks are characterized and a detailed experimental analysis of more than 600 grasps with seven different industrial parts evaluates the approach.

General information

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Contributors: Netzev, M., Angleraud, A., Pieters, R.
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http://urn.fi/URN:NBN:fi:tuni-202009287146
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Source ID: 85091134388
Research output: Contribution to journal › Article › Scientific › peer-review

Tree species classification using structural features derived from terrestrial laser scanning

Fast and automated collection of forest data, such as species composition information, is required to support climate mitigation actions. Recently, there have been significant advances in the use of terrestrial laser scanning (TLS) instruments, which facilitate the capture of detailed forest structure. However, for tree species recognition the structural information from TLS has mainly been used to complement spectral information. TLS-only classification studies have been limited in size and diversity of plot forest types. In this paper, we investigate the potential of TLS for tree species classification. We used quantitative structure models to determine 17 structural tree features. These features were computed for 758 trees of five tree species, including two understory species, of a 1.4 hectare mixed deciduous forest plot. Three classification methods were compared: k-nearest neighbours, multinomial logistic regression and support vector machine. We assessed the potential underlying causes for structural differences with principal component analysis. We obtained classification success rates of approximately 80%, however, with producer accuracies for three of the five species ranging from 0 to 60%. Low producer accuracies were the result of a high intra- and low inter-species variability. These effects were, respectively, caused by a high size-dependency of the structural features and a convergence of structural traits across species as a result of the individual tree position in the forest canopy and shade tolerance. Nevertheless, the producer accuracies could be improved through sensitivity vs. specificity trade-offs, with over 50% for all species being obtainable. The high intra -and low inter-species variability complicate the classification. Furthermore, the classification performance and best classification method greatly depend on its targeted application. In conclusion, this study proves the added value of TLS for tree species classification but also shows that TLS opens up potential for testing and further development of ecological theory.

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Organisations: Computing Sciences, Research group: Inverse Problems, Universiteit Gent, National Physical Laboratory, University of Oxford, CSIRO Energy Centre, NERC National Centre for Earth Observation (NCEO), UCL Department of Geography
Contributors: Terryn, L., Calders, K., Disney, M., Origo, N., Malhi, Y., Newnham, G., Raumonen, P., Åkerblom, M., Verbeeck, H.
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Measurements of Mobile Blockchain Execution Impact on Smartphone Battery

This is a data descriptor paper for a set of the battery output data measurements during the turned on display discharge process caused by the execution of modern mobile blockchain projects on Android devices. The measurements were executed for Proof-of-Work (PoW) and Proof-of-Activity (PoA) consensus algorithms. In this descriptor, we give examples of Samsung Galaxy S9 operation while a broader range of measurements is available in the dataset. Examples provide the data about battery output current, output voltage, temperature, and status. We also show the measurements obtained utilizing short-range (IEEE 802.11n) and cellular (LTE) networks. This paper describes the proposed dataset and the method employed to gather the data. To provide a further understanding of the dataset's nature, an analysis of the collected data is also briefly presented. This dataset may be of interest to both researchers from information security and human–computer interaction fields and industrial distributed ledger/blockchain developers.

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Contributors: Bardinova, Y., Zhidanov, K., Bezzateev, S., Komarov, M., Ometov, A.
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EXT="Zhidanov, Konstantin"
EXT="Komarov, Mikhail"
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Flow-bounded trajectory-scaling algorithm for hydraulic robotic manipulators

On-line methods for trajectory scaling have focused on torque or acceleration bounded minimum time trajectories, while other system constraints have received little attention. For hydraulic systems, volumetric flow rate of the supply unit establishes a critical constraint, that has been neglected in control design. Consequently, commercial solutions for robotic control of hydraulic manipulators are typically limited to a compromise of a slower constant endpoint velocity, that can be achieved in any operating point without violating the constrained flow rate. However, with real-time analysis of the required volumetric flow rate, the desired trajectories can be executed much faster without violating the flow rate constraint or losing control accuracy. This study proposes an on-line method for trajectory scaling to perform predetermined trajectories in minimum time. Essentially, the method scales velocity along the trajectory to maintain achievable velocity at all times. The proposed method is capable of enforcing a global volumetric flow limit, whether it is constant or time-varying. The method is validated with simulations and experiments with a real hydraulic robotic manipulator. Experimental results show a very significant improvement in the trajectory tracking control, where the tracking error is reduced from 461 mm to 73 mm on a square trajectory.

General information

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Organisations: Automation Technology and Mechanical Engineering, Rambooms Oy
Contributors: Lampinen, S., Niemi, J., Mattila, J.

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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

On the zeros of the partial Hosoya polynomial of graphs
The partial Hosoya polynomial (or briefly the partial H-polynomial) can be used to construct the well-known Hosoya polynomial. The ith coefficient of this polynomial, defined for an arbitrary vertex u of a graph G, is the number of vertices at distance i from u. The aim of this paper is to determine the partial H-polynomial of several well-known graphs and, then, to investigate the location of their zeros. To pursue, we characterize the structure of graphs with the minimum and the maximum modulus of the zeros of partial H-polynomial. Finally, we define another graph polynomial of the partial H-polynomial, see [9]. Also, we determine the unique positive root of this polynomial for particular graphs.

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Organisations: Computing Sciences, Shahid Rajaee Teacher Training University, Swiss Distance University of Applied Sciences, Institute for Bioinformatics and Translational Research, Nankai University, Tianjin Polytechnic University, Central South University China, Aalto University, Peking University, Mathematics Faculty of Information Technology and Communication Sciences
Contributors: Ghorbani, M., Dehmer, M., Cao, S., Feng, L., Tao, J., Emmert-Streib, F.
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Source ID: 85083078026
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Wake-up Radio-Based 5G Mobile Access: Methods, Benefits, and Challenges
Future mobile networks will enable new use cases, requiring further enhanced data rates, latency, coverage, capacity, and reliability. In this article, to emphasize sustainable energy consumption and improved device battery lifetime, the concept,

benefits, and challenges of utilizing wake-up radio-based access in 5G networks are reviewed and discussed. To this end, the operating principle and associated wake-up signal structures are first reviewed, together with the corresponding power consumption and buffering delay trade-offs. Then the applicability of wake-up methods at mmWave bands and beamforming systems is addressed and highlighted. Additionally, an energy-efficient mobility management procedure for wake-up radio-based devices is described and demonstrated, utilizing narrowband uplink reference signals. Overall, the article provides an overview of wake-up-based access in 5G systems as a promising power-saving mechanism, and discusses the associated prospects, benefits, and challenges.

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Organisations: Electrical Engineering, Research group: Wireless Communications and Positioning, Huawei Technologies, Bell Labs, University of Oulu
Contributors: Rostami, S., Kela, P., Leppanen, K., Valkama, M.
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EXT="Rostami, Soheil"
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Characterizing Resource Allocation Trade-Offs in 5G NR Serving Multicast and Unicast Traffic
The use of highly directional antenna radiation patterns for both the access point (AP) and the user equipment (UE) in the emerging millimeter-wave (mmWave)-based New Radio (NR) systems is inherently beneficial for unicast transmissions by providing an extension of the coverage range and eventually resulting in lower required NR AP densities. On the other hand, efficient resource utilization for serving multicast sessions demands narrower antenna directivities, which yields a trade-off between these two types of traffic that eventually affects the system deployment choices. In this work, with the tools from queuing theory and stochastic geometry, we develop an analytical framework capturing both the distance- and traffic-related aspects of the NR AP serving a mixture of multicast and unicast traffic. Our numerical results indicate that the service process of unicast sessions is severely compromised when (i) the fraction of unicast sessions is significant, (ii) the spatial session arrival intensity is high, or (iii) the service time of the multicast sessions is longer than that of the unicast sessions. To balance the multicast and unicast session drop probabilities, an explicit prioritization is required. Furthermore, for a given fraction of multicast sessions, lower antenna directivity at the NR AP characterized by a smaller NR AP inter-site distance (ISD) leads to a better performance in terms of multicast and unicast session drop probabilities. Aiming to increase the ISD, while also maintaining the drop probability at the target level, the serving of multicast sessions is possible over the unicast mechanisms, but it results in worse performance for the practical NR AP antenna configurations. However, this approach may become feasible as arrays with higher numbers of antenna elements begin to be available. Our developed mathematical framework can be employed to estimate the parameters of the NR AP when handling a mixture of multicast and unicast sessions as well as drive a lower bound on the density of the NR APs, which is needed to serve a certain mixture of multicast and unicast traffic types with their target performance requirements.

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Organisations: Electrical Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Peoples' Friendship University of Russia, Federal Research Center Computer Science and Control of the Russian Academy of Sciences
Contributors: Samuylov, A., Moltchanov, D., Kovalchukov, R., Pirmagomedov, R., Gaidamaka, Y., Andreev, S., Koucheryavy, Y., Samouylov, K.
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Source ID: 85084923005
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TinderMIX: Time-dose integrated modelling of toxicogenomics data

BACKGROUND: Omics technologies have been widely applied in toxicology studies to investigate the effects of different substances on exposed biological systems. A classical toxicogenomic study consists in testing the effects of a compound at different dose levels and different time points. The main challenge consists in identifying the gene alteration patterns that are correlated to doses and time points. The majority of existing methods for toxicogenomics data analysis allow the study of the molecular alteration after the exposure (or treatment) at each time point individually. However, this kind of analysis cannot identify dynamic (time-dependent) events of dose responsiveness. RESULTS: We propose TinderMIX, an approach that simultaneously models the effects of time and dose on the transcriptome to investigate the course of molecular alterations exerted in response to the exposure. Starting from gene log fold-change, TinderMIX fits different integrated time and dose models to each gene, selects the optimal one, and computes its time and dose effect map; then a user-selected threshold is applied to identify the responsive area on each map and verify whether the gene shows a dynamic (time-dependent) and dose-dependent response; eventually, responsive genes are labelled according to the integrated time and dose point of departure. CONCLUSIONS: To showcase the TinderMIX method, we analysed 2 drugs from the Open TG-GATEs dataset, namely, cyclosporin A and thioacetamide. We first identified the dynamic dose-dependent mechanism of action of each drug and compared them. Our analysis highlights that different time- and dose-integrated point of departure recapitulates the toxicity potential of the compounds as well as their dynamic dose-dependent mechanism of action.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: BioMediTech, Tampere University, University of Helsinki
Contributors: Serra, A., Fratello, M., Del Giudice, G., Saarimäki, L. A., Paci, M., Federico, A., Greco, D.
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Source ID: 85085537918
Research output: Contribution to journal › Article › Scientific › peer-review

Utilizing Neurons for Digital Logic Circuits: A Molecular Communications Analysis

With the advancement of synthetic biology, several new tools have been conceptualized over the years as alternative treatments for current medical procedures. As part of this work, we investigate how synthetically engineered neurons can operate as digital logic gates that can be used towards bio-computing inside the brain and its impact on epileptic seizure-like behaviour. We quantify the accuracy of logic gates under high firing rates amid a network of neurons and by how much it can smooth out uncontrolled neuronal firings. To test the efficacy of our method, simulations composed of computational models of neurons connected in a structure that represents a logic gate are performed. Our simulations demonstrate the accuracy of performing the correct logic operation, and how specific properties such as the firing rate can play an important role in the accuracy. As part of the analysis, the mean squared error is used to quantify the quality of our proposed model and predict the accurate operation of a gate based on different sampling frequencies. As an application, the logic gates were used to smooth out epileptic seizure-like activity in a biological neuronal network, where the results demonstrated the effectiveness of reducing its mean firing rate. Our proposed system has the potential to be used in future approaches to treating neurological conditions in the brain.

General information

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Organisations: Electrical Engineering, Waterford Institute of Technology, Tampere University, Telecommunications Software and Systems Group (TSSG)
Contributors: Adonias, G. L., Yastrebova, A., Barros, M. T., Koucheryavy, Y., Cleary, F., Balasubramaniam, S.
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Bibliographical note

EXT="Balasubramaniam, Sasitharan"
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Research output: Contribution to journal › Article › Scientific › peer-review

ICface: Interpretable and controllable face reenactment using GANs

This paper presents a generic face animator that is able to control the pose and expressions of a given face image. The animation is driven by human interpretable control signals consisting of head pose angles and the Action Unit (AU) values. The control information can be obtained from multiple sources including external driving videos and manual controls. Due to the interpretable nature of the driving signal, one can easily mix the information between multiple sources (e.g. pose from one image and expression from another) and apply selective postproduction editing. The proposed face animator is implemented as a two stage neural network model that is learned in self-supervised manner using a large video collection. The proposed Interpretable and Controllable face reenactment network (ICface) is compared to the state-of-the-art neural network based face animation techniques in multiple tasks. The results indicate that ICface produces better visual quality, while being more versatile than most of the comparison methods. The introduced model could provide a lightweight and easy to use tool for multitude of advanced image and video editing tasks. The program code will be publicly available upon the acceptance of the paper.

General information

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Organisations: Computing Sciences, Aalto University
Contributors: Tripathy, S., Kannala, J., Rahtu, E.

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Source: Scopus
Source ID: 85085467341
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Serverless: What it Is, What to Do and What Not to Do
Serverless, the new buzzword, has been gaining a lot of attention from the developers and industry. Cloud vendors such as AWS and Microsoft have hyped the architecture almost everywhere, from practitioners' conferences to local events, to blog posts. In this work, we introduce serverless functions (also known as Function-as-a-Service or FaaS), together with on bad practices experienced by practitioners, members of the Tampere Serverless Meetup group.

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Organisations: Computing Sciences, Gofore Plc
Contributors: Nupponen, J., Taibi, D.
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73-fs SESAM mode-locked Tm,Ho:CNGG laser at 2061 nm
Tm,Ho co-doped disordered calcium niobium gallium garnet (CNGG) crystals are investigated as a novel gain medium for mode-locked lasers near 2 μm. With a GaSb-based semiconductor saturable absorber mirror (SESAM) and chirped mirrors for dispersion compensation such a laser is mode-locked at a repetition rate of 89.3 MHz. For a 5% output coupler, a maximum average output power of 157 mW is obtained with a pulse duration of 170 fs (28-nm broad spectrum centered at 2.075 μm, leading to a time-bandwidth product of 0.331). With a 0.5% output coupler, 73-fs pulses are generated at 2.061 μm with a spectral width of 62 nm (time-bandwidth product of 0.320) and an average output power of 36 mW.

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MoE publication type: A4 Article in a conference publication
Organisations: Research group: ORC, Physics, Max Born Institute, Ruhr-Universität Bochum, Jiangsu Normal University, China Academy of Engineering Physics, Hefei Institutes of Physical Sciences Chinese Academy of Sciences, Université de Caen Normandie, Universitat Rovira i Virgili, Fujian Institute of Research on the Structure of Matter
Contributors: Wang, Y., Zhao, Y., Pan, Z., Suomalainen, S., Härkönen, A., Guina, M., Griebner, U., Wang, L., Loiko, P., Mateos, X., Chen, W., Petrov, V.

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Keywords: Disordered garnets, Femtosecond pulses, Holmium lasers, Mode-locked lasers, Semiconductor saturable absorber mirror (SESAM), Solid-state lasers, Thulium lasers
DOIs:
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jufoid=71479
Source: Scopus
Source ID: 85085246577
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Adjoint-based optimization in the development of low-emission industrial boilers

A gradient-based method has been developed and programmed to optimize the NH (Formula presented.) injections of an existing biomass-fired bubbling fluidized bed boiler, the targets being to minimize both the NO and the NH (Formula presented.) emissions. In this context, the reactive flow inside the boiler is modelled using a custom-built OpenFOAM (Formula presented.) solver, and then the NO and NH (Formula presented.) species are calculated using a post-processing technique. The multiobjective optimization problem is solved by optimizing several weight combinations of the objectives using the gradient-projection method. The required sensitivities were calculated by differentiating the post-processing solver according to the discrete adjoint method. The adjoint-based sensitivities are validated against finite differences calculations. Moreover, in order to evaluate the optimization results, the optimization problem is solved using evolutionary algorithms software. Finally, the optimization results are physically interpreted and the strengths and weaknesses of the proposed method are discussed.

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Research output: Contribution to journal › Article › Scientific › peer-review

A membrane external-cavity surface-emitting laser (MECSEL) with emission around 825 nm

A MECSEL emitting around 825nm is reported. With a tuning range from 807nm to 840 nm, the MECSEL extends the coverage of high beam quality semiconductor based lasers in the short 8XXnm region and opens new perspectives for scanning ground-based water-vapor differential absorption lidar. 1.4W maximum output power has been achieved at room temperature operation and at 12.5W absorbed power using a 532 nm emitting pump laser. The beam quality has been investigated by M^2 measurements at different pump power. The effect from a growing pump mode and thermal lensing has been observed as the beam divergence angle decreases and the beam waist radius enlargens with increasing pump power.

General information

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Contributors: Phung, H. M., Kahle, H., Penttinen, J., Rajala, P., Ranta, S., Guina, M.
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DOIs:
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Bibliographical note

INT=phys,"Rajala, Patrik"
jufoid=71479
Source: Scopus
Source ID: 85082694209
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Anthropometric clothing measurements from 3D body scans

We propose a full processing pipeline to acquire anthropometric measurements from 3D measurements. The first stage of our pipeline is a commercial point cloud scanner. In the second stage, a pre-defined body model is fitted to the captured point cloud. We have generated one male and one female model from the SMPL library. The fitting process is based on non-rigid iterative closest point algorithm that minimizes overall energy of point distance and local stiffness energy terms. In the third stage, we measure multiple circumference paths on the fitted model surface and use a nonlinear regressor to provide the final estimates of anthropometric measurements. We scanned 194 male and 181 female subjects, and the proposed pipeline provides mean absolute errors from 2.5 to 16.0 mm depending on the anthropometric measurement.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Computing Sciences, Research group: Vision, NOMO Technologies Ltd
Contributors: Yan, S., Wirta, J., Kämäräinen, J.
Number of pages: 11
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Original language: English
ASJC Scopus subject areas: Software, Hardware and Architecture, Computer Vision and Pattern Recognition, Computer Science Applications
Keywords: 3D body model, Anthropometric measurement, Non-rigid ICP
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URLs:
http://urn.fi/URN:NBN:fi:tuni-202006116044
Source: Scopus
Source ID: 85078296322
Research output: Contribution to journal › Article › Scientific › peer-review

Complex-domain sparse imaging in terahertz pulse time-domain holography with balance detection

Terahertz pulse time-domain holography (THz PTDH) is an ultimate technique both for the measurement of object optical properties and broadband wavefront sensing. However, THz PTDH has valuable restriction connected with low signal-to-noise ratio which becomes a serious issue in coherent measurements. This noise problem could be solved by filtering with use of modern block-matching algorithms based on nonlocal similarity of small patches of images existing in investigated objects. Here we present the study on the use of denoising algorithms applied for hyperspectral THz data in the spatio-temporal and spatial-spectral domain. We provide a numerical simulation of denoising in case of broadband uniform topologically charged (BUTCH) beam of pulsed THz radiation.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, ITMO University
Contributors: Kulya, M. S., Katkovnik, V., Egiazarian, K., Petrov, N. V.
Publication date: 2020

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Editors: Sadwick, L. P., Yang, T.
Article number: 1127921
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Bibliographical note

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Source ID: 85083756750
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Continuous-wave optical parametric oscillators for mid-infrared spectroscopy

The atmospheric window at 3 to 5 μm is one of the most important spectral regions for molecular spectroscopy. This region accommodates strong fundamental vibrational spectra of several interesting molecules, including species relevant for air quality monitoring, medical diagnostics, and fundamental research. These applications require excellent spectroscopic sensitivity and selectivity. For example, atmospheric research often needs precise quantification of trace gas fractions of down to the parts-per-trillion level (10^{-12}), with the capability of resolving individual spectral features of different molecular compounds. This sets stringent requirements for the light source of the spectrometer in terms of output power, noise, and linewidth. In addition, the wavelength tuning range of the light source needs to be large, preferably over the entire atmospheric window, in order to enable measurements of molecular fingerprints of several compounds.

Continuous-wave optical parametric oscillators (CW-OPOs) are one of the few light sources that have the potential of combining all these favorable characteristics. This contribution summarizes our progress in the development of CW-OPOs, with an emphasis on precise frequency control methods for high-resolution molecular spectroscopy. Examples of new applications enabled by the advanced CW-OPO technologies will be presented. These examples include a demonstration of world-record detection sensitivity in trace gas analysis, as well as the first characterization of infrared spectrum of radioactive methane $^{14}CH_4$.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Physics, Research group: Infrared Light Sources, University of Helsinki
Contributors: Vainio, M.
Publication date: 2020

Host publication information
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Publisher: SPIE
Editors: Schunemann, P. G., Schepler, K. L.
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
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Bibliographical note
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Correlates of social media fatigue and academic performance decrement: A large cross-sectional study
Purpose: The current study aims to investigate if different measures related to online psychosocial well-being and online behavior correlate with social media fatigue.
Design/methodology/approach: To understand the antecedents and consequences of social media fatigue, the stressor-strain-outcome (SSO) framework is applied. The study consists of two cross-sectional surveys that were organized with young-adult students. Study A was conducted with 1,398 WhatsApp users (aged 19 to 27 years), while Study B was organized with 472 WhatsApp users (aged 18 to 23 years).
Findings: Intensity of social media use was the strongest predictor of social media fatigue. Online social comparison and self-disclosure were also significant predictors of social media fatigue. The findings also suggest that social media fatigue further contributes to a decrease in academic performance.
Originality/value: This study builds upon the limited yet growing body of literature on a theme highly relevant for scholars, practitioners as well as social media users. The current study focuses on examining different causes of social media fatigue induced through the use of a highly popular mobile instant messaging app, WhatsApp. The SSO framework is applied to explore and establish empirical links between stressors and social media fatigue.

General information
Publication status: E-pub ahead of print
MoE publication type: A1 Journal article-refereed
Organisations: Computing Sciences, Aalto University, George Mason University, Turun Kauppakorkeakoulu, North-West University
Contributors: Malik, A., Dhir, A., Kaur, P., Johri, A.
Number of pages: 24
Publication date: 2020
Peer-reviewed: Yes

Publication information
Journal: INFORMATION TECHNOLOGY AND PEOPLE

ISSN (Print): 0959-3845
Original language: English
ASJC Scopus subject areas: Information Systems, Computer Science Applications, Library and Information Sciences
Keywords: Academic performance decrement, Fear of missing out (FoMO), Online privacy, Self-disclosure, Social comparison, Social media fatigue
Electronic versions:
Correlates of social media fatigue 2020
DOIs:
10.1108/ITP-06-2019-0289
URLs:
http://urn.fi/URN:NBN:fi:tuni-202009247121
Source: Scopus
Source ID: 85081375513
Research output: Contribution to journal › Article › Scientific › peer-review

Cyclic quantum walks: Photonic realization and decoherence analysis

Quantum walks serve as novel tools for performing efficient quantum computation and simulation. In a recent experimental demonstration [1] we have realized photonic quantum walks for simulating cyclic quantum systems, such as hexagonal lattices or aromatic molecules like benzene. In that experiment we explored the wave function dynamics and the probability distribution of a quantum particle located on a six-site system (with periodic boundary conditions), alongside with simpler demonstration of three- and four-site systems, under various initial conditions. Localization and revival of the wave function were demonstrated. After revisiting that experiment we will theoretically analyze the case of noisy quantum walks by implementing the bit-phase flip channel. This will allow us to draw conclusions regarding the performance of our photonic quantum simulation in noisy environments. Finally, we will briefly outline some future directions.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Physics, University of Ottawa, Canada, National Research Council, Bar Ilan University, Massachusetts Institute of Technology
Contributors: Nejadsattari, F., Zhang, Y., Jayakody, M. N., Bouchard, F., Larocque, H., Sit, A., Fickler, R., Cohen, E., Karimi, E.
Publication date: 2020

Host publication information

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Publisher: SPIE
Editors: Hemmer, P. R., Migdall, A. L., Hasan, Z. U.
Article number: 1129503
ISBN (Print): 9781510633537
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Decoherence, Photonic quantum walks, Quantum simulation
DOIs:
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Bibliographical note

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Source ID: 85084182226
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Data augmentation approaches for improving animal audio classification

In this paper we present ensembles of classifiers for automated animal audio classification, exploiting different data augmentation techniques for training Convolutional Neural Networks (CNNs). The specific animal audio classification problems are i) birds and ii) cat sounds, whose datasets are freely available. We train five different CNNs on the original datasets and on their versions augmented by four augmentation protocols, working on the raw audio signals or their representations as spectrograms. We compared our best approaches with the state of the art, showing that we obtain the

best recognition rate on the same datasets, without ad hoc parameter optimization. Our study shows that different CNNs can be trained for the purpose of animal audio classification and that their fusion works better than the stand-alone classifiers. To the best of our knowledge this is the largest study on data augmentation for CNNs in animal audio classification audio datasets using the same set of classifiers and parameters. Our MATLAB code is available at https://github.com/LorisNanni.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: BioMediTech, Research group: Computational Biophysics and Imaging Group, Universita degli Studi di Padova, Italy
Contributors: Nanni, L., Maguolo, G., Paci, M.
Number of pages: 8
Publication date: 2020
Peer-reviewed: Yes

Publication information

Journal: Ecological Informatics
Volume: 57
Article number: 101084
ISSN (Print): 1574-9541
Original language: English
ASJC Scopus subject areas: Ecology, Evolution, Behavior and Systematics, Ecology, Modelling and Simulation, Ecological Modelling, Computer Science Applications, Computational Theory and Mathematics, Applied Mathematics
Keywords: Acoustic features, Animal audio, Audio classification, Data augmentation, Ensemble of classifiers, Pattern recognition
DOIs:
10.1016/j.ecoinf.2020.101084
URLs:
http://urn.fi/URN:NBN:fi:tuni-202004163294. Embargo ends: 19/03/22
Source: Scopus
Source ID: 85082116223
Research output: Contribution to journal › Article › Scientific › peer-review

Development of measurement instrument for visual qualities of graphical user interface elements (VISQUAL): a test in the context of mobile game icons

Graphical user interfaces are widely common and present in everyday human–computer interaction, dominantly in computers and smartphones. Today, various actions are performed via graphical user interface elements, e.g., windows, menus and icons. An attractive user interface that adapts to user needs and preferences is progressively important as it often allows personalized information processing that facilitates interaction. However, practitioners and scholars have lacked an instrument for measuring user perception of aesthetics within graphical user interface elements to aid in creating successful graphical assets. Therefore, we studied dimensionality of ratings of different perceived aesthetic qualities in GUI elements as the foundation for the measurement instrument. First, we devised a semantic differential scale of 22 adjective pairs by combining prior scattered measures. We then conducted a vignette experiment with random participant (n = 569) assignment to evaluate 4 icons from a total of pre-selected 68 game app icons across 4 categories (concrete, abstract, character and text) using the semantic scales. This resulted in a total of 2276 individual icon evaluations. Through exploratory factor analyses, the observations converged into 5 dimensions of perceived visual quality: Excellence/Inferiority, Graciousness/Harshness, Idleness/Liveliness, Normalness/Bizarreness and Complexity/Simplicity. We then proceeded to conduct confirmatory factor analyses to test the model fit of the 5-factor model with all 22 adjective pairs as well as with an adjusted version of 15 adjective pairs. Overall, this study developed, validated, and consequently presents a measurement instrument for perceptions of visual qualities of graphical user interfaces and/or singular interface elements (VISQUAL) that can be used in multiple ways in several contexts related to visual human-computer interaction, interfaces and their adaption.

General information

Publication status: E-pub ahead of print
MoE publication type: A1 Journal article-refereed
Organisations: Computing Sciences, Gamification Group
Contributors: Jylhä, H., Hamari, J.
Publication date: 2020
Peer-reviewed: Yes

Publication information

Journal: User Modeling and User-Adapted Interaction
ISSN (Print): 0924-1868

Original language: English
ASJC Scopus subject areas: Education, Human-Computer Interaction, Computer Science Applications
Keywords: Adaptive user interfaces, Aesthetics, Design guidelines, Graphical user interface, Measurement instrument, Questionnaire
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10.1007/s11257-020-09263-7
URLs:

http://urn.fi/URN:NBN:fi:tuni-202007026309
Source: Scopus
Source ID: 85085161179
Research output: Contribution to journal › Article › Scientific › peer-review

FinnForest dataset: A forest landscape for visual SLAM

This paper presents a novel challenging dataset that offers a new landscape of testing material for mobile robotics, autonomous driving research, and forestry operation. In contrast to common urban structures, we explore an unregulated natural environment to exemplify sub-urban and forest environment. The sequences provide two-natured data where each place is visited in summer and winter conditions. The vehicle used for recording is equipped with a sensor rig that constitutes four RGB cameras, an Inertial Measurement Unit, and a Global Navigation Satellite System receiver. The sensors are synchronized based on non-drifting timestamps. The dataset provides trajectories of varying complexity both for the state of the art visual odometry approaches and visual simultaneous localization and mapping algorithms. The full dataset and toolkits are available for download at: http://urn.fi/urn:nbn:fi:att:9b8157a7-1e0f-47c2-bd4e-a19a7e952c0d. As an alternative, you can browse for the dataset using the article title at: http://etsin.fairdata.fi.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Computing Sciences, Research group: 3D MEDIA, JC Inertial Oy
Contributors: Ali, I., Durmush, A., Suominen, O., Yli-Hietanen, J., Peltonen, S., Collin, J., Gotchev, A.
Number of pages: 13
Publication date: 2020
Peer-reviewed: Yes

Publication information

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ASJC Scopus subject areas: Control and Systems Engineering, Software, Mathematics(all), Computer Science Applications
Keywords: Autonomous driving, Computer vision, Dataset, Field robotics, Forest, Localization, Mapping, Mobile robotics, Navigation, SLAM, Stereo, Visual odometry
Electronic versions:

FinnForest dataset 2020
DOIs:

10.1016/j.robot.2020.103610
URLs:

http://urn.fi/URN:NBN:fi:tuni-202009016823
Source: Scopus
Source ID: 85089744434
Research output: Contribution to journal › Article › Scientific › peer-review

Game-theoretic semantics for ATL^+ with applications to model checking

We develop a game-theoretic semantics (GTS) for the fragment ATL^+ of the alternating-time temporal logic ATL, thereby extending the recently introduced GTS for ATL. We show that the game-theoretic semantics is equivalent to the standard compositional semantics of ATL^+ with perfect-recall strategies. Based on the new semantics, we provide an analysis of the memory and time resources needed for model checking ATL^+ and show that strategies of the verifier that use only a very limited amount of memory suffice. Furthermore, using the GTS, we provide a new algorithm for model checking ATL^+ and identify a natural hierarchy of tractable fragments of ATL^+ that substantially extend ATL.

General information

Publication status: E-pub ahead of print
MoE publication type: A1 Journal article-refereed
Organisations: Computing Sciences, Stockholm University, University of Johannesburg, Tampere University, University of Helsinki
Contributors: Goranko, V., Kuusisto, A., Rönnholm, R.
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Journal: Information and Computation
Article number: 104554
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ASJC Scopus subject areas: Theoretical Computer Science, Information Systems, Computer Science Applications, Computational Theory and Mathematics
Keywords: Algorithmic model checking, Alternating-time temporal logic, Finite memory strategies, Game-theoretic semantics, Tractable fragments
DOIs:
10.1016/j.ic.2020.104554
Source: Scopus
Source ID: 85082775187
Research output: Contribution to journal › Article › Scientific › peer-review

Hysteresis and eddy-current losses in electrical steel utilising edge degradation due to cutting effects

Cutting of electrical steel sheets typically deteriorates the permeability and increases the iron loss close to the cutting edges. We estimated iron losses in the cross-section of electrical steel sheets by numerically solving the 1-D and 2-D eddy-current distributions while accounting for static magnetic behaviour with a hysteresis model. The magnetization curves in the cross-section are defined using a continuous local material model, making them dependent on the distance from the cut edge by a degradation profile. Damaged and undamaged hysteresis loops were identified by measurements of different wide strips of M400-50A steel sheets. The eddy-current distributions were solved when the strips of different widths were excited with sinusoidal average flux densities at different frequencies. It was found that the cutting degradation also affects the eddy-current loss particularly around 1.0 T. The exact shape of the degradation profile was found to be less significant while the increase of excess losses is significant for the overall loss estimation.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Electrical Engineering, Research group: Electromechanics, Research area: Power engineering, DENSO AUTOMOTIVE Deutschland GmbH, RWTH Aachen University
Contributors: Elfgen, S., Rasilo, P., Hameyer, K.
Number of pages: 10
Publication date: 2020
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ISSN (Print): 0894-3370
Original language: English
ASJC Scopus subject areas: Modelling and Simulation, Computer Science Applications, Electrical and Electronic Engineering
Keywords: cut edges, edge degradation, hysteresis model, iron losses, thin sheet model
DOIs:
10.1002/jnm.2781
Source: Scopus
Source ID: 85088045733
Research output: Contribution to journal › Article › Scientific › peer-review

In-flightwind field identification and prediction of parafoil systems

The wind field is an essential factor that affects accurate homing and flare landing of parafoil systems. In order to obtain the ambient wind field during the descent of a parafoil system, a combination method of in-flight wind field identification and prediction is proposed. First, a wind identification method only using global position system information is derived based on the flight dynamics of parafoil systems. Then a wind field prediction model is constructed using the atmospheric dynamics, and the low-altitude wind field is predicted based on the identified wind field of high-altitude. Finally, simulations of wind field identification and prediction are conducted. The results demonstrate that the proposed method can identify

the wind fields precisely and also predict the wind fields reasonably. This method can potentially be applied in practical parafoil systems to provide wind field information for homing tasks.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Computing Sciences, Research group: Predictive Society and Data Analytics (PSDA), Research group: Computational Medicine and Statistical Learning Laboratory (CMSL), Anhui Science and Technology University, Aalto University, Peking University, University of Applied Sciences Upper Austria, School of Management, Nankai University
Contributors: Gao, H., Tao, J., Dehmer, M., Emmert-Streib, F., Sun, Q., Chen, Z., Xie, G., Zhou, Q.
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Journal: Applied Sciences (Switzerland)
Volume: 10
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Article number: 1958
ISSN (Print): 2076-3417
Original language: English
ASJC Scopus subject areas: Materials Science(all), Instrumentation, Engineering(all), Process Chemistry and Technology , Computer Science Applications, Fluid Flow and Transfer Processes
Keywords: Autonomous homing, Identification, Parafoil system, Prediction, Wind field
Electronic versions:

In-flight wind field identification 2020
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URLs:

http://urn.fi/URN:NBN:fi:tuni-202008266688
Source: Scopus
Source ID: 85082646563
Research output: Contribution to journal › Article › Scientific › peer-review

Internet of Things and Sensor Networks
As we enter the much-awaited year 2020, it is essential to understand the impact that the emerging IoT technologies will have across various industrial sectors and throughout the broader society. According to Gartner, there will be over 20 billion connected devices in 2020, while IDC forecasts expect this number to at least double by the year 2025. This increasingly global and autonomous IoT ecosystem has already demonstrated potential in revolutionizing business operations and consumer products. However, for it to remain successful, we will need to learn how IoT connectivity can help produce valuable outcomes across the two pillars of machine-type communications, massive and critical.

General information
Publication status: Published
MoE publication type: B1 Article in a scientific magazine
Organisations: Electrical Engineering, Research group: Wireless Communications and Positioning, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, University Politehnica of Bucharest, TCS Research and Innovation
Contributors: Andreev, S., Dobre, C., Misra, P.
Number of pages: 1
Pages: 34-34
Publication date: 2020
Peer-reviewed: No

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Journal: IEEE Communications Magazine
Volume: 58
Issue number: 2
ISSN (Print): 0163-6804
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
DOIs:

10.1109/MCOM.2020.8999424
Source: Scopus
Source ID: 85081253178

Research output: Contribution to journal › Editorial › Scientific

Lage und Zukunft des wissenschaftlichen Nachwuchses: Eine Stellungnahme des Beirats des Wissenschaftlichen Nachwuchses (WiN) der Gesellschaft für Informatik (GI e.V.)

The Advisory Board for Junior Scientific Staff (WiN) of the German Informatics Society (GI) calls for and recommends measures to improve the situation of doctoral candidates and post-doctoral researchers in computer science and other technical sciences. Doctoral and postdoctoral scientists in the field of computer science are increasingly affected by the complex structural and financial problems of academia. The bottleneck on the way to a professorship leads to precarious employment conditions in academic careers. The difficulty in combining family and academic careers creates an additional disadvantage, especially for female scientists. A lack of quality assurance and reliable and transparent decision-making processes make it difficult to identify and deal with conflicts during the doctoral and postdoctoral period. Misguided incentives in the academic system impair the direct, intensive and regular supervision of early career researchers. Timely coping with the challenges outlined in this paper is of central importance for the future survival of university research institutions and for a successful continuation of the principle of best selection. In addition to measures already planned and implemented to empower early career researchers, this paper outlines concrete measures to improve supervision during the doctoral phase, and to structure and create further career paths in academia.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: BioMediTech, Beirat des Wissenschaftlichen Nachwuchses der Gesellschaft für Informatik (GI WiN), University of York, Technische Hochschule Ingolstadt, Universitat Potsdam, bitGilde IT Solutions UG (haftungsbeschränkt) , Brandenburgische Technische Universität Cottbus-Senftenberg, Universität Hamburg
Contributors: Lenk, K., Gleirscher, M., Nestler, S., Rödiger, S., Petersen, T., Loebel, J. M.
Number of pages: 9
Pages: 94–102
Publication date: 2020
Peer-reviewed: Yes

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Original language: German
ASJC Scopus subject areas: Information Systems, Computer Science Applications
Electronic versions:
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10.1007/s00287-020-01250-x
URLs:
http://urn.fi/URN:NBN:fi:tuni-202005295825
Source: Scopus
Source ID: 85080076017
Research output: Contribution to journal › Article › Scientific › peer-review

Microflow-Based Device for In Vitro and Ex Vivo Drug Permeability Studies

This paper presents a novel microflow-based concept for studying the permeability of in vitro cell models or ex vivo tissues. Using the proposed concept, we demonstrate how to maintain physiologically relevant test conditions and produce highly reproducible permeability values for a range (31) of drug compounds. The apparent permeability coefficients (P_{app}) showed excellent correlation (0.89) with the values from experiments performed with a conventional Ussing chamber. Additionally, the microflow-based concept produces notably more concentrated samples than the conventional Ussing chamber-based approach, despite the fact that more than 10 times smaller quantities of test compounds and biological membranes are needed in the microflow-based concept.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: BioMediTech, School of Pharmacy, University of Eastern Finland, University of Helsinki, St. Petersburg State University
Contributors: Hemmilä, S., Ruponen, M., Toropainen, E., Tengvall-Unadike, U., Urtti, A., Kallio, P.
Publication date: 2020
Peer-reviewed: Yes

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ISSN (Print): 2472-6303
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Medical Laboratory Technology
Keywords: ex vivo, in vitro, microfluidics, permeability
DOIs:
10.1177/2472630320916190

Bibliographical note
EXT="Ruponen, Marika"
Source: Scopus
Source ID: 85084825294
Research output: Contribution to journal › Article › Scientific › peer-review

Modified Wilkinson power divider with harmonics suppression and compact size for GSM applications
In this article, a modified microstrip Wilkinson power divider with harmonics suppression for GSM communications applications is presented. For low-pass filter designing, one open stub, one radial resonator, and two rectangular resonators are used. According to results related to insertion losses ($|S_{21}|$ and $|S_{31}|$), stopband is wide and equal to 7.5 GHz (3.4-10.9 GHz), under the condition of 20 dB harmonic suppression level. The results show that at the designed frequency of 1.8 GHz, the input return loss ($|S_{11}|$) and output return losses ($|S_{22}|$ and $|S_{33}|$) are better than 22 dB, and the isolation between of output ports ($|S_{32}|$) is better than 30 dB. The size of the proposed power divider is compact and equal to 10.6 × 14.6 mm^2. Finally, the proposed power divider was fabricated and the measurement results illustrate a good agreement with simulation results.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: BioMediTech, Research group: Wireless Identification and Sensing Systems Research Group, Islamic Azad University, Arak Branch
Contributors: Moloudian, G., Miri Rostami, S. R., Björninen, T.
Number of pages: 11
Publication date: 2020
Peer-reviewed: Yes

Publication information
Journal: International Journal of RF and Microwave Computer-Aided Engineering
Article number: e22209
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Graphics and Computer-Aided Design, Electrical and Electronic Engineering
Keywords: harmonics suppression, low-pass filter, microstrip, Wilkinson power divider
DOIs:
10.1002/mmce.22209

Bibliographical note
INT=comp,"Miri Rostami, Seyyed Reza"
Source: Scopus
Source ID: 85082326650
Research output: Contribution to journal › Article › Scientific › peer-review

Multi-sensor next-best-view planning as matroid-constrained submodular maximization
3D scene models are useful in robotics for tasks such as path planning, object manipulation, and structural inspection. We consider the problem of creating a 3D model using depth images captured by a team of multiple robots. Each robot selects a viewpoint and captures a depth image from it, and the images are fused to update the scene model. The process is repeated until a scene model of desired quality is obtained. Next-best-view planning uses the current scene model to select the next viewpoints. The objective is to select viewpoints so that the images captured using them improve the quality of the scene model the most. In this letter, we address next-best-view planning for multiple depth cameras. We propose a utility function that scores sets of viewpoints and avoids overlap between multiple sensors. We show that multi-sensor next-best-view planning with this utility function is an instance of submodular maximization under a matroid constraint. This allows the planning problem to be solved by a polynomial-Time greedy algorithm that yields a solution within a constant factor from the optimal. We evaluate the performance of our planning algorithm in simulated experiments with up to 8 sensors, and in real-world experiments using two robot arms equipped with depth cameras.

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Organisations: Computing Sciences, Technical University Darmstadt, Max Planck Institute for Intelligent Systems, University of Hamburg
Contributors: Lauri, M., Pajarinen, J., Peters, J., Frintrop, S.
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EXT="Lauri, Mikko"
Source: Scopus
Source ID: 85090245712
Research output: Contribution to journal › Article › Scientific › peer-review

On the diffuseness of technical debt items and accuracy of remediation time when using SonarQube
Context. Among the static analysis tools available, SonarQube is one of the most used. SonarQube detects Technical Debt (TD) items—i.e., violations of coding rules—and then estimates TD as the time needed to remedy TD items. However, practitioners are still skeptical about the accuracy of remediation time estimated by the tool. Objective. In this paper, we analyze both diffuseness of TD items and accuracy of remediation time, estimated by SonarQube, to fix TD items on a set of 21 open-source Java projects. Method. We designed and conducted a case study where we asked 81 junior developers to fix TD items and reduce the TD of 21 projects. Results. We observed that TD items are diffused in the analyzed projects and most items are code smells. Moreover, the results point out that the remediation time estimated by SonarQube is inaccurate and, as compared to the actual time spent to fix TD items, is in most cases overestimated. Conclusions. The results of our study are promising for practitioners and researchers. The former can make more aware decisions during project execution and resource management, the latter can use this study as a starting point for improving TD estimation models.

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Contributors: Baldassarre, M. T., Lenarduzzi, V., Romano, S., Saarimäki, N.
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Bibliographical note
EXT="Lenarduzzi, Valentina"

Source: Scopus
Source ID: 85088664918
Research output: Contribution to journal › Article › Scientific › peer-review

Patterns for serverless functions (Function-as-a-Service): A multivocal literature review

[Context] Serverless is a recent technology that enables companies to reduce the overhead for provisioning, scaling and in general managing the infrastructure. Companies are increasingly adopting Serverless, by migrating existing applications to this new paradigm. Different practitioners proposed patterns for composing and managing serverless functions. However, some of these patterns offer different solutions to solve the same problem, which makes it hard to select the most suitable solution for each problem. [Goal] In this work, we aim at supporting practitioners in understanding the different patterns, by classifying them and reporting possible benefits and issues. [Method]We adopted a multivocal literature review process, surveying peer-reviewed and grey literature and classifying patterns (common solutions to solve common problems), together with benefits and issues. [Results] Among 24 selected works, we identified 32 patterns that we classified as orchestration, aggregation, event-management, availability, communication, and authorization. [Conclusion] Practitioners proposed a list of fairly consistent patterns, even if a small number of patterns proposed different solutions to similar problems. Some patterns emerged to circumvent some serverless limitations, while others for some classical technical problems (e.g. publisher/subscriber).

General information

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Organisations: Computing Sciences, Free University of Bolzano-Bozen
Contributors: Taibi, D., El Ioini, N., Pahl, C., Niederkofler, J. R. S.
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Probabilistic approach to physical object disentangling

Physically disentangling entangled objects from each other is a problem encountered in waste segregation or in any task that requires disassembly of structures. Often there are no object models, and especially with cluttered irregularly shaped objects, the robot cannot create a model of the scene due to occlusion. One of our key insights is that based on previous sensory input we are only interested in moving an object out of the disentanglement around obstacles. That is, we only need to know where the robot can successfully move in order to plan the disentangling. Due to the uncertainty we integrate information about blocked movements into a probability map. The map defines the probability of the robot successfully moving to a specific configuration. Using as cost the failure probability of a sequence of movements we can then plan and execute disentangling iteratively. Since our approach circumvents only previously encountered obstacles, new movements will yield information about unknown obstacles that block movement until the robot has learned to circumvent all obstacles and disentangling succeeds. In the experiments, we use a special probabilistic version of the Rapidly exploring Random Tree (RRT) algorithm for planning and demonstrate successful disentanglement of objects both in 2-D and 3-D simulation, and, on a KUKA LBR 7-DOF robot. Moreover, our approach outperforms baseline methods.

General information

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ASJC Scopus subject areas: Control and Systems Engineering, Biomedical Engineering, Human-Computer Interaction, Mechanical Engineering, Computer Vision and Pattern Recognition, Computer Science Applications, Control and Optimization, Artificial Intelligence
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Propagation dynamics of ultrabroadband terahertz beams with orbital angular momentum for wireless data transfer
We investigate an approach to short and medium-range wireless communications based on the use of terahertz beams possessing an orbital angular momentum (OAM) that allows for noise-resistant broadband carrier. A the- oretical model of the proposed beams generation is developed and numerical predictions are given for propagation and visualization of complex-structured THz beams, including ones carrying a unit topological charge on a large number of spectral components of broadband terahertz radiation. The assessment method which in our case is terahertz pulse time-domain holography allows for analyzing spatiooral and spatio-spectral evolution of arbitrary shaped THz wave trains during their propagation in free space and interaction with obstacles.

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Contributors: Kulya, M. S., Sokolenko, B., Gorodetsky, A., Petrov, N. V.
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Keywords: THz radiation, Vortex beams, wireless data transfer
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jufoid=71479
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Redundancy-based visual tool center point pose estimation for long-reach manipulators

In this paper, we study a visual sensing scheme for 6 degree-of-freedom (DOF) tool center point (TCP) pose estimation of large-scale, long-reach manipulators. A sensor system is proposed, designed especially for mining manipulators, comprising a stereo camera running a simultaneous localization and mapping (SLAM) algorithm near the TCP and multiple cameras that track a fiducial marker attached near the stereo camera. In essence, the TCP pose is formulated using two different routes in a co-operative (eye-in-hand/eye-to-hand) manner using data fusion, with the goal of increasing the system's fault tolerance and robustness via sensor redundancy. The system is studied in offline data analysis based on real-world measurements recorded using a hydraulic 6 DOF robotic manipulator with a 5 m reach. The SLAM pose trajectory is obtained using the open source ORB-SLAM2 Stereo algorithm, whereas marker-based tracking is realized with a high-end motion capture system. For reference measurements, the pose trajectory is also formulated using joint encoders and a kinematic model of the manipulator. Results of the 6 DOF pose estimation using the proposed sensor system are presented, with future work and key challenges also highlighted.

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Contributors: Mäkinen, P., Mustalahti, P., Launis, S., Mattila, J.
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JUFOID=73592
Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Safety at chimney-roof penetration: A numerical investigation

Chimneys convey exhaust gas produced in heat generators to the external ambient. To do this, they cross building elements such as floors and roofs, which can be made of flammable materials such as wood, wood fiber, cellulose, etc. This represents a dangerous condition that can lead to the overheating of the structure and, consequently, to possible fires. In recent years, numerous roof fires have occurred in Europe due to the presence of a chimney, and some of these have also involved certified chimneys. The aim of the certification procedure is the determination of the distance between chimney and flammable structures to avoid fires. This paper describes an investigation performed to understand the causes of the high number of fires and to propose solutions to the roof fires problem. The study was carried out numerically and experimentally, and consisted of three steps. Firstly, the chimney certification procedure was investigated to highlight possible weaknesses. Then, by means of a 2D and a 3D numerical models, the variables affecting heat transfer at chimney-roof penetration were identified. Finally, solutions and prescriptions to prevent roof fires are proposed. The solutions consist of a set of tables for checking chimney installations, and a universal device to be installed between chimney and roof to prevent the overheating of the latter, also in very critical conditions represented by soot fires, and installations in very thick and insulating roofs.

General information

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Contributors: Neri, M., Perttu, L., Alanen, M., Luscietti, D., Pilotelli, M.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Social media overload, exhaustion, and use discontinuance: Examining the effects of information overload, system feature overload, and social overload

While users' discontinuance of use has posed a challenge for social media in recent years, there is a paucity of knowledge on the relationships between different dimensions of overload and how overload adversely affects users' social media discontinuance behaviors. To address this knowledge gap, this study employed the stressor–strain–outcome (SSO) framework to explain social media discontinuance behaviors from an overload perspective. It also conceptualized social media overload as a multidimensional construct consisting of system feature overload, information overload, and social overload. The proposed research model was empirically validated via 412 valid questionnaire responses collected from Facebook users. Our results indicated that the three types of overload are interconnected through system feature overload. System feature overload, information overload, and social overload engender user exhaustion, which in turn leads to users' discontinued usage of social media. This study extends current technostress research by demonstrating the value of the SSO perspective in explaining users' social media discontinuance.

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Contributors: Fu, S., Li, H., Liu, Y., Pirkkalainen, H., Salo, M.
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UAV-Aided Interference Assessment for Private 5G NR Deployments: Challenges and Solutions

Industrial automation has created a high demand for private 5G networks, the deployment of which calls for an efficient and reliable solution to ensure strict compliance with regulatory emission limits. While traditional methods for measuring outdoor interference include collecting real-world data by walking or driving, the use of unmanned aerial vehicles (UAVs) offers an attractive alternative due to their flexible mobility and adaptive altitude. As UAVs perform measurements quickly and semiautomatically, they can potentially assist in near-real-time adjustments of the network configuration and fine-tuning its parameters, such as antenna settings and transmit power, as well as help improve indoor connectivity while respecting outdoor emission constraints. This article offers a firsthand tutorial on using aerial 5G emission assessment for interference management in nonpublic networks by reviewing the key challenges of UAV-mounted radio scanner measurements. In particular, we outline the challenges of practical assessment of the outdoor interference originating from a local indoor 5G network while discussing regulatory and other related constraints, and address practical methods and tools while summarizing the recent results of our measurement campaign. The reported proof of concept confirms that UAV-based systems represent a promising tool for capturing outdoor interference from private 5G systems.

General information

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Contributors: Urama, J., Wiren, R., Galinina, O., Kauppi, J., Hiltunen, K., Erkkilä, J., Chernogorov, F., Eteläaho, P., Heikkilä, M., Torsner, J., Andreev, S., Valkama, M.
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Who contributes what? Scrutinizing the activity data of 4.2 million Zhihu users via immersion scores

Studies of knowledge communities have focused predominantly on contributors who ask questions and/or post replies, while little research has examined the contributions of those who neither pose questions nor suggest answers in knowledge communities. To illuminate member contributions of various sorts, this study evaluated user contribution to knowledge community from three dimensions (influence, content-contribution, and activeness) of immersion. Based on the user activity data of more than 4 million users from Zhihu, the largest online knowledge community in China, we calculated the immersion level for the four user groups (Lurkers, Questioners, Answerers, and Questioner-Answerers) in line with their question-asking and question-answering behaviors in Zhihu. The research findings revealed that Lurkers (members who posted nothing) showed higher community-immersion score than Questioners who asked questions only. The latter, Questioners, had the lowest community-immersion score, while Questioner-Answerers, who posted both questions and answers, exhibited the greatest contribution in the case knowledge community. We further made horizontal comparison of immersion score among the four different user groups, and found that when immersion scores of the four different user groups are above a certain threshold, the immersion scores of the four different user groups display a consistent distinguishing pattern. This result highlights the similarity of tendencies in behavioral orientation among different users in knowledge communities. Theoretical contributions and practical implications to be gleaned from this research are discussed.

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Contributors: Deng, S., Jiang, Y., Li, H., Liu, Y.
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Empowering Heterogeneous Communication Data Links in General Aviation through mmWave Signals

We study data transfer links that would enable development of low-cost technologies for increasing safety of general aviation (GA). The solution proposed here is to supplement the existing cmWave solutions with mmWave cellular signals in order to better handle interferences and to reach lower outage probabilities and higher throughputs. Moreover, cellular solutions have the advantage of re-using existing or planned infrastructure, and thus they are expected to require minor additional investments. Our article aims both at shedding some light on the terminology in the GA field and at proposing future viable data-link solutions in GA. We also survey the existing solutions, challenges, and opportunities related to the wireless communication links in GA, and we present several case studies related to the achievable outage probabilities and throughputs under rural and urban scenarios of low-altitude GA vehicles. We conclude that supplementing the existing cmWave wireless links with mmWave wireless connections is a workable solution for affordable communication links for low-altitude GA aircraft.

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Contributors: Wang, W., Talvitie, J., Adamova, E. J., Fath, T., Korenciak, L., Valkama, M., Lohan, E. S.
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Motivating scholars' responses in academic social networking sites: An empirical study on ResearchGate Q&A behavior

The advent of academic social networking sites (ASNS) has offered an unprecedented opportunity for scholars to obtain peer support online. However, little is known about the characteristics that make questions and answers popular among scholars on ASNS. Focused on the statements embedded in questions and answers, this study strives to explore the precursors that motivate scholars to respond, such as reading, following, or recommending a question or an answer. We collected empirical data from ResearchGate and coded the data via the act4teams coding scheme. Our analysis revealed a threshold effect—when the length of question description is over circa 150 words, scholars would quickly lose interest and thus not read the description. In addition, we found that questions, including positive action-oriented statements, are more likely to entice subsequent reads from other scholars. Furthermore, scholars prefer to recommend an answer with positive procedural statements or negative action-oriented statements.

General information

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Contributors: Deng, S., Tong, J., Lin, Y., Li, H., Liu, Y.
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Position Estimation for Drones based on Visual SLAM and IMU in GPS-denied Environment

Due to the increased rate of drone usage in various commercial and industrial fields, the need for their autonomous operation is rapidly increasing. One major aspect of autonomous movement is the ability to operate safely in an unknown environment. The majority of current works are persistently using a global positioning system (GPS) to directly find the absolute position of the drone. However, GPS accuracy might be not suitable in some applications and this solution is not applicable to all situations. In this paper, a positioning system based on monocular SLAM and inertial measurement unit (IMU) is presented. The position is calculated through the semi-direct visual odometry (SVO) method alongside IMU data, and is integrated with an extended Kalman filter (EKF) to enhance the efficiency of the algorithm. The data is then employed to control the drone without any requirement to any source of external input. The experiment results for long-distance flying paths is very promising.

General information

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Deliberate or Instinctive? Proactive and Reactive Coping for Technostress

Employees in organizations face technostress that is, stress from information technology (IT) use. Although technostress is a highly prevalent organizational phenomenon, there is a lack of theory-based understanding on how IT users can cope with it. We theorize and validate a model for deliberate proactive and instinctive reactive coping for technostress. Drawing from theories on coping, our model posits that the reactive coping behaviors of distress venting and distancing from IT can alleviate technostress by diminishing the negative effect of technostress creators on IT-enabled productivity. The proactive coping behaviors of positive reinterpretation and IT control can help IT users by influencing the extent to which reactive coping behaviors are effective and by positively influencing IT-enabled productivity. The findings of a cross-sectional survey study of 846 organizational IT users support the model. The paper provides a new theoretical contribution by identifying ways in which organizational IT users can cope with technostress.

General information

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Contributors: Pirkkalainen, H., Salo, M., Tarafdar, M., Makkonen, M.
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Source ID: 85073528603
Research output: Contribution to journal › Article › Scientific › peer-review

Automatic word count estimation from daylong child-centered recordings in various language environments using language-independent syllabification of speech

Automatic word count estimation (WCE) from audio recordings can be used to quantify the amount of verbal communication in a recording environment. One key application of WCE is to measure language input heard by infants and toddlers in their natural environments, as captured by daylong recordings from microphones worn by the infants. Although WCE is nearly trivial for high-quality signals in high-resource languages, daylong recordings are substantially more challenging due to the unconstrained acoustic environments and the presence of near- and far-field speech. Moreover, many use cases of interest involve languages for which reliable ASR systems or even well-defined lexicons are not available. A good WCE system should also perform similarly for low- and high-resource languages in order to enable unbiased comparisons across different cultures and environments. Unfortunately, the current state-of-the-art solution, the LENA system, is based on proprietary software and has only been optimized for American English, limiting its applicability. In this paper, we build on existing work on WCE and present the steps we have taken towards a freely available system for WCE that can be adapted to different languages or dialects with a limited amount of orthographically transcribed speech data. Our system is based on language-independent syllabification of speech, followed by a language-dependent mapping from syllable counts (and a number of other acoustic features) to the corresponding word count estimates. We

evaluate our system on samples from daylong infant recordings from six different corpora consisting of several languages and socioeconomic environments, all manually annotated with the same protocol to allow direct comparison. We compare a number of alternative techniques for the two key components in our system: speech activity detection and automatic syllabification of speech. As a result, we show that our system can reach relatively consistent WCE accuracy across multiple corpora and languages (with some limitations). In addition, the system outperforms LENA on three of the four corpora consisting of different varieties of English. We also demonstrate how an automatic neural network-based syllabifier, when trained on multiple languages, generalizes well to novel languages beyond the training data, outperforming two previously proposed unsupervised syllabifiers as a feature extractor for WCE.

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Organisations: Computing Sciences, Aalto University, Laboratoire de Sciences Cognitives et Psycholinguistique, Carnegie Mellon University, University of Manitoba, Max Planck Institute for Psycholinguistics, CONICET, Duke University
Contributors: Räsänen, O., Seshadri, S., Karadayi, J., Riebling, E., Bunce, J., Cristia, A., Metze, F., Casillas, M., Rosemberg, C., Bergelson, E., Soderstrom, M.
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Source ID: 85070952723
Research output: Contribution to journal › Article › Scientific › peer-review

DevOps in practice: A multiple case study of five companies
Context: DevOps is considered important in the ability to frequently and reliably update a system in operational state. DevOps presumes cross-functional collaboration and automation between software development and operations. DevOps adoption and implementation in companies is non-trivial due to required changes in technical, organisational and cultural aspects. Objectives: This exploratory study presents detailed descriptions of how DevOps is implemented in practice. The context of our empirical investigation is web application and service development in small and medium sized companies. Method: A multiple-case study was conducted in five different development contexts with successful DevOps implementations since its benefits, such as quick releases and minimum deployment errors, were achieved. Data was mainly collected through interviews with 26 practitioners and observations made at the companies. Data was analysed by first coding each case individually using a set of predefined themes and thereafter perform a cross-case synthesis. Results: Our analysis yielded some of the following results: (i) software development team attaining ownership and responsibility to deploy software changes in production is crucial in DevOps. (ii) toolchain usage and support in deployment pipeline activities accelerates the delivery of software changes, bug fixes and handling of production incidents. (ii) the delivery speed to production is affected by context factors, such as manual approvals by the product owner (iii) steep learning curve for new skills is experienced by both software developers and operations staff, who also have to cope with working under pressure. Conclusion: Our findings contributes to the overall understanding of DevOps concept, practices and its perceived impacts, particularly in small and medium sized companies. We discuss two practical implications of the results.

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Organisations: Computing Sciences, University of Oulu, Aalto University, University of Helsinki
Contributors: Lwakatare, L. E., Kilamo, T., Karvonen, T., Sauvola, T., Heikkilä, V., Itkonen, J., Kuvaja, P., Mikkonen, T., Oivo, M., Lassenius, C.

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Bibliographical note
EXT="Mikkonen, Tommi"
Source: Scopus
Source ID: 85068546035
Research output: Contribution to journal › Article › Scientific › peer-review

Red Alert: Break-Glass Protocol to Access Encrypted Medical Records in the Cloud

Availability of medical records during an emergency situation is of paramount importance since it allows healthcare professionals to access patient's data on time and properly plan the next steps that need to be taken. Cloud storage has the potential to provide a solution to the problem of data unavailability during an emergency situation. However, sharing medical records raises several concerns about security and privacy. In this paper, we study the problem of how to share encrypted patients' data during an emergency situation. To this end, we propose a protocol through which a team of healthcare professionals can securely decrypt the medical records of a patient who is under an emergency situation (e.g. acute stroke). Furthermore, our protocol ensures that a team of healthcare professionals will only have access to the patient's data for the time needed to complete a specific process related to the patient's situation (e.g. transfer patient to the hospital). In our study, the dynamically granting and revoking data access during an emergency treatment is the main novelty.

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MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, University of Amsterdam
Contributors: De Oliveira, M. T., Michalas, A., Groot, A. E., Marquering, H. A., Olabarriaga, S. D.
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Article number: 9009598
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ASJC Scopus subject areas: Artificial Intelligence, Computer Networks and Communications, Computer Science Applications, Human-Computer Interaction, Health Informatics, Health(social science)
Keywords: Attribute-Based Encryption, e-Health Privacy, Electronic Medical Records, Emergency care, Secure Cloud Storage
DOIs:

10.1109/HealthCom46333.2019.9009598
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

The Internet of Things and Sensor Networks

The articles in this special section focus on the Internet of Things (IoT) and sensor networks. IoT is being embraced by numerous companies across most industries. This transformation is all about the adoption of digital technologies underpinning essential societal and human activities, while at its heart is the digital transformation of businesses. As more Internet-connected devices are being deployed to automate and collect various data, the adoption of IoT efficiently boosts business life all over the world, which is further supported by breakthrough innovations. The latter are remarkable as they employ the IoT technologies to mitigate global warming, save water, increase yields in smart farming, provide a backbone for autonomous vehicles, and many more.

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MoE publication type: B1 Article in a scientific magazine
Organisations: Electrical Engineering, University Politehnica of Bucharest
Contributors: Andreev, S., Dobre, C.
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Source: Scopus
Source ID: 85072773996
Research output: Contribution to journal › Editorial › Scientific

Hermitian normalized Laplacian matrix for directed networks
In this paper, we extend and generalize the spectral theory of undirected networks towards directed networks by introducing the Hermitian normalized Laplacian matrix for directed networks. In order to start, we discuss the Courant–Fischer theorem for the eigenvalues of Hermitian normalized Laplacian matrix. Based on the Courant–Fischer theorem, we obtain a similar result towards the normalized Laplacian matrix of undirected networks: for each $i \in \{1, 2,\ldots, n\}$, any eigenvalue of Hermitian normalized Laplacian matrix $\lambda_i \in [0, 2]$. Moreover, we prove some special conditions if 0, or 2 is an eigenvalue of the Hermitian normalized Laplacian matrix L(X). On top of that, we investigate the symmetry of the eigenvalues of L(X)and the edge-version for the eigenvalue interlacing result. Finally we present two expressions for the coefficients of the characteristic polynomial of the Hermitian normalized Laplacian matrix. As an outlook, we sketch some novel and intriguing problems to which our apparatus could generally be applied.

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Organisations: Computing Sciences, Research group: Predictive Society and Data Analytics (PSDA), Guizhou University of Finance and Economics, University of Applied Sciences Upper Austria, Nankai University, Hall in Tyrol, Institute of Biosciences and Medical Technology
Contributors: Yu, G., Dehmer, M., Emmert-Streib, F., Jodlbauer, H.
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Pages: 175-184
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Keywords: Characteristic polynomial, Courant–Fischer theorem, Directed networks, Eigenvalue interlacing inequality, Hermitian normalized Laplacian matrix
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Source: Scopus
Source ID: 85065248406
Research output: Contribution to journal › Article › Scientific › peer-review

Internet of Autonomous Vehicles: Architecture, Features, and Socio-Technological Challenges

Mobility is the backbone of urban life and a vital economic factor in the development of the world. Rapid urbanization and the growth of mega-cities are bringing dramatic changes in the capabilities of vehicles. Innovative solutions like autonomy, electrification, and connectivity are on the horizon. How, then, we can provide ubiquitous connectivity to legacy and autonomous vehicles? This article seeks to answer this question by combining recent leaps of innovation in network virtualization with remarkable feats of wireless communications. To do so, this article proposes a novel paradigm called the Internet of Autonomous Vehicles (IoAV). We begin painting the picture of IoAV by discussing the salient features and applications of IoAV, followed by a detailed discussion on the key enabling technologies. Next, we describe the proposed layered architecture of IoAV and uncover some critical functions of each layer. This is followed by the performance evaluation of IoAV, which shows significant advantages of the proposed architecture in terms of transmission time and energy consumption. Finally, to best capture the benefits of IoAV, we enumerate some social and technological challenges, and explain how some unresolved issues can disrupt the widespread use of autonomous vehicles in the future.

General information

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Contributors: Jameel, F., Chang, Z., Huang, J., Ristaniemi, T.
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Source ID: 85071324963
Research output: Contribution to journal › Article › Scientific › peer-review

Visibility-Aware Part Coding for Vehicle Viewing Angle Estimation

A number of spatially-localised semantic parts of vehicles sensitive to pose changes are encoded their visible probabilities into a mid-level feature vector. Car pose estimation is then formulated into a regression on concatenated low-and mid-level features to continuously changing viewing angles. Each dimension of our visibility-Aware part codes separates all the training samples into two groups according to its visual existence in images, which provides additional part-specific range constraint of viewing angles. Moreover, the proposed codes can alleviate the suffering from sparse and imbalanced data distribution in the light of modelling latent dependency across angle targets. Experimental evaluation for car pose estimation on the EPFL Multi-View Car benchmark demonstrates significant improvement of our method over the state-of-The-Art regression methods, especially when only sparse and imbalanced data is available.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Research group: Vision, South China University of Technology
Contributors: Yang, D., Qian, Y., Cai, D., Yan, S., Kämäräinen, J., Chen, K.
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10.1109/ICIST.2019.8836907

Bibliographical note
EXT="Chen, Ke"
jufoid=79229
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

High-performance SIMD implementation of the lattice-Boltzmann method on the Xeon Phi processor
We present a high-performance implementation of the lattice-Boltzmann method (LBM) on the Knights Landing generation of Xeon Phi. The Knights Landing architecture includes 16GB of high-speed memory (MCDRAM) with a reported bandwidth of over 400 GB/s, and a subset of the AVX-512 single instruction multiple data (SIMD) instruction set. We explain five critical implementation aspects for high performance on this architecture: (1) the choice of appropriate LBM algorithm, (2) suitable data layout, (3) vectorization of the computation, (4) data prefetching, and (5) running our LBM simulations exclusively from the MCDRAM. The effects of these implementation aspects on the computational performance are demonstrated with the lattice-Boltzmann scheme involving the D3Q19 discrete velocity set and the TRT collision operator. In our benchmark simulations of fluid flow through porous media, using double-precision floating-point arithmetic, the observed performance exceeds 960 million fluid lattice site updates per second.

General information
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Organisations: Physics, CSC - IT center for science, Abo Akad Univ, Abo Akademi University, Dept Phys, Jyväskylän yliopisto
Contributors: Robertsén, F., Mattila, K., Westerholm, J.
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Keywords: Lattice Boltzmann, prefetching, SIMD, Xeon Phi
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Source: Scopus
Source ID: 85056764195
Research output: Contribution to journal › Article › Scientific › peer-review

Hand gesture-based on-line programming of industrial robot manipulators
Robots are widely used in industrial manufacturing processes and play an important role in the enhancement of industrial organizations productivity. One of the major issues that engineers are facing is that, current programming methods are too time-consuming and they lack of intuitiveness use by human users. However, the latest advances in the field of sensors, let manufacturers to develop and produce devices that allow humans to interact with machines in a more intuitive way, reducing the need of additional complex software components, and hence, the required time to establish the aforementioned human-machine interactions. This research work presents an approach for gesture-based on-line programming of industrial robot manipulators. This is achieved by utilizing a combination of devices with a set of integrated, cost-effective visual and bending sensors, in order to precisely track the user's hand position and gestures at system run-time. This continuous tracking allows the robot manipulator to mimic the operator's hand motion. In addition, desired paths performed by a human with expertise on task execution, are translated into robot targets, composing a new robot path, and are stored for later use. Such path can be modified to fit into different robot manufacturers, programming language. Further steps of the presented approach will include the possibility of path optimization by the industrial manipulator itself.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Automation Technology and Mechanical Engineering, Research group: Automation and Systems Theory, Tampere University, FAST-Lab
Contributors: Sylari, A., Ferrer, B. R., Lastra, J. L.
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ASJC Scopus subject areas: Computer Science Applications, Information Systems
Keywords: Gesture recognition, Human-Robot Interaction, Industrial automation, Multi-modal on-line programming, Robotics
DOIs:
10.1109/INDIN41052.2019.8972301

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jufoid=72024
INT=atme,"Sylari, Antonios"
Source: Scopus
Source ID: 85079038001
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

KPI-ML based integration of industrial information systems

In order to stay competitive in the global market, industrial manufacturers are implementing various methods to improve the production processes. This requires measuring important metrics and making use of performance measurement systems. Based on the data generated in manufacturing operations, various indicators can be defined and measured. These indicators serve as the basis for decision-making, control and health monitoring of a manufacturing process. In this paper an approach is presented that makes use of key performance indicators (KPIs). The KPIs used are defined in a standard known as, ISO 22400 Automation systems and integration-Key performance indicators (KPIs) that is usually applied for management of manufacturing operations. The approach uses the database of a production line to define KPIs and generates a tool for visualizing them. The KPIs are defined using a data model of Key Performance Indicator Markup Language (KPI-ML), which is an XML utilization of the ISO 22400 standard. The recommended approach paves a way for constructing generic KPI-ML visualization tools serving various industries to assess their performance with the same tool.

General information
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Contributors: Tahir, M. A., Mahmoodpour, M., Lobov, A.
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ASJC Scopus subject areas: Computer Science Applications, Information Systems
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MAST: Mask-accelerated shearlet transform for densely-sampled light field reconstruction

Shearlet Transform (ST) is one of the most effective algorithms for the Densely-Sampled Light Field (DSLF) reconstruction from a Sparsely-Sampled Light Field (SSLF) with a large disparity range. However, ST requires a precise estimation of the disparity range of the SSLF in order to design a shearlet system with decent scales and to pre-shear the sparsely-sampled Epipolar-Plane Images (EPIs) of the SSLF. To overcome this limitation, a novel coarse-to-fine DSLF reconstruction method, referred to as Mask-Accelerated Shearlet Transform (MAST), is proposed in this paper. Specifically, a state-of-the-art learning-based optical flow method, FlowNet2, is employed to estimate the disparities of a SSLF. The estimated disparities are then utilized to roughly estimate the densely-sampled EPIs for the sparsely-sampled EPIs of the SSLF. Finally, an elaborately-designed soft mask for a coarsely-inpainted EPI is exploited to perform an iterative refinement on this EPI. Experimental results on nine challenging horizontal-parallax real-world SSLF datasets with large disparity ranges (up to 35 pixels) demonstrate the effectiveness and efficiency of the proposed method over the other state-of-the-art approaches.

General information

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Organisations: Computing Sciences, Research group: 3D MEDIA, Computer Science Institute
Contributors: Gao, Y., Bregovic, R., Gotchev, A., Koch, R.
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
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Source: Scopus
Source ID: 85070959105
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Modeling mmWave Channels in High-Fidelity Simulations of Unmanned Aerial Systems

As the capabilities of Unmanned Aerial Systems (UASs) evolve, their novel and demanding applications emerge, which require improved capacity and reduced latency. Millimeter-wave (mmWave) connections are particularly attractive for UASs due to their predominantly line-of-sight regime and better signal locality. In this context, understanding the interactions between the environment, the flight dynamics, and the beam tracking capabilities is a challenge that has not been resolved by today's simulation environments. In this work, we develop the means to model these crucial considerations as well as provide the initial insights into the performance of mmWave-based UAS communications made available with the use of our proposed platform.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Electrical Engineering, Research group: Wireless Communications and Positioning, Tampere University, University of Pennsylvania
Contributors: Godbole, T. R., Calvo-Fullana, M., Pyattaev, A., Mox, D., Andreev, S., Ribeiro, A., Valkama, M.
Publication date: 1 Jul 2019

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ISSN (Electronic): 1948-3252
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Keywords: beamforming, Millimeter-wave (mmWave), Robot Operating System (ROS), Unmanned Aerial System (UAS)
DOIs:
10.1109/SPAWC.2019.8815528

Bibliographical note

jufoid=57486
INT=elen,"Godbole, Tanmay Ram"
Source: Scopus
Source ID: 85072324343
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Portrait instance segmentation for mobile devices

Accurate and efficient portrait instance segmentation has become a crucial enabler for many multimedia applications on mobile devices. We present a novel convolutional neural network (CNN) architecture to explicitly address the long standing problems in portrait segmentation, i.e., semantic coherence and boundary localization. Specifically, we propose a cross-granularity categorical attention mechanism leveraging the deep supervisions to close the semantic gap of CNN feature hierarchy by imposing consistent category-oriented information across layers. Furthermore, a cross-granularity boundary enhancement module is proposed to boost the boundary awareness of deep layers by integrating the shape context cues from shallow layers of the network. We further propose a novel and efficient non-parametric affinity model to achieve efficient instance segmentation on mobile devices. We present a portrait image dataset with instance level annotations dedicated to evaluating portrait instance segmentation algorithms. We evaluate our approach on challenging datasets which obtains state-of-the-art results.

General information

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Organisations: Computing Sciences, Research group: Vision, Nokia Technologies
Contributors: Zhu, L., Wang, T., Aksu, E., Kämäräinen, J.
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Keywords: Convolutional neural networks, Instance segmentation, Portrait segmentation, Semantic segmentation
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10.1109/ICME.2019.00281
Source: Scopus
Source ID: 85071050950
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Acceptance and perceptions of interactive location-tracking displays

Tracking the location of people and their mobile devices creates opportunities for new and exciting ways of interacting with public technology. For instance, users can transfer content from public displays to their mobile device without touching it, because location tracking allows automatic recognition of the target device. However, many uncertainties remain regarding how users feel about interactive displays that track them and their mobile devices, and whether their experiences vary based on the setting. To close this research gap, we conducted a 24-participant user study. Our results suggest that users are largely willing - even excited - to adopt novel location-tracking systems. However, users expect control over when and where they are tracked, and want the system to be transparent about its ownership and data collection. Moreover, the deployment setting plays a much bigger role on people's willingness to use interactive displays when location tracking is involved.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Ludwig Maximilian University, Tampere University

Contributors: Mäkelä, V., Linna, J., Keskinen, T., Hakulinen, J., Turunen, M.
Publication date: 12 Jun 2019

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Keywords: Acceptance, Location tracking, Location-based services, Mobile devices, Perceptions, Privacy, Public displays , Trust, Ubiquitous computing
DOIs:
10.1145/3321335.3324931
URLs:
http://urn.fi/URN:NBN:fi:tuni-201910013614
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Biomechanical performance of cranial implants with different thicknesses and material properties: A finite element study
This study investigated the effect of implant thickness and material on deformation and stress distribution within different components of cranial implant assemblies. Using the finite element method, two cranial implants, differing in size and shape, and thicknesses (1, 2, 3 and 4 mm, respectively), were simulated under three loading scenarios. The implant assembly model included the detailed geometries of the mini-plates and micro-screws and was simulated using a sub-modeling approach. Statistical assessments based on the Design of Experiment methodology and on multiple regression analysis revealed that peak stresses in the components are influenced primarily by implant thickness, while the effect of implant material is secondary. On the contrary, the implant deflection is influenced predominantly by implant material followed by implant thickness. The highest values of deformation under a 50 N load were observed in the thinnest (1 mm) Polymethyl Methacrylate implant (Small defect: 0.296 mm; Large defect: 0.390 mm). The thinnest Polymethyl Methacrylate and Polyether Ether Ketone implants also generated stresses in the implants that can potentially breach the materials' yield limit. In terms of stress distribution, the change of implant thickness had a more significant impact on the implant performance than the change of Young's modulus of the implant material. The results indicated that the stresses are concentrated in the locations of fixation; therefore, the detailed models of mini-plates and micro-screws implemented in the finite element simulation provided a better insight into the mechanical performance of the implant-skull system.

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Publication status: Published
MoE publication type: Not Eligible
Organisations: Faculty of Information Technology and Communication Sciences, Brno University of Technology, Faculty of Mechanical Engineering, Division of Biomedical Engineering, University of Cape Town, Faculty of Health Sciences, Hamburg-Eppendorf, Fraunhofer Research Institution for Additive Manufacturing Technologies IAPT
Contributors: Marcián, P., Narra, N., Borák, L., Chamrad, J., Wolff, J.
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ASJC Scopus subject areas: Computer Science Applications, Health Informatics
Keywords: 3D printing, Cranioplasty, Finite element method, Mechanical properties, Skull implant
DOIs:
10.1016/j.compbiomed.2019.04.016
Source: Scopus
Source ID: 85064648863
Research output: Contribution to journal › Article › Scientific › peer-review

Energy Efficiency of Multi-Radio Massive Machine-Type Communication (MR-MMTC): Applications, Challenges, and Solutions

While the IoT has made significant progress along the lines of supporting its individual applications, there are many MMTC scenarios in which the performance offered by any single RAT available today might be insufficient. To address these use cases, we introduce the concept of MR-MMTC, which implies the availability and utilization of several RATs within a single IoT device. We begin by offering insights into which use cases could be beneficial and what the key challenges for MR-MMTC implementation are. We continue by discussing the potential technical solutions and employing our own prototype of an MR-MMTC device capable of using LoRaWAN and NB-IoT RATs to characterize its energy-centric performance across the alternative feasible MR-MMTC implementation strategies. The obtained results reveal that an increased flexibility delivered by MR-MMTC permits the selection of more energy-efficient RAT options. The IoT devices capable of utilizing multiple radios simultaneously can thus improve their energy utilization by leveraging the synergy between RATs. The novel vision of MR-MMTC outlined in this work could be impactful across multiple fields, and calls for cross-community research efforts in order to adequately design, implement, and deploy future multi-RAT MMTC solutions.

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Contributors: Mikhaylov, K., Petrov, V., Gupta, R., Lema, M. A., Galinina, O., Andreev, S., Koucheryavy, Y., Valkama, M., Pouttu, A., Dohler, M.
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Face verification and recognition for digital forensics and information security

In this paper, we present an extensive evaluation of face recognition and verification approaches performed by the European COST Action MULTI-modal Imaging of FOREnsic SciEnce Evidence (MULTI-FORESEE). The aim of the study is to evaluate various face recognition and verification methods, ranging from methods based on facial landmarks to state-of-the-art off-the-shelf pre-trained Convolutional Neural Networks (CNN), as well as CNN models directly trained for the task at hand. To fulfill this objective, we carefully designed and implemented a realistic data acquisition process, that corresponds to a typical face verification setup, and collected a challenging dataset to evaluate the real world performance of the aforementioned methods. Apart from verifying the effectiveness of deep learning approaches in a specific scenario, several important limitations are identified and discussed through the paper, providing valuable insight for future research directions in the field.

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Organisations: Computing Sciences, Inst. of Info. Sci. and Technol. of the Natl. Res. Cncl. of Italy (ISTI-CNR), University of Milan Bicocca, Department of Informatics, Aristotle University of Thessaloniki, University of Applied Sciences of Southern Switzerland
Contributors: Amato, G., Falchi, F., Gennaro, C., Massoli, F. V., Passalis, N., Tefas, A., Trivilini, A., Vairo, C.
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Publisher: IEEE
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ASJC Scopus subject areas: Health Informatics, Pathology and Forensic Medicine, Computer Networks and Communications, Computer Science Applications, Safety, Risk, Reliability and Quality
Keywords: Deep learning, Face verification, Forensics, Security, Surveillance
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Bibliographical note
EXT="Tefas, Anastasios"
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Future of Ultra-Dense Networks Beyond 5G: Harnessing Heterogeneous Moving Cells
For the past 40 years, the cellular industry has been relying on static radio access deployments with gross over-provisioning. However, to meet the exponentially growing volumes of irregular data, the very notion of a cell will have to be rethought to allow them be (re-)configured on-demand and in an automated manner. This work puts forward a vision of moving networks to match dynamic user demand with network access supply in beyond-5G cellular systems. The resulting adaptive and flexible network infrastructures will leverage intelligent capable devices (e.g., cars and drones) by employing appropriate user involvement schemes. This work is a recollection of our efforts in this space with the goal to contribute a comprehensive research agenda. Particular attention is paid to quantifying the network performance scaling and session continuity gains with ultra-dense moving cells. Our findings argue for non-incremental benefits of integrating moving access points on a par with conventional (static) cellular access infrastructure.

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Organisations: Electrical Engineering, Research group: Wireless Communications and Positioning, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, King's College London, Carleton University
Contributors: Andreev, S., Petrov, V., Dohler, M., Yanikomeroglu, H.
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Original language: English
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Source: Scopus
Source ID: 85067074122
Research output: Contribution to journal › Article › Scientific › peer-review

Socially inspired relaying and proactive mode selection in mmWave vehicular communications
As the Internet of Vehicles matures and acquires its social flavor, novel wireless connectivity enablers are being demanded for reliable data transfer in high-rate applications. The recently ratified New Radio communications technology operates in millimeter-wave (mmWave) spectrum bands and offers sufficient capacity for bandwidth-hungry services. However, seamless operation over mmWave is difficult to maintain on the move, since such extremely high frequency radio links are susceptible to unexpected blockage by various obstacles, including vehicle bodies. As a result, proactive mode selection, that is, migration from infrastructure- to vehicle-based connections and back, is becoming vital to avoid blockage situations. Fortunately, the very social structure of interactions between the neighboring smart cars and their passengers may be leveraged to improve session continuity by relaying data via proximate vehicles. This paper

conceptualizes the socially inspired relaying scenarios, conducts underlying mathematical analysis, continues with a detailed 3-D modeling to facilitate proactive mode selection, and concludes by discussing a practical prototype of a vehicular mmWave platform.

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Organisations: Electrical Engineering, University of California, Los Angeles
Contributors: Moltchanov, D., Kovalchukov, R., Gerasimenko, M., Andreev, S., Koucheryavy, Y., Gerla, M.
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Source: Scopus
Source ID: 85067875266
Research output: Contribution to journal › Article › Scientific › peer-review

Approximate robust output regulation of boundary control systems
We extend the internal model principle for systems with boundary control and boundary observation, and construct a robust controller for this class of systems. However, as a consequence of the internal model principle, any robust controller for a plant with infinite-dimensional output space necessarily has infinite-dimensional state space. We proceed to formulate the approximate robust output regulation problem and present a finite-dimensional controller structure to solve it. Our main motivating example is a wave equation on a bounded multidimensional spatial domain with force control and velocity observation at the boundary. In order to illustrate the theoretical results, we construct an approximate robust controller for the wave equation on an annular domain and demonstrate its performance with numerical simulations.

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Contributors: Humaloja, J. P., Kurula, M., Paunonen, L.
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On Unified Vehicular Communications and Radar Sensing in Millimeter-Wave and Low Terahertz Bands

Future smart vehicles will incorporate high-data-rate communications and high-resolution radar sensing capabilities operating in the millimeter-wave and higher frequencies. These two systems are preparing to share and reuse many common functionalities, such as steerable millimeter-wave antenna arrays. Motivated by this growing overlap, which is advanced further by space and cost constraints, the vehicular community is pursuing a vision of unified vehicular communications and radar sensing that represents a major paradigm shift for next-generation connected and self-driving cars. This article outlines a path to materialize this decisive transformation. We begin by reviewing the latest developments in hybrid vehicular communications and radar systems, and then propose a concept of unified channel access over millimeter-wave and higher frequencies. Our supporting system-level performance characterization relies upon real-life measurements and extensive ray-based modeling to confirm the significant improvements brought by our proposal to mitigating the interference and deafness effects. Since our results aim to open the door to unified vehicular communications and radar sensing, we conclude by outlining the potential research directions in this rapidly developing field.

General information

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Organisations: Electrical Engineering, Ericsson Research
Contributors: Petrov, V., Fodor, G., Kokkoniemi, J., Moltchanov, D., Lehtomäki, J., Andreev, S., Koucheryavy, Y., Juntti, M., Valkama, M.
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Source: Scopus
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Research output: Contribution to journal › Article › Scientific › peer-review

Linearization of BJTs with logarithmic predistortion

This paper proposes a novel linearization technique for bipolar junction transistors (BJT) and their derivatives, e.g., heterojunction BJTs. Since the non-linearity of BJTs is exponential by nature, analog predistortion caused by a logarithmic amplifier should linearize the response completely, in theory. This paper reports that, in practice, cascading a logarithmic amplifier in front of a simple one-transistor BJT amplifier boosted its output third-order inter-modulation intercept point (OIP3) by 10 dB. The proposed linearization scheme is extremely simple and it is inherently broadbanded. To the best of our knowledge, this idea has not been reported previously.

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Organisations: Electrical Engineering
Contributors: Lunden, O., Paldanius, T.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

OFDM radar with LTE waveform: Processing and performance

Nokia Mobile Networks, Ulm, Germany This paper addresses the processing principles and performance of OFDM based radar, with particular focus on the LTE mobile network base-stations and the use of the LTE downlink transmit waveform for radar/sensing purposes. We specifically address the problem stemming from the unused subcarriers, within the transmit signal passband, and their impact on the frequency domain radar processing. We also formulate and adopt a computationally efficient interpolation approach to mitigate the effects of such empty subcarriers in the radar processing. We evaluate the target range and velocity estimation performance through computer simulations, and show that high-quality target detection can be achieved, with LTE waveform, when combined with the interpolation approach. Impacts of the different LTE carrier bandwidths and number of transmitted LTE sub-frames are also evaluated, together with aggregating up to 5 individual 20 MHz LTE carriers.

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Contributors: Barneto, C. B., Anttila, L., Fleischer, M., Valkama, M.
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Asterism: Decentralized file sharing application for mobile devices
Most applications and services rely on central authorities. This introduces a single point of failure to the system. The central authority must be trusted to have data stored by the application available at any given time. More importantly, the privacy of the user depends on the service provider capability to keep the data safe. A decentralized system could be a solution to remove the dependency from a central authority. Moreover, due to the rapid growth of mobile device usage, the availability of decentralization must not be limited only to desktop computers. In this work we aim at studying the possibility to use mobile devices as a decentralized file sharing platform without any central authorities. This was done by implementing Asterism, a peer-to-peer file-sharing mobile application based on the Inter-Planetary File System. We validate the results by deploying and measuring the application network usage and power consumption in multiple different devices. Results show that mobile devices can be used to implement a worldwide distributed file sharing network. However, the file sharing application generated large amounts of network traffic even when no files were shared. This was caused by the chattiness of the protocol of the underlying peer-to-peer network. Consequently, constant network traffic prevented the mobile devices from entering to deep sleep mode. Due to this the battery life of the devices was greatly degraded.

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Contributors: Heinisuo, O., Lenarduzzi, V., Taibi, D.
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Dense Moving Fog for Intelligent IoT: Key Challenges and Opportunities
As the ratification of 5G New Radio technology is being completed, enabling network architectures are expected to undertake a matching effort. Conventional cloud and edge computing paradigms may thus become insufficient in supporting the increasingly stringent operating requirements of intelligent IoT devices that can move unpredictably and at high speeds. Complementing these, the concept of fog emerges to deploy cooperative cloud-like functions in the immediate vicinity of various moving devices, such as connected and autonomous vehicles, on the road and in the air. Envisioning the gradual evolution of these infrastructures toward an increasingly denser geographical distribution of fog functionality, we in this work put forward the vision of dense moving fog for intelligent IoT applications. To this aim, we review the recent powerful enablers, outline the main challenges and opportunities, and corroborate the performance benefits of collaborative dense fog operation in a characteristic use case fe.

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Contributors: Andreev, S., Petrov, V., Huang, K., Lema, M. A., Dohler, M.
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http://www.scopus.com/inward/record.url?scp=85062145622&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 85062145622
Research output: Contribution to journal › Article › Scientific › peer-review

Error analysis of NOMA-based user cooperation with SWIPT
The present contribution analyzes the performance of non-orthogonal multiple access (NOMA)-based user cooperation with simultaneous wireless information and power transfer (SWIPT). In particular, we consider a two-user NOMA-based cooperative SWIPT scenario, in which the near user acts as a SWIPT-enabled relay that assists the farthest user. In this context, we derive analytic expressions for the pairwise error probability (PEP) of both users assuming the both amplify-and-forward (AF) and decode-and-forward (DF) relay protocols. The derived expressions are expressed in closed-form and have a tractable algebraic representation which renders them convenient to handle both analytically and numerically. In addition to this, we derive a simple asymptotic closed-form expression for the PEP in the high signal-to-noise ratio (SNR) regime which provide useful insights on the impact of the involved parameters on the overall system performance. Capitalizing on this, we subsequently quantify the maximum achievable diversity order of both users. It is shown that numerical and simulation results corroborate the derived analytic expressions. Furthermore, the offered results provide interesting insights into the error rate performance of each user, which are expected to be useful in future designs and deployments of NOMA based SWIPT systems.

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Contributors: Li, S., Bariah, L., Muhaidat, S., Sofotasios, P., Liang, J., Wang, A.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Effects of percutaneous transluminal angioplasty of superficial femoral artery on photoplethysmographic pulse transit times

We analyze the changes in upper and lower limb pulse transit times (PTT) caused by peripheral artery disease (PAD) and its treatment with percutaneous transluminal angioplasty (PTA) of the superficial femoral artery. PTTs were extracted from the photoplethysmograms (PPG) recorded from an index finger and 2nd toes. PTTs were defined between the R-peaks of the ECG and different reference points of the (PPG): foot and peak points, maxima of 1st and 2nd derivative, and by means of intersecting tangents method. Also the PTTs between the toe and finger pulses were analyzed. Our sample consists of 24 subjects examined before and after the PTA and in 1-month follow-up visit. Also 28 older than 65 years controls having normal ankle-to-brachial pressure index (ABI) and no history in cardiovascular diseases as well as 21 younger subjects were examined. The differences between the groups and pre- and post-treatment phases were analyzed by means of non-parametric statistical tests. The changes in the PTTs of upper limb and non-treated lower limb were negligible. The agreement with the reference values, ABI and toe pressures, was studied by kappa-analysis, resulting in kappa-values of 0.33- 0.91. Differences in PTTs were found between pre-treatment state of the treated limb, post-treatment state and the follow-up visit, as well as between the pre-treatment state and controls. If patients' age and systolic blood pressure were taken into consideration, the method of lower limb PTT calculation from the peak point turns out feasible in finding the markers of PAD and monitoring post- treatment vascular remodellation.

General information

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Sensor Technology and Biomeasurements (STB), Division of Vascular Surgery, Division of Interventional Radiology, Oulu University Hospital, Tampere University Hospital
Contributors: Peltokangas, M., Suominen, V., Vakhitov, D., Korhonen, J., Verho, J., Mattila, V. M., Romsi, P., Lekkala, J., Vehkaoja, A., Oksala, N.
Pages: 1058-1065
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Peer-reviewed: Yes
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URLs:
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Additional files:
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Source ID: 85049142393
Research output: Contribution to journal › Article › Scientific › peer-review

On the complexity of restoring corrupted colorings

In the r-Fix problem, we are given a graph G, a (non-proper) vertex-coloring c: V(G) → [r] , and a positive integer k. The goal is to decide whether a proper r-coloring c is obtainable from c by recoloring at most k vertices of G. Recently, Junosza-Szaniawski et al. (in: SOFSEM 2015: theory and practice of computer science, Springer, Berlin, 2015) asked whether the problem has a polynomial kernel parameterized by the number of recolorings k. In a full version of the

manuscript, the authors together with Garnero and Montealegre, answered the question in the negative: for every r≥ 3 , the problem r-Fix does not admit a polynomial kernel unless [InlineEquation not available: see fulltext.]. Independently of their work, we give an alternative proof of the theorem. Furthermore, we study the complexity of r-Swap, where the only difference from r-Fix is that instead of k recolorings we have a budget of k color swaps. We show that for every r≥ 3 , the problem r-Swap is [InlineEquation not available: see fulltext.]-hard whereas r-Fix is known to be FPT. Moreover, when r is part of the input, we observe both Fix and Swap are [InlineEquation not available: see fulltext.]-hard parameterized by the treewidth ρof the input graph. We also study promise variants of the problems, where we are guaranteed that a proper r-coloring c is indeed obtainable from c by some finite number of swaps. For instance, we prove that for r= 3 , the problems r-Fix-Promise and r-Swap-Promise are [InlineEquation not available: see fulltext.]-hard for planar graphs. As a consequence of our reduction, the problems cannot be solved in 2o(n) time unless the Exponential Time Hypothesis fails.

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Organisations: Mathematics, Bell Labs
Contributors: De Biasi, M., Lauri, J.
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Keywords: Combinatorial reconfiguration, Computational complexity, Graph coloring, Local search, Parameterized complexity
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Source ID: 85053264976
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Energy-efficient and high-precision control of hydraulic robots
In addition to high-precision closed-loop control performance, energy efficiency is another vital characteristic in field-robotic hydraulic systems as energy source(s) must be carried on board in limited space. This study proposes an energy-efficient and high-precision closed-loop controller for the highly nonlinear hydraulic robotic manipulators. The proposed method is twofold: 1) A possibility for energy consumption reduction is realized by using a separate meter-in separate meter-out (SMISMO) control set-up, enabling an independent metering (pressure control) of each chamber in hydraulic actuators. 2) A novel subsystem-dynamics-based and modular controller is designed for the system actuators, and it is integrated to the previously designed state-of-the-art controller for multiple degrees-of-freedom (n-DOF) manipulators. Stability of the overall controller is rigorously proven. The comparative experiments with a three-DOF redundant hydraulic robotic manipulator (with a payload of 475 kg) demonstrate that: 1) It is possible to design the triple objective of high-precision piston position, piston force and chamber pressure trackings for the hydraulic actuators. 2) In relation to the previous SMISMO-control methods, unprecedented motion and chamber pressure tracking performances are reported. 3) In comparison to the state-of-the-art motion tracking controller with a conventional energy-inefficient servovalve control, the actuators' energy consumption is reduced by 45% without noticeable motion control (position-tracking) deterioration.

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Organisations: Research group: Innovative Hydraulic Automation, Automation Technology and Mechanical Engineering, Canadian Space Agency
Contributors: Koivumäki, J., Zhu, W. H., Mattila, J.
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10.1016/j.conengprac.2018.12.013
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http://urn.fi/URN:NBN:fi:tty-201905141598
Source: Scopus
Source ID: 85061341920
Research output: Contribution to journal › Article › Scientific › peer-review

Employing Knowledge on Causal Relationship to Assist Multidisciplinary Design Optimization

With the increasing design dimensionality, it is more difficult to solve multidisciplinary design optimization (MDO) problems. Many MDO decomposition strategies have been developed to reduce the dimensionality. Those strategies consider the design problem as a black-box function. However, practitioners usually have certain knowledge of their problem. In this paper, a method leveraging causal graph and qualitative analysis is developed to reduce the dimensionality of the MDO problem by systematically modeling and incorporating the knowledge about the design problem into optimization. Causal graph is created to show the input-output relationships between variables. A qualitative analysis algorithm using design structure matrix (DSM) is developed to automatically find the variables whose values can be determined without resorting to optimization. According to the impact of variables, an MDO problem is divided into two subproblems, the optimization problem with respect to the most important variables, and the other with variables of lower importance. The novel method is used to solve a power converter design problem and an aircraft concept design problem, and the results show that by incorporating knowledge in form of causal relationship, the optimization efficiency is significantly improved.

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Organisations: Automation Technology and Mechanical Engineering, Research area: Manufacturing and Automation, Simon Fraser University
Contributors: Wu, D., Coatanea, E., Wang, G. G.
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ASJC Scopus subject areas: Mechanics of Materials, Mechanical Engineering, Computer Science Applications, Computer Graphics and Computer-Aided Design
Keywords: causal graph, dimension reduction, dimensional analysis, multidisciplinary design optimization
DOIs:
10.1115/1.4042342
Source: Scopus
Source ID: 85059942742
Research output: Contribution to journal › Article › Scientific › peer-review

DGC-Net: Dense geometric correspondence network

This paper addresses the challenge of dense pixel correspondence estimation between two images. This problem is closely related to optical flow estimation task where Con-vNets (CNNs) have recently achieved significant progress. While optical flow methods produce very accurate results for the small pixel translation and limited appearance variation scenarios, they hardly deal with the strong geometric transformations that we consider in this work. In this paper, we propose a coarse-to-fine CNN-based framework that can leverage the advantages of optical flow approaches and extend them to the case of large transformations providing dense and subpixel accurate estimates. It is trained on synthetic transformations and demonstrates very good performance to unseen, realistic, data. Further, we apply our method to the problem of relative camera pose estimation and demonstrate that the model outperforms existing dense approaches.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Aalto University, Univ of Oulu, HCI e 486.1
Contributors: Melekhov, I., Tiulpin, A., Sattler, T., Pollefeys, M., Rahtu, E., Kannala, J.
Number of pages: 9
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Publication date: 4 Mar 2019

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Bibliographical note

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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Digging deeper into egocentric gaze prediction

This paper digs deeper into factors that influence egocentric gaze. Instead of training deep models for this purpose in a blind manner, we propose to inspect factors that contribute to gaze guidance during daily tasks. Bottom-up saliency and optical flow are assessed versus strong spatial prior baselines. Task-specific cues such as vanishing point, manipulation point, and hand regions are analyzed as representatives of top-down information. We also look into the contribution of these factors by investigating a simple recurrent neural model for ego-centric gaze prediction. First, deep features are extracted for all input video frames. Then, a gated recurrent unit is employed to integrate information over time and to predict the next fixation. We also propose an integrated model that combines the recurrent model with several top-down and bottom-up cues. Extensive experiments over multiple datasets reveal that (1) spatial biases are strong in egocentric videos, (2) bottom-up saliency models perform poorly in predicting gaze and underperform spatial biases, (3) deep features perform better compared to traditional features, (4) as opposed to hand regions, the manipulation point is a strong influential cue for gaze prediction, (5) combining the proposed recurrent model with bottom-up cues, vanishing points and, in particular, manipulation point results in the best gaze prediction accuracy over egocentric videos, (6) the knowledge transfer works best for cases where the tasks or sequences are similar, and (7) task and activity recognition can benefit from gaze prediction. Our findings suggest that (1) there should be more emphasis on hand-object interaction and (2) the egocentric vision community should consider larger datasets including diverse stimuli and more subjects.

General information

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Organisations: Computing Sciences, Aalto University
Contributors: Tavakoli, H. R., Rahtu, E., Kannala, J., Borji, A.
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

How do academics experience use of recorded audio feedback in higher education? A thematic analysis

Our Work in Progress Paper in Research to Practice Category focuses on use of recorded audio feedback (RAF) in higher education. RAF is one method for providing feedback that is becoming increasingly popular, especially in e-education. According to previous studies, most learners have an overall positive attitude towards RAF. However, many of the studies have been carried out from learners' point of view. To complement RAF research, we study how academics experience use of RAF as a feedback method. We adopted a qualitative content analysis approach, applying thematic network analysis to the data received from four case academics. This approach proposes graphical networks as an aid for analyzing and synthesizing qualitative data into basic, organizing and global themes. The thematic network analysis produced two global, nine organizational and 45 basic themes. The two global themes were named 'Dialogue diversification' and 'Load reduction'. Based on our analysis, academics can, by using RAF, provide learners more relaxed and dialogic feedback and reduce their own workload both mentally and physically.

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Contributors: Heimbirger, A., Isomottonen, V., Nieminen, P., Keto, H.
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ASJC Scopus subject areas: Software, Education, Computer Science Applications
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jufoid=70484
Source: Scopus
Source ID: 85063507477
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Layered approach for improving the quality of free-viewpoint depth-image-based rendering images

In free-viewpoint rendering systems, one of the most challenging goals is the creation of virtual views based on available color texture (RGB) and depth data. Conventional depth-image-based rendering (DIBR) approaches have assumed that the virtual camera can only be displaced horizontally, thus leading to fairly simple disocclusion artifacts. However, in free-viewpoint DIBR, the virtual camera can be positioned in an arbitrary way and the respective disocclusion artifacts can exhibit complicated anisotropic appearances. Consequently, conventional approaches for compensating disocclusion holes usually fail in such arbitrary camera motion. We present a disocclusion compensation technique based on texture inpainting. We propose a layered representation of both the color and depth images in local foreground, background, and undefined segments (a trimap). This representation allows for employing an efficient alpha-matting approach for reconstructing the underlying opacity layer followed by a background compensation and layered rendering. The

performance of the proposed method is evaluated with respect to the state-of-the-art through objective and subjective tests. The achieved results, especially for large camera displacements, outperform the state-of-the-art. Those results assess the effectiveness of the proposed method and highlight the need for new quality metrics able to address the impairments of this type of content.

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Contributors: Smirnov, S., Battisti, F., Gotchev, A.
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EXT="Battisti, Federica"
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Iterative unsupervised domain adaptation for generalized cell detection from brightfield z-stacks
Background:
Cell counting from cell cultures is required in multiple biological and biomedical research applications. Especially, accurate brightfield-based cell counting methods are needed for cell growth analysis. With deep learning, cells can be detected with high accuracy, but manually annotated training data is required. We propose a method for cell detection that requires annotated training data for one cell line only, and generalizes to other, unseen cell lines. Results: Training a deep learning model with one cell line only can provide accurate detections for similar unseen cell lines (domains). However, if the new domain is very dissimilar from training domain, high precision but lower recall is achieved. Generalization capabilities of the model can be improved with training data transformations, but only to a certain degree. To further improve the detection accuracy of unseen domains, we propose iterative unsupervised domain adaptation method. Predictions of unseen cell lines with high precision enable automatic generation of training data, which is used to train the model together with parts of the previously used annotated training data. We used U-Net-based model, and three consecutive focal planes from brightfield image z-stacks. We trained the model initially with PC-3 cell line, and used LNCaP, BT-474 and 22Rv1 cell lines as target domains for domain adaptation. Highest improvement in accuracy was achieved for 22Rv1 cells. F_1-score after supervised training was only 0.65, but after unsupervised domain adaptation we achieved a score of 0.84. Mean accuracy for target domains was 0.87, with mean improvement of 16 percent.
Conclusions:
With our method for generalized cell detection, we can train a model that accurately detects different cell lines from brightfield images. A new cell line can be introduced to the model without a single manual annotation, and after iterative domain adaptation the model is ready to detect these cells with high accuracy.

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Organisations: BioMediTech, Tampere University of Applied Sciences, University of Eastern Finland
Contributors: Liimatainen, K., Kananen, L., Latonen, L., Ruusuvuori, P.
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DUPL=47150514
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Source ID: 85061610929
Research output: Contribution to journal › Article › Scientific › peer-review

Challenges and recommended practices for software architecting in global software development
Context: Global software development (GSD), although now a norm in the software industry, carries with it enormous challenges mostly regarding communication and coordination. Aforementioned challenges are highlighted when there is a need to transfer knowledge between sites, particularly when software artifacts assigned to different sites depend on each other. The design of the software architecture and associated task dependencies play a major role in reducing some of these challenges. Objective: The current literature does not provide a cohesive picture of how the distributed nature of software development is taken into account during the design phase: what to avoid, and what works in practice. The objective of this paper is to gain an understanding of software architecting in the context of GSD, in order to develop a framework of challenges and solutions that can be applied in both research and practice. Method: We conducted a systematic literature review (SLR) that synthesises (i) challenges which GSD imposes on software architecture design, and (ii) recommended practices to alleviate these challenges. Results: We produced a comprehensive set of guidelines for performing software architecture design in GSD based on 55 selected studies. Our framework comprises nine key challenges with 28 related concerns, and nine recommended practices, with 22 related concerns for software architecture design in GSD. These challenges and practices were mapped to a thematic conceptual model with the following concepts: Organization (Structure and Resources), Ways of Working (Architecture Knowledge Management, Change Management and Quality Management), Design Practices, Modularity and Task Allocation. Conclusion: The synthesis of findings resulted in a thematic conceptual model of the problem area, a mapping of the key challenges to practices, and a concern framework providing concrete questions to aid the design process in a distributed setting. This is a first step in creating more concrete architecture design practices and guidelines.

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Organisations: Pervasive Computing, Research area: Software engineering, University of Limerick
Contributors: Sievi-Korte, O., Beecham, S., Richardson, I.
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Challenges and Recommended practices. Embargo ended: 29/11/20
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URLs:
http://urn.fi/URN:NBN:fi:tty-201908232006. Embargo ended: 29/11/20
Source: Scopus
Source ID: 85055646041
Research output: Contribution to journal › Article › Scientific › peer-review

Towards sustainable manufacturing by extending Manufacturing Execution System functions

Sustainability performance targets of products and production systems can be seen as non-functional requirements. Current manufacturing systems do not take sustainability metrics into account during production, rather sustainability performance evaluation is performed a posteriori. This research analyzes how standard manufacturing execution system (MES) functions can support building more sustainable products by extending the functions with relevant sustainability questions. We identify an approach for addressing sustainability for eleven MES functions.

General information

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Organisations: Automation Technology and Mechanical Engineering, School of Mechanical Industrial and Manufacturing Engineering, Oregon State University
Contributors: Lobov, A., Haapala, K. R.
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10.1109/ICIT.2019.8755102

Bibliographical note

EXT="Haapala, Karl R."
Source: Scopus
Source ID: 85069050672
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Additional lossless compression of JPEG images based on BPG

The task of additional lossless compression of JPEG images is considered. We propose to decode JPEG image and recompress it using lossy BPG (Better Portable Graphics) codec based on a subset of the HEVC open video compression standard. Then the decompressed and smoothed BPG image is used for calculation and quantization of DCT coefficients in 8x8 image blocks using quantization tables of the source JPEG image. A difference between obtained quantized DCT coefficients and quantized DCT coefficients of the source JPEG image (prediction error) is calculated. The difference is lossless compressed by a proposed context modeling and arithmetical coding. In this way the source JPEG image is replaced by two files: compressed BPG image and the compressed difference which needed for lossless restoration of the source JPEG image. It is shown that the proposed approach provides compression ratios comparable with state of the art PAQ8, WinZip and STUFFIT file archivers. At the same time BPG images may be used for fast preview of compressed JPEG images.

General information

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Contributors: Ponomarenko, M., Miroshnichenko, O., Lukin, V., Egiazarian, K.
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Publication series

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ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
Keywords: Context modelling, Discrete cosine transform, JPEG, JPEG additional compression
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Combined no-reference IQA metric and its performance analysis

The problem of increasing efficiency of blind image quality assessment is considered. No-reference image quality metrics both independently and as components of complex image processing systems are employed in various application areas where images are the main carriers of information. Meanwhile, existing no-reference metrics have a significant drawback characterized by a low adequacy to image perception by human visual system (HVS). Many well-known no-reference metrics are analyzed in our paper for several image databases. A method of combining several no-reference metrics based on artificial neural networks is proposed based on multi-database verification approach. The effectiveness of the proposed approach is confirmed by extensive experiments.

General information

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Source ID: 85080028392
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Phase masks optimization for broadband diffractive imaging

The task of optimization of phase masks for broadband diffractive imaging to minimize chromatic aberrations and to provide given value of Depth of Focus (DoF) is considered. Different schemes of multilevel phase mask (MPM) forming by combining pixels of two Fresnel lenses are analyzed. The Fresnel lenses are calculated for the same focal distance but for very different wavelengths. A possibility of adding to the optimized mask a cubic component is taking into account as well as usage of discrete phase masks with optimized number of levels. It is shown that the proposed approach in the combination with inverse imaging allows to significantly increase image quality for a focus distance in comparison to refractive lens-based optical systems. Moreover, it is shown that by changing of aforementioned parameters it is possible to increase or decrease DoF value depending from a given goal of optimization. It is demonstrated by numerical analysis that the proposed approach significantly increases robustness of designed MPM to Gaussian additive noise in MPM introduced due to fabrication errors.

General information

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Organisations: Computing Sciences, Research group: Computational Imaging-CI
Contributors: Ponomarenko, M., Katkovnik, V., Egiazarian, K.
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Publication series

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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Thin form-factor super multiview head-up display system

We propose a virtual-image head-up display (HUD) based on the super multiview (SMV) display technology. Implementation-wise, the HUD provides a compact solution, consisting of a thin form-factor SMV display and a combiner placed on the windshield of the vehicle. Since the utilized display is at most few centimeters thick, it does not need extra installation space that is usually required by most of the existing virtual image HUDs. We analyze the capabilities of the proposed system in terms of several HUD related quality factors such as resolution, eyebox width, and target image depth. Subsequently, we verify the analysis results through experiments carried out using our SMV-HUD demonstrator. We show that the proposed system is capable of visualizing images at the typical virtual image HUD depths of 2 − 3m, in a reasonably large eyebox, which is slightly over 30cm in our demonstrator. For an image at the target virtual image depth of 2.5m, the field of view of the developed system is 11°x16° and the spatial resolution is around 240x60 pixels in vertical and horizontal directions, respectively. There is, however, plenty of room for improvement regarding the resolution, as we actually utilize an LCD at moderate resolution (216 ppi) and off-the-shelf lenticular sheet in our demonstrator.

General information

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Organisations: Computing Sciences
Contributors: Akpinar, U., Sahin, E., Suominen, O., Gotchev, A.
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Bibliographical note

jufoid=84313
Source: Scopus
Source ID: 85081086336
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Performance evaluation of bandwidth reservation for mmWave 5G NR systems

Introduction: In 3GPP New Radio (NR) systems, frequent radio propagation path blockages can lead to the disconnection of ongoing sessions already accepted into the system, reducing the quality of service in the network. Controlling access to system resource by prioritizing for the ongoing sessions can increase the session continuity. In this paper, we propose resource allocation with a reservation mechanism. Purpose: Development of a mathematical model for analyzing the effect of this mechanism on other system performance indicators - dropping probabilities for new and ongoing sessions and system utilization. The model takes into account the key features of the 3GPP NR technology, including the height of the interacting objects, the spatial distribution and mobility of the blockers, as well as the line-of-sight propagation properties between the transceivers for mmWave NR technology. Results: We analyzed the reservation mechanism with the help of a developed model in the form of a resource queueing system with signals, where the base station bandwidth corresponds to the resource, and the signals model a change in the line-of-sight conditions between the receiving and transmitting devices. Creating a priority for ongoing sessions whose service has not yet been completed provides a considerable flexibility for balancing the session continuity and dropping of a new session, with a slight decrease in the efficiency of the radio resource utility. With the developed model, we showed that reserving even a small bandwidth (less than 10% of the total resources) to maintain the ongoing sessions has a positive effect on their continuity, as it increases the probability of their successful completion. Practical relevance: The proposed mechanism works more efficiently in overload conditions and with sessions which have a high data transfer rate requirements. This increases the demand for the proposed mechanism in 5G NR communication systems.

General information

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Organisations: Electrical Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Peoples' Friendship University of Russia, Federal Research Center Computer Science and Control of the Russian Academy of Sciences
Contributors: Begishev, V. O., Sopin, E. S., Molchanov, D. A., Samouylov, A. K., Gaidamaka, Y. V., Samouylov, K. E.
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ASJC Scopus subject areas: Software, Control and Systems Engineering, Information Systems, Human-Computer Interaction, Computer Science Applications, Control and Optimization
Keywords: 5G networks, Bandwidth reservation, Millimeter wave, New Radio, New session drop probability, Ongoing session drop probability, Session continuity, System resource utilization
DOIs:

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Source ID: 85082424315
Research output: Contribution to journal › Article › Scientific › peer-review

Towards detecting structural branching and cyclicity in graphs: A polynomial-based approach
Structural properties of graphs and networks have been investigated across scientific disciplines ranging from mathematics to structural chemistry. Structural branching, cyclicity and, more generally, connectedness are well-known examples of such properties. In particular, various graph measures for detecting structural branching and cyclicity have been investigated. These measures are of limited applicability since their interpretation relies heavily on a certain definition of structural branching. In this paper we define a related measure, taking an approach to measurement similar to that of Lovász and Pelikán (On the eigenvalues of trees, Periodica Mathematica Hungarica, Vol. 3 (1–2), 1973, 175–182). We define a complex valued polynomial which also has a unique positive root. Analytical and numerical results demonstrate that this measure can be interpreted as a structural branching and cyclicity measure for graphs. Our results generalize the work of Lovász and Pelikán since the measure we introduce is not restricted to trees.

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Contributors: Dehmer, M., Chen, Z., Emmert-Streib, F., Mowshowitz, A., Shi, Y., Tripathi, S., Zhang, Y.
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ASJC Scopus subject areas: Software, Control and Systems Engineering, Theoretical Computer Science, Computer Science Applications, Information Systems and Management, Artificial Intelligence
Keywords: Data science, Graphs, Networks, Quantitative graph theory, Structural branching
DOIs:

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Source ID: 85052883508
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1.3μm U-bend traveling wave SOA devices for high efficiency coupling to silicon photonics

We present a U-bend design for traveling wave III-V gain devices, such as semiconductor optical amplifiers and laser diodes. The design greatly simplifies the butt-coupling between the III-V chip and silicon-on-insulator photonic circuit by bringing the I/O ports on one facet. This removes the need for precise dimension control otherwise required for 2-side coupling, therefore increasing the yield of mounted devices towards 100%. The design, fabrication and characterization of the U-bend device based on Euler bend geometry is presented. The losses for a bend with a minimum bending radius of 83 μm are 1.1 dB. In addition, we present an analysis comparing the yield and coupling losses of the traditionally cleaved devices with the results that the Euler bend approach enable, with the final conclusion that the yield is improved by several times while the losses are decreased by several dB.

General information

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Organisations: Physics, VTT Technical Research Centre of Finland
Contributors: Viheriälä, J., Tuorila, H., Zia, N., Cherchi, M., Aalto, T., Guina, M.
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Keywords: Coupling losses, Hybrid integration, III-V, Semiconductor optical amplifiers, Silicon-on-insulator
DOIs:

10.1117/12.2505935

Bibliographical note

jufoid=71479
Source: Scopus
Source ID: 85065404814
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

1.55-μm wavelength wafer-fused OP-VECSELs in flip-chip configuration

Optically-pumped vertical external cavity surface emitting lasers (VECSELs) based on flip-chip gain mirrors emitting at the 1.55-μm wavelength range are reported. The gain mirrors employ wafer-fused InAlGaAs/InP quantum well heterostructures and GaAs/AlAs distributed Bragg reflectors, which were incorporated in a linear and a V-cavity configurations. A maximum output power of 3.65 W was achieved for a heatsink temperature of 11°C and employing a 2.2% output coupler. The laser exhibited circular beam profiles for the full emission power range. The demonstration represents more than 10-fold increase of the output power compared to state-of-the-art flip-chip VECSELs previously demonstrated at the 1.55-μm wavelength range, and opens a new perspective for developing practical VECSEL-based laser system for applications such as LIDAR, spectroscopy, communications and distributed sensing.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Physics, CRPP, LakeDiamond SA
Contributors: Mereuta, A., Nechay, K., Caliman, A., Suruceanu, G., Gallo, P., Guina, M., Kapon, E.
Publication date: 2019

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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Optically-pumped VECSELs, Semiconductor lasers, Wafer-Fusion
DOIs:
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Bibliographical note
jufoid=71479
Source: Scopus
Source ID: 85066636665
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

405-nm pumped Ce^{3+}-doped silica fiber for broadband fluorescence from cyan to red

A pure Ce-doped silica fiber is fabricated using modified chemical vapor deposition (MCVD) technique. Fluorescence characteristics of a Ce-doped silica fiber are experimentally investigated with continuous wave pumping from 440 nm to 405 nm. Best pump absorption and broad fluorescence spectrum is observed for ~ 405 nm laser. Next, the detailed analysis of spectral response as a function of pump power and fiber length is performed. It is observed that a-10dB spectral width of ~ 280 mn can be easily achieved with different combinations of the fiber length and pump power. Lastly, we present, for the first time to the best of our knowledge, a broadband fluorescence spectrum with-10dB spectral width of 301 nm, spanning from ~ 517.36 nm to ~ 818 nm, from such fibers with non-UV pump lasers.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Physics, Aston University, Fiber Optics Research Center of the Russian Academy of Sciences, Russian Academy of Sciences
Contributors: Yadav, A., Chichkov, N. B., Gumenyuk, R., Zherebtsov, E., Melkumov, M. A., Yashkov, M. V., Dianov, E. M. , Rafailov, E. U.
Publication date: 2019

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Publisher: SPIE, IEEE
Editors: Digonnet, M. J. F., Jiang, S.
Article number: 1091406
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Keywords: Broadband spectrum, Ce-doped fiber, Ce-ion, Rare earth doped
DOIs:
10.1117/12.2509599

Bibliographical note
jufoid=71479
Source: Scopus
Source ID: 85066046508
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

5G-U: Conceptualizing Integrated Utilization of Licensed and Unlicensed Spectrum for Future IoT

IoT applications constitute one of the fastest developing areas in today's technology and at the same time pose the most demanding challenges for the respective radio access network design. While the initial studies in IoT were focused

primarily on scaling the existing radio solutions for higher numbers of small-data and low-cost sensors, the current developments aim at supporting wearable augmented/virtual reality platforms, moving industrial robots, driving (semi-)autonomous vehicles, and flying drones, which produce large amounts of data. To satisfy these rapidly growing performance demands, the 5G-grade IoT is envisioned to increasingly employ millimeter-wave (mmWave) spectrum, where wider bandwidths promise to enable higher data rates and low-latency communication. While the mainstream trend in mmWave-based IoT is to rely on licensed bands around 28 GHz or leverage unlicensed bands at 60 GHz, in this work we introduce a conceptual vision for the integrated use of these frequencies within a single radio access system named 5G over unlicensed spectrum or 5G-U. We study the performance of 5G-U in supporting stringent IoT use cases, discuss and compare the alternative strategies for spectrum management in 5G-U, and demonstrate that a harmonized utilization of licensed and unlicensed bands provides notable performance improvements in both device-centric and network-centric metrics. Finally, we offer useful guidelines for future implementations of 5G-U and detail its potential applications in the area of advanced IoT services.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Electrical Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Research group: Wireless Communications and Positioning, King's College London
Contributors: Lu, X., Petrov, V., Moltchanov, D., Andreev, S., Mahmoodi, T., Dohler, M.
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URLs:
http://urn.fi/URN:NBN:fi:tuni-202001311731
URLs:
http://www.scopus.com/inward/record.url?scp=85067057054&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 85067057054
Research output: Contribution to journal › Article › Scientific › peer-review

Action and power efficiency in self-organization: The case for growth efficiency as a cellular objective in escherichia coli

Complex systems of different nature self-organize using common mechanisms. One of those is increase of their efficiency. The level of organization of complex systems of different nature can be measured as increased efficiency of the product of time and energy for an event, which is the amount of physical action consumed by it. Here we apply a method developed in physics to study the efficiency of biological systems. The identification of cellular objectives is one of the central topics in the research of microbial metabolic networks. In particular, the information about a cellular objective is needed in flux balance analysis which is a commonly used constrained-based metabolic network analysis method for the prediction of cellular phenotypes. The cellular objective may vary depending on the organism and its growth conditions. It is probable that nutritionally scarce conditions are very common in the nature, and, in order to survive in those conditions, cells exhibit various highly efficient nutrient-processing systems like enzymes. In this study, we explore the efficiency of a metabolic network in transformation of substrates to new biomass, and we introduce a new objective function simulating growth efficiency. We are searching for general principles of self-organization across systems of different nature. The objective of increasing efficiency of physical action has been identified previously as driving systems toward higher levels of self-organization. The flow agents in those networks are driven toward their natural state of motion, which is governed by the principle of least action in physics. We connect this to a power efficiency principle. Systems structure themselves in a way to decrease the average amount of action or power per one event in the system. In this particular example, action efficiency is examined in the case of growth efficiency of E. coli. We derive the expression for growth efficiency as a special case of action (power) efficiency to justify it through first principles in physics. Growth efficiency as a cellular

objective of E. coli coincides with previous research on complex systems and is justified by first principles in physics. It is expected and confirmed outcome of this work. We examined the properties of growth efficiency using a metabolic model for Escherichia coli. We found that the maximal growth efficiency is obtained at a finite nutrient uptake rate. The rate is substrate dependent and it typically does not exceed 20 mmol/h/gDW. We further examined whether the maximal growth efficiency could serve as a cellular objective function in metabolic network analysis and found that cellular growth in batch cultivation can be predicted reasonably well under this assumption. The fit to experimental data was found slightly better than with the commonly used objective function of maximal growth rate. Based on our results, we suggest that the maximal growth efficiency can be considered a plausible optimization criterion in metabolic modeling for E. coli. In the future, it would be interesting to study growth efficiency as an objective also in other cellular systems and under different cultivation conditions.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: BioMediTech, Wireless Innovation Laboratory at Worcester Polytechnic Institute, Assumption College, Tufts University, Complex Systems Center, University of Vermont
Contributors: Georgiev, G. Y., Aho, T., Kesseli, J., Yli-Harja, O., Kauffman, S. A.
Number of pages: 16
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Publication date: 2019

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Title of host publication: Evolution, Development and Complexity - Multiscale Evolutionary Models of Complex Adaptive Systems
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Editors: Flores Martinez, C. L., Georgiev, G. Y., Smart, J. M., Price, M. E.
ISBN (Print): 9783030000745

Publication series
Name: Springer Proceedings in Complexity
ISSN (Print): 2213-8684
ISSN (Electronic): 2213-8692
ASJC Scopus subject areas: Applied Mathematics, Modelling and Simulation, Computer Science Applications
Keywords: Action efficiency, Constraint-based modeling, Metabolism, Microorganism, Principle of least action
DOIs:
10.1007/978-3-030-00075-2_8

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Source: Scopus
Source ID: 85071889407
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Benchmarking of several disparity estimation algorithms for light field processing

A number of high-quality depth imaged-based rendering (DIBR) pipelines have been developed to reconstruct a 3D scene from several images taken from known camera viewpoints. Due to the specific limitations of each technique, their output is prone to artifacts. Therefore, the quality cannot be ensured. To improve the quality of the most critical and challenging image areas, an exhaustive comparison is required. In this paper, we consider three questions of benchmarking the quality performance of eight DIBR techniques on light fields: First, how does the density of original input views affect the quality of the rendered novel views? Second, how does disparity range between adjacent input views impact the quality? Third, how does each technique behave for different object properties? We compared and evaluated the results visually as well as quantitatively (PSNR, SSIM, AD, and VDP2). The results show some techniques outperform others in different disparity ranges. The results also indicate using more views not necessarily results in visually higher quality for all critical image areas. Finally, we have shown a comparison for different scene's complexity such as non-Lambertian objects.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Moving Picture Technologies
Contributors: Zakeri, F. S., Bätz, M., Jaschke, T., Keinert, J., Chuchvara, A.
Publication date: 2019

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Editors: Bazeille, S., Verrier, N., Cudel, C.

Article number: 111721C
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Name: Proceedings of SPIE - The International Society for Optical Engineering
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Keywords: Depth image-based rendering, Disparity estimation, Quality evaluation
DOIs:
10.1117/12.2521747

Bibliographical note
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Source: Scopus
Source ID: 85070208910
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Characterization of the anisotropic deformation of the right ventricle during open heart surgery

Digital Image Correlation (DIC) was used for studying the anisotropic behavior of the thin walled right ventricle of the human heart. Strains measured with Speckle Tracking Echocardiography (STE) were compared with the DIC data. Both DIC and STE were used to measure longitudinal strains of the right ventricle in the beginning of an open-heart surgery as well as after the cardiopulmonary bypass. Based on the results, the maximum end-systolic strains obtained with the DIC and STE change similarly during the surgery with less than 10% difference. The difference is largely due to the errors in matching the longitudinal direction in the two methods, sensitivity of the measurement to the positioning of the virtual extensometer of in both STE and DIC, and physiological difference of the measurements as the DIC measures the top surface of the heart whereas the STE obtains the data from below. The anisotropy of the RV was measured using full field principal strains acquired from the DIC displacement fields. The full field principal strains cover the entire region of interest instead of just two points as the virtual extensometer approach used by the STE. The principal strains are not direction dependent measures, and therefore are more independent of the anatomy of the patient and the exact positioning of the virtual strain gage or the STE probe. The results show that the longitudinal strains alone are not enough to fully characterize the behavior of the heart, as the deformation of the heart can be very anisotropic, and the anisotropy changes during the surgery, and from patient to patient.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Materials Science and Environmental Engineering, Research group: Materials Characterization, Hospital Heart Center, Tampere University
Contributors: Soltani, A., Lahti, J., Järvelä, K., Laurikka, J., Kuokkala, V. T., Hokka, M.
Number of pages: 12
Publication date: 2019
Peer-reviewed: Yes

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Journal: COMPUTER METHODS IN BIOMECHANICS AND BIOMEDICAL ENGINEERING
ISSN (Print): 1025-5842
Ratings:
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Original language: English
ASJC Scopus subject areas: Bioengineering, Biomedical Engineering, Human-Computer Interaction, Computer Science Applications
Keywords: anisotropy, biomaterial characterization, deformation, digital image correlation, heart muscle, Human biomechanics, motion
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dupl=51243005
Source: Scopus
Source ID: 85076903988
Research output: Contribution to journal › Article › Scientific › peer-review

Code ABC hackathons: Teachers as tinkerers

Motto ‘hands-on exercises are the most efficient means to learn coding’ prevails the design of Code ABC hackathons. Hackathons are emergent and challenge-based ways to engage participants. The participants of this study comprise Finnish comprehensive schoolteachers that are willing to develop their coding skills. Perceiving hackathon participants as players grants employing the same motivation and engagement theories that game researchers and developers exploit in developing serious games. This paper represents two subsequent Code ABC hackathon iterations, the autumn of 2017 and the spring of 2018. The development of hackathon challenges was based on the previous semester-long Code ABC MOOC exercises field-tested since autumn 2015. As the data, we exploit the returned work from participants (multiple-choice questions, open-ended responses, programming exercises, N = 10, the first, N = 30, the second) and the instructors’ reflections (N = 5). In particular, we address the topics considered challenging, engaging, and the lessons learned; the analysis utilizes mixed methods. Results show that the hackathons were almost too demanding yet engaging; however, their full potential was left unexploited.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, City of Tampere, City of Espoo, LifeLearn, Oulu City Hospital, Ylivieska City
Contributors: Niemelä, P., Partanen, T., Toivanen, T., Toikkanen, T., Kangas, V., Översti, M.
Number of pages: 13
Pages: 157-169
Publication date: 2019

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Publisher: Springer International Publishing
ISBN (Print): 978-981-13-7360-2
ISBN (Electronic): 978-981-13-7361-9

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ISSN (Print): 2196-4963
ISSN (Electronic): 2196-4971
ASJC Scopus subject areas: Education, Computer Science Applications, Computer Networks and Communications
Keywords: Engagement, Flow, Hackathon, Knowmad, K–12 computer science education, Teacher in-service training
DOIs:
10.1007/978-981-13-7361-9_11

Bibliographical note

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Source: Scopus
Source ID: 85066928045
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Color Constancy Convolutional Autoencoder

In this paper, we study the importance of pretraining for the generalization capability in the color constancy problem. We propose two novel approaches based on convolutional autoencoders: an unsupervised pre-training algorithm using a fine-tuned encoder and a semi-supervised pre-training algorithm using a novel composite-loss function. This enables us to solve the data scarcity problem and achieve competitive, to the state-of-the-art, results while requiring much fewer parameters on ColorChecker RECommended dataset. We further study the over-fitting phenomenon on the recently introduced version of INTEL-TUT Dataset for Camera Invariant Color Constancy Research, which has both field and non-field scenes acquired by three different camera models.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Research group: Multimedia Research Group - MRG, Aarhus University, Intel Finland
Contributors: Laakom, F., Raitoharju, J., Iosifidis, A., Nikkanen, J., Gabbouj, M.
Number of pages: 6
Pages: 1085-1090
Publication date: 2019

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Publisher: IEEE
Article number: 9002684
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ISBN (Electronic): 9781728124858
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Modelling and Simulation
Keywords: color constancy, convolutional autoencoders, illumination, pre-training
DOIs:
10.1109/SSCI44817.2019.9002684

Bibliographical note
EXT="Iosifidis, Alexandros"
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Customized dimensional analysis conceptual modelling framework for design optimization—a case study on the cross-flow micro turbine model
Dimensional Analysis Conceptual Modelling (DACM) is a framework used for conceptual modelling and simulation in system and product designs. The framework is based on cause–effect analysis between variables and functions in a problem. This article presents an approach that mobilizes concepts from the DACM framework to assist solve high-dimensional expensive optimization problems with lower computational costs. The latter fundamentally utilizes theories and concepts from well-practised dimensional analysis, functional modelling and bond graphing. Statistical design-of-experiments theory is also utilized in the framework to measure impact levels of variables towards the objective. Simplifying as well as decomposing followed by optimization of expensive problems are the focuses of the article. To illustrate the approach, a case study on the performance optimization of a cross-flow micro hydro turbine is presented. The customized DACM framework assisted optimization approach converges faster and returns better results than the one without. A single-step simplification approach is employed in the case study and it returns a better average optimization result with about only one fifth of the function evaluations compared to optimization using the original model.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Mechanical Engineering and Industrial Systems, Research area: Manufacturing and Automation, University of Stavanger, Simon Fraser University
Contributors: Woldemariam, E. T., Coatanéa, E., Wang, G. G., Lemu, H. G., Wu, D.
Pages: 1168-1184
Publication date: 2019
Peer-reviewed: Yes
Early online date: 2018

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Volume: 51
Issue number: 7
ISSN (Print): 0305-215X
Ratings:
Scopus rating (2019): CiteScore 4.2 SJR 0.636 SNIP 1.294
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Management Science and Operations Research, Control and Optimization, Industrial and Manufacturing Engineering, Applied Mathematics
Keywords: Causality analysis, conceptual modelling, DACM assisted optimization, high-dimensional optimization, micro cross-flow turbine
DOIs:
10.1080/0305215X.2018.1519556
Source: Scopus
Source ID: 85054818014
Research output: Contribution to journal › Article › Scientific › peer-review

DNA Molecular Storage System: Transferring Digitally Encoded Information through Bacterial Nanonetworks
Since the birth of computer and networks, fuelled by pervasive computing, Internet of Things and ubiquitous connectivity, the amount of data stored and transmitted has exponentially grown through the years. Due to this demand, new storage solutions are needed. One promising media is the DNA as it provides numerous advantages, which includes the ability to store dense information while achieving long-term reliability. However, the question as to how the data can be retrieved from a DNA-based archive, still remains. In this paper, we aim to address this question by proposing a new storage solution that relies on bacterial nanonetworks properties. Our solution allows digitally-encoded DNA to be stored into motility-restricted bacteria, which compose an archival architecture of clusters, and to be later retrieved by engineered motile bacteria, whenever reading operations are needed. We conducted extensive simulations, in order to determine the

reliability of data retrieval from motility-restricted storage clusters, placed spatially at different locations. Aiming to assess the feasibility of our solution, we have also conducted wet lab experiments that show how bacteria nanonetworks can effectively retrieve a simple message, such as "Hello World", by conjugation with motility-restricted bacteria, and finally mobilize towards a target point for delivery.

General information
Publication status: E-pub ahead of print
MoE publication type: A1 Journal article-refereed
Organisations: Electrical Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Universita degli Studi di Padova, Italy, Örebro University, Waterford Institute of Technology
Contributors: Tavella, F., Giaretta, A., Dooley-Cullinane, T. M., Conti, M., Coffey, L., Balasubramaniam, S.
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ASJC Scopus subject areas: Computer Science (miscellaneous), Information Systems, Human-Computer Interaction, Computer Science Applications
Keywords: Bacterial Nanonetworks, Data Storage, DNA Encoding, Molecular Communications
DOIs:
10.1109/TETC.2019.2932685
Source: Scopus
Source ID: 85070665316
Research output: Contribution to journal › Article › Scientific › peer-review

Emptiness problems for distributed automata
We investigate the decidability of the emptiness problem for three classes of distributed automata. These devices operate on finite directed graphs, acting as networks of identical finite-state machines that communicate in an infinite sequence of synchronous rounds. The problem is shown to be decidable in LOGSPACE for a class of forgetful automata, where the nodes see the messages received from their neighbors but cannot remember their own state. When restricted to the appropriate families of graphs, these forgetful automata are equivalent to classical finite word automata, but strictly more expressive than finite tree automata. On the other hand, we also show that the emptiness problem is undecidable in general. This already holds for two heavily restricted classes of distributed automata: those that reject immediately if they receive more than one message per round, and those whose state diagram must be acyclic except for self-loops. Additionally, to demonstrate the flexibility of distributed automata in simulating different models of computation, we provide a characterization of constraint satisfaction problems by identifying a class of automata with exactly the same computational power.

General information
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Organisations: Computing Sciences, Helsinki University, UPEM
Contributors: Kuusisto, A., Reiter, F.
Publication date: 2019
Peer-reviewed: Yes

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Article number: 104503
ISSN (Print): 0890-5401
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ASJC Scopus subject areas: Theoretical Computer Science, Information Systems, Computer Science Applications, Computational Theory and Mathematics
Keywords: Distributed computing, Emptiness problem, Finite automata
DOIs:
10.1016/j.ic.2019.104503
Source: Scopus
Source ID: 85076991997
Research output: Contribution to journal › Article › Scientific › peer-review

Environmental and social sustainability–emergence of well-being in the built environment, assessment tools and real estate market implications

Well-being has emerged as the new ‘green’ for buildings thought to reward occupiers, property owners, developers and other concerned actors. The new assessment tools for well-being are seen as the next step of currently widely used ‘traditional’ sustainability tools. However, a lack of knowledge globally about these tools, their compatibility and general adoption in the market due to the newness of the topic inspired this study. In the research, we aim at developing a deeper understanding of the well-being and social sustainability perspective as an innovation in relation to the built environment. The study consists of a literature review, a desktop study of sustainability and well-being rating tools and a qualitative interview data-based research on stakeholders’ position regarding the WELL-certificate adoption in the market. Lastly, the conclusions are drawn based on the results of empirical and desktop study. The results of this research benefit the scientific community by providing a better understanding of the well-being approach in the market and points out the areas of interest for further research. Practitioners can benefit from a deeper understanding of market adoption of well-being assessment tools and the development of sustainability concept in the built environment.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Civil Engineering, Research group: Responsible Construction, Aalto University, University of Melbourne, Finnish University Properties, Ltd
Contributors: Danivska, V., Heywood, C., Christersson, M., Zhang, E., Nenonen, S.
Publication date: 2019
Peer-reviewed: Yes

Publication information

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Ratings:

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ASJC Scopus subject areas: Building and Construction, Computer Science Applications
Keywords: assessment tools, building certification, Health and well-being, market acceptance, social sustainability
DOIs:

10.1080/17508975.2019.1678005

Bibliographical note

EXT="Danivska, Vitalija"
Source: Scopus
Source ID: 85074504857
Research output: Contribution to journal › Article › Scientific › peer-review

Experimental analysis on the turning of aluminum alloy 7075 based on Taguchi method and artificial neural network

This paper mainly aims to disclose the effects of cutting conditions on the turning of aluminum alloy 7075 (AA7075). First, the artificial neural network (ANN) was programmed to investigate how cutting parameters, namely cutting speed, feed rate and depth of cut, affect the surface roughness of AA7075. Then, the taguchi method was introduced to design an L_{27} orthogonal array, in which each cutting parameter is considered on three levels. The results of orthogonal analysis were used to train the ANN called backpropagation neural network (BPNN) on MATLAB. The trained network was applied to predict the surface roughness of AA7075 through MATLAB simulation. Meanwhile, an experiment was conducted under the same conditions. The experimental results were found consistent with the simulation data, indicating that the BPNN is suitable for simulation the turning of AA7075. It is also learned that the cutting speed has the greatest impact on surface roughness; the surface roughness is negeatively correlated with feed rate; the negative correlation is positively mediated by the cutting speed.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Materials Science and Environmental Engineering, Manipal Academy of Higher Education, Dubai Campus
Contributors: Joshy, A., Dsouza, R., Muthirulan, V., Sachidananda, K. H.
Number of pages: 9
Pages: 429-437
Publication date: 2019
Peer-reviewed: Yes

Publication information

Journal: Journal Europeen des Systemes Automatises

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Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Industrial and Manufacturing Engineering, Electrical and Electronic Engineering
Keywords: Artificial neural network (ANN), Cutting speed, Depth of cut, Feed rate, Machining, Surface roughness, Taguchi method, Turning
DOIs:
10.18280/jesa.520501
Source: Scopus
Source ID: 85077879334
Research output: Contribution to journal › Article › Scientific › peer-review

From monolithic systems to microservices: A decomposition framework based on process mining

Decomposition is one of the most complex tasks during the migration from monolithic systems to microservices, generally performed manually, based on the experience of the software architects. In this work, we propose a 6-step framework to reduce the subjectivity of the decomposition process. The framework provides software architects with a set of decomposition options, together with a set of measures to evaluate and compare their quality. The decomposition options are identified based on the independent execution traces of the system by means of the application of a process-mining tool to the log traces collected at runtime. We validated the process, in an industrial project, by comparing the proposed decomposition options with the one proposed by the software architect that manually analyzed the system. The application of our framework allowed the company to identify issues in their software that the architect did not spot manually, and to discover more suitable decomposition options that the architect did not consider. The framework could be very useful also in other companies to improve the quality of the decomposition of any monolithic system, identifying different decomposition strategies and reducing the subjectivity of the decomposition process. Moreover, researchers could extend our approach increasing the support and further automating the decomposition support.

General information

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Organisations: Computing Sciences, TASE - Tampere Software Engineering Research Group
Contributors: Taibi, D., Systä, K.
Number of pages: 12
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Publication date: 2019

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Publisher: SCITEPRESS
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ISBN (Electronic): 9789897583650
ASJC Scopus subject areas: Computer Science (miscellaneous), Computer Science Applications
Keywords: Cloud-native, Microservice decomposition, Microservice migration, Microservice slicing, Microservices
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Source ID: 85067463647
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Hardware-in-the-loop platform for testing autonomous vehicle control algorithms

Autonomous vehicles are a demanding topic which has attracted a lot of attention lately. This kind of vehicle should be capable of sensing its environment and react on the presence of obstacles and other traffic participants. Algorithms for obstacle avoidance and overall control of the autonomous driving in relation to robustness regarding environmental conditions are required for driving safely on roads. For the development of these algorithms, a safe environment is needed. In order to speed up the development of the algorithms, this paper proposes a Hardware in the loop (HIL) based test environment and analysis of it for autonomous vehicle development. Proposed HIL is combining a virtual driving environment based on Unity (game engine) and Apollo (an open autonomous driving platform) as well as a real car. Unity provides ability to vary weather, road conditions and driving scenarios. Apollo includes all the code necessary for autonomous driving and consists of numerous modules: localization, perception, control, routing, safety module and others. This will allow the testing of algorithms in various conditions and scenarios in a safe way while being closer to real world. Possible challenges with realization of the HIL are discussed and highlighted in this paper.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Automation Technology and Mechanical Engineering, St-Petersburg State Electrotechnical University 'Leti' , Innopolis University
Contributors: Heikkinen, J. E., Gafurov, S., Kopylov, S., Minav, T., Grebennikov, S., Kurbanov, A.
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Publisher: IEEE
Editors: Al-Jumeily, D., Hind, J., Mustafina, J., Al-Hajj, A., Hussain, A., Magid, E., Tawfik, H.
Article number: 9073320
ISBN (Print): 978-1-7281-3022-4
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Measuring stem diameters with TLS in boreal forests by complementary fitting procedure

Point clouds generated by terrestrial laser scanners (TLS) have enabled new ways to measure stem diameters. A common method for diameter calculation is to fit cylindrical or circular shapes into the TLS point cloud, which can be based either on a single scan or a co-registered combination of several scans. However, as various defects in the point cloud may affect the final diameter results, we propose an automatized processing chain which takes advantage of complementing steps. Processing consists of two fitting phases and an additional taper curve calculation to define the final diameter measurements. First, stems are detected from co-registered data of several scans using surface normals and cylinder fitting. This provides a robust framework for localizing the stems and estimating diameters at various heights. Then, guided by the cylinders and their indicative diameters, another fitting round is performed by cutting the stems into thin horizontal slices and reassessing their diameters by circular shape. For each slice, the quality of the cylinder-modelled diameter is evaluated first with co-registered data and if it is found to be deficient, potentially due to modelling defects or co-registration errors, diameter is detected through single scans. Finally, slice diameters are applied to construct a spline-based taper curve model for each tree, which is used to calculate the final stem dimensions. This methodology was tested in southern Finland using a set of 505 trees. At the breast height level (1.3 m), the results indicate 5.2 mm mean difference (3.2%), −0.4 mm bias (-0.3%) and 7.3 mm root mean squared error (4.4%) to reference measurements, and at the height of 6.0 m, respective values are 6.5 mm (3.6%), +1.6 mm (0.9%) and 8.4 mm (4.8%). These values are smaller compared to most of the corresponding contemporary studies, and outperform the initial cylinder models. This indicates that the applied processing chain is capable of producing relatively accurate diameter measurements, which can, at the cost of computational heaviness, remove various defects and improve the modelling results.

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Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Mathematics, Natural Resources Institute Finland (Luke)
Contributors: Pitkänen, T. P., Raumonen, P., Kangas, A.
Number of pages: 13
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Source: Scopus
Source ID: 85057752987
Research output: Contribution to journal › Article › Scientific › peer-review

MECSELs with direct emission in the 760 nm to 810 nm spectral range: A single- and double-side pumping comparison and high-power continuous-wave operation

We compared single-side pumping (SSP) and double-side pumping (DSP) of a semiconductor membrane external-cavity surface-emitting laser (MECSEL). The MECSEL's active region was based on a 4×3 AlGaAs quantum well (QW) structure. This structure was embedded between two silicon carbide (SiC) wafer pieces that were used as transparent intra-cavity (IC) heat spreaders creating a symmetrical cooling environment. The MECSEL structure targeted emission at 780nm and was operated at 20°C heat sink temperature. Via DSP the differential efficiency was improved from 31.9% to 34.4 %. The laser threshold was reduced from 0.79 W to 0.69 W of absorbed pump power while the maximum output power was increased from 3.13 W to 3.22 W. The DSP configuration enabled these improvements by a reduced thermal resistance of the gain element by 9 %. The MECSEL operated at a fundamental Gaussian TEM_{00} mode profile and the beam quality was measured to be M^2 <1.09. We further demonstrate a maximum tuning range from 767 nm to 811 nm. A similar active region with about half the thickness (2×3 AlGaAs QWs) was investigated using the DSP configuration and first results are presented here. 500-µm-thick sapphire IC heat spreaders were used instead of SiC. The output power exceeded 0.5W and the emission was spectrally located around 770 nm.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Physics
Contributors: Kahle, H., Penttinen, J. P., Phung, H. M., Rajala, P., Tukiainen, A., Ranta, S., Guina, M.
Publication date: 2019

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DOIs:
10.1117/12.2512111

Bibliographical note

INT=phys,"Rajala, Patrik"
jufoid=71479
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Modeling mass transfer in fracture flows with the time domain-random walk method

The time domain-random walk method was developed further for simulating mass transfer in fracture flows together with matrix diffusion in surrounding porous media. Specifically, a time domain-random walk scheme was developed for numerically approximating solutions of the advection-diffusion equation when the diffusion coefficient exhibits significant spatial variation or even discontinuities. The proposed scheme relies on second-order accurate, central-difference approximations of the advective and diffusive fluxes. The scheme was verified by comparing simulated results against analytical solutions in flow configurations involving a rectangular channel connected on one side with a porous matrix. Simulations with several flow rates, diffusion coefficients, and matrix porosities indicate good agreement between the numerical approximations and analytical solutions.

General information

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Organisations: Physics, Geological Survey of Finland, University of Helsinki, University of Jyvaskyla
Contributors: Kuva, J., Voutilainen, M., Mattila, K.
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Source: Scopus
Source ID: 85069698468
Research output: Contribution to journal › Article › Scientific › peer-review

Observation of local electroluminescent cooling and identifying the remaining challenges

The cooling of a light emitting diode (LED) by photons carrying out more energy than was used to electrically bias the device, has been predicted decades ago. [1, 2] While this effect, known as electroluminescent cooling (ELC), may allow e.g. fabricating thermophotonic heat pumps (THP) providing higher efficiencies than the existing solid state coolers, [3] ELC at powers sufficient for practical applications is still not demonstrated. To study high-power ELC we use double diode structures (DDSs), which consist of a double heterojunction (DHJ) LED and a photodiode (PD) grown within a single technological process and, thus, enclosed in a cavity with a homogeneous refractive index. [4, 5] The presence of the PD in the structure allows to more directly probe the efficiency of the LED, without the need for light extraction from the system, reducing undesirable losses. Our analysis of experimentally measured I - V curves for both the LED and the PD suggests that the local efficiency of the high-performance LEDs we have fabricated is approximately 110%, exceeding unity over a wide range of injection current densities of up to about 100A/cm ^{2}. At present the efficiency of the full DDS, however, still falls short of unity, not allowing direct evidence of the extraction of thermal energy from the LED. Here we review our previous studies of DDS for high-power EL cooling and discuss in more detail the remaining bottlenecks for demonstrating high-power ELC in the DDS context: the LED surface states, resistive and photodetection losses. In particular we report our first surface passivation measurements. Further optimization therefore mainly involves reducing the influence of the surface states, e.g. using more efficient surface passivation techniques and optimizing the PD. This combined with the optimization of the DDS layer thicknesses and contact metallization schemes is expected to finally allow purely experimental observation of high-power ELC.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Physics, Aalto University
Contributors: Radevici, I., Sadi, T., Tripurari, T., Tiira, J., Ranta, S., Tukiainen, A., Guina, M., Oksanen, J.
Publication date: 2019

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Keywords: Double diode structures, Electroluminescent cooling, III-V semiconductors, Quantum efficiency, Surface states
DOIs:
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Bibliographical note
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Source: Scopus
Source ID: 85065604697
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

On Confidences and Their Use in (Semi-)Automatic Multi-Image Taxa Identification

We analyzed classification confidences in biological multi-image taxa identification problems, where each specimen is represented by multiple images. We observed that confidences can be exploited to progress toward semi-automated identification process, where images are initially classified using a convolutional neural network and taxonomic experts manually inspect only the samples with a low confidence. We studied different ways to evaluate confidences and concluded that the difference of the largest and second largest values in unnormalized network outputs leads to best results. Furthermore, we compared different ways to use image-wise confidences when deciding on the final identification using all the input images of a specimen. The best results were obtained using a confidence-weighted sum rule over the unnormalized outputs. This approach also outperformed the evaluated supervised decision method.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Research group: Multimedia Research Group - MRG, Finnish Environment Institute
Contributors: Raitoharju, J., Meissner, K.
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ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Modelling and Simulation
Keywords: benthic macroinvertebrates, classification confidence, decision rules, taxa identification
DOIs:
10.1109/SSCI44817.2019.9002975
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Positioning and Location-Aware Communications for Modern Railways with 5G New Radio

Providing high-capacity radio connectivity for high-speed trains (HSTs) is one of the most important use cases of emerging fifth generation (5G) New Radio (NR) networks. In this article, we show that 5G NR technology can also facilitate high-accuracy continuous localization and tracking of HSTs. Furthermore, we describe and demonstrate how the NR network can utilize the continuous location information for efficient beam management and beamforming, as well as for downlink Doppler precompensation in the single-frequency network context. Additionally, with particular focus on millimeter-wave networks, novel concepts for low-latency inter-carrier interference (ICI) estimation and compensation, due to residual Doppler and oscillator phase noise, are described and demonstrated. The provided numerical results at 30 GHz operating band show that sub-meter positioning and sub-degree beam direction accuracies can be obtained with very high probabilities on the order of 95-99 percent. The results also show that the described Doppler precompensation and ICI

estimation and cancellation methods substantially improve the throughput of the single-frequency HST network.

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MoE publication type: A1 Journal article-refereed
Organisations: Electrical Engineering, Nokia Bell Labs
Contributors: Talvitie, J., Levanen, T., Koivisto, M., Ihalainen, T., Pajukoski, K., Valkama, M.
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Bibliographical note
EXT="Ihalainen, Tero"
Source: Scopus
Source ID: 85072768579
Research output: Contribution to journal › Article › Scientific › peer-review

Quality and Capacity Analysis of Molecular Communications in Bacterial Synthetic Logic Circuits
Synthetic logic circuits have been proposed as potential solutions for theranostics of biotechnological problems. One proposed model is the engineering of bacteria cells to create logic gates, and the communication between the bacteria populations will enable the circuit operation. In this paper, we analyse the quality of bacteria-based synthetic logic circuit through molecular communications that represent communication along a bus between three gates. In the bacteria-based synthetic logic circuit, the system receives environmental signals as molecular inputs and will process this information through a cascade of synthetic logic gates and free diffusion channels. We analyse the performance of this circuit by evaluating its quality and its relationship to the channel capacity of the molecular communications links that interconnect the bacteria populations. Our results show the effect of the molecular environmental delay and molecular amplitude differences over both the channel capacity and circuit quality. Furthermore, based on these metrics we also obtain an optimum region for the circuit operation resulting in an accuracy of 80% for specific conditions. These results show that the performance of synthetic biology circuits can be evaluated through molecular communications, and lays the groundwork for combined systems that can contribute to future biomedical and biotechnology applications.

General information
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Organisations: Electrical Engineering, Waterford Institute of Technology
Contributors: Martins, D. P., Barros, M. T., Balasubramaniam, S.
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ASJC Scopus subject areas: Biotechnology, Bioengineering, Medicine (miscellaneous), Biomedical Engineering, Pharmaceutical Science, Computer Science Applications, Electrical and Electronic Engineering

Keywords: Engineered bacteria, Logic circuits, Logic gates, Microorganisms, Molecular communication (telecommunication), Molecular communications, Sensors, Sociology, Statistics, Synthetic logic circuits
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Source: Scopus
Source ID: 85070392121
Research output: Contribution to journal › Article › Scientific › peer-review

Revisiting gray pixel for statistical illumination estimation

We present a statistical color constancy method that relies on novel gray pixel detection and mean shift clustering. The method, called Mean Shifted Grey Pixel – MSGP, is based on the observation: true-gray pixels are aligned towards one single direction. Our solution is compact, easy to compute and requires no training. Experiments on two real-world benchmarks show that the proposed approach outperforms state-of-the-art methods in the camera-agnostic scenario. In the setting where the camera is known, MSGP outperforms all statistical methods.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Czech Technical University in Prague, Intel Finland
Contributors: Qian, Y., Pertuz, S., Nikkanen, J., Kämäräinen, J., Matas, J.
Number of pages: 11
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ASJC Scopus subject areas: Computer Science Applications, Computer Vision and Pattern Recognition, Computer Graphics and Computer-Aided Design
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http://urn.fi/URN:NBN:fi:tty-201908282042
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Short-range supercontinuum based lidar for combustion diagnostics

We developed a short range Lidar system using a supercontinuum source spectrally tailored to cover the ro-vibrational transition energies of desired components of a flue gas. The system enables simultaneous remote measurements of the gas parameters, like temperature and concentration which play a key role in the performance of combustion power plants. The technique requires only one inspection window and can thus be used in combustion units with limited access. It exploits differential absorption between specific wavelength bands of the gas absorption spectrum. The transmittance of individual wavelength band is derived from the detected backscattered temporal intensity of the supercontinuum pulses. We demonstrate preliminary industrial measurement of water vapor temperature and concentration in a full scale boiler. The technique also enables 3D mapping of temperature and concentration.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Physics, Valmet Technologies Oy
Contributors: Saleh, A., Ryczkowski, P., Genty, G., Toivonen, J.
Publication date: 2019

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Keywords: Combustion, Diagnostics, Lidar, Remote sensing, Supercontinuum
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jufoid=71479
Source: Scopus
Source ID: 85078209433
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Single exposure lensless subpixel phase imaging

Lensless phase-retrieval system with phase modulation of free propagation wavefront is proposed. Contrary to the traditional super-resolution phase-retrieval, the method in this paper requires a single observation only and uses advanced SR-SPAR iterative technique. Successful object imaging relies on modulation of the object wavefront with a random phase-mask, which generates enlarged intensity patterns, allowing us to extract more information than it is possible without such a mask. The achieved high-quality super-resolution phase-imaging is demonstrated by simulation-tests produced with the parameters corresponding to the physical prototype of the considered optical system.

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MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences, Research group: Computational Imaging-CI
Contributors: Kocsis, P., Shevkunov, I., Katkovnik, V., Egiazarian, K.
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Editors: Kress, B. C., Schelkens, P.
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Diffractive optical element, Lensless imaging, Lensless system design, Phase imaging, Phase measurement, Phase retrieval, Sparse representation, Sub-pixel resolution
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10.1117/12.2525679
Source: Scopus
Source ID: 85074197001
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Smartphone teleoperation for self-balancing telepresence robots

Self-balancing mobile platforms have recently been adopted in many applications thanks to their light-weight and slim build. However, inherent instability in their behaviour makes both manual and autonomous operation more challenging as compared to traditional self-standing platforms. In this work, we experimentally evaluate three teleoperation user interface approaches to remotely control a self-balancing telepresence platform: 1) touchscreen button user interface, 2) tilt user interface and 3) hybrid touchscreen-tilt user interface. We provide evaluation in quantitative terms based on user trajectories and recorded control data, and qualitative findings from user surveys. Both quantitative and qualitative results support our finding that the hybrid user interface (a speed slider with tilt turn) is a suitable approach for smartphone-based teleoperation of self-balancing telepresence robots. We also introduce a client-server based multi-user telepresence architecture using open source tools.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Computing Sciences
Contributors: Ainasoja, A. E., Pertuz, S., Kämäräinen, J.
Number of pages: 8
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ASJC Scopus subject areas: Computer Science Applications, Computer Vision and Pattern Recognition, Computer Graphics and Computer-Aided Design
Keywords: Teleoperation, Telepresence, User Interface
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Switchable unidirectional second-harmonic emission through GaAs nanoantennas
Switching the scattering direction of high-index dielectric nanoantennas between forward and backward, via Mie resonances in the linear regime, has been widely studied, recently. However, switching the harmonic emission of nanoantennas without applying any physical change to the antennas, such as geometry, or environment, is a chal-lenging task that has not been demonstrated yet. Here, we investigate multipolar second-harmonic switch from GaAs nanoantennas. Based on the peculiar nonlinearities of zinc-blende semiconductors, we demonstrate both theoretically and experimentally unidirectional nonlinear emission routing and switching via pump polarization control. Our results offer exciting opportunities for nonlinear nanophotonics technologies, such as nanoscale light routing elements, nonlinear light sources, nonlinear imaging, multifunctional flat optical elements.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research group: Nonlinear Optics, Physics, School of Engineering and Information Technology, University of New South Wales (UNSW) Australia, HCI e 486.1, Australian National University, Institute of Applied Physics of the Russian Academy of Sciences
Contributors: Xu, L., Saerens, G., Timofeeva, M., Miroshnichenko, A. E., Camacho-Morales, R., Volkovskaya, I., Smirnova, D. A., Lysevych, M., Huang, L., Cai, M., Karouta, F., Hoe Tan, H., Kauranen, M., Jagadish, C., Grange, R., Neshev, D. N., Rahmani, M.
Publication date: 2019

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Editors: Mitchell, A., Rubinsztein-Dunlop, H.
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Source: Scopus
Source ID: 85079683447
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Tailoring directional scattering of second-harmonic generation from (111)-GaAs nanoantennas
The group of zincblende III-V compound semiconductors, especially (100)-grown AlGaAs and GaAs, have recently been presented as promising materials for second harmonic generation (SHG) at the nanoscale. However, major obstacles to push the technology towards practical applications are the limited control over directionality of the SH emission and especially zero forward/backward radiation. In this work we provide both theoretically and experimentally a solution to these problems by presenting the first SHG nanoantennas made from (111)-GaAs embedded in a low index material. These nanoantennas show superior forward directionality compared to their (100)-counterparts. Most importantly, it is possible to manipulate the SHG radiation pattern of the nanoantennas by changing the pump polarization without affecting the linear properties and the total nonlinear conversion efficiency.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research group: Nonlinear Optics, Physics, Australian National University, Friedrich-Schiller-University Jena, School of Engineering and Information Technology, University of New South Wales (UNSW) Australia, Institute of Applied Physics of the Russian Academy of Sciences
Contributors: Sautter, J., Xu, L., Miroshnichenko, A., Lysevych, M., Volkovskaya, I., Smirnova, D., Camacho Morales, M., Zangeneh Kamali, K., Karouta, F., Vora, K., Tan, H. H., Kauranen, M., Staude, I., Jagadish, C., Neshev, D. N., Rahmani, M.
Publication date: 2019

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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Dielectric nanoantennas, Directional emission, Multipolar interference, Second harmonic generation
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Source: Scopus
Source ID: 85079653740
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Uses and Gratifications of Pokémon Go: Why do People Play Mobile Location-Based Augmented Reality Games?
In recent years, augmented reality games (ARGs) such as Pokémon Go have become increasingly popular. These games not only afford a novel gaming experience but also have the potential to alter how players view their physical realities. In addition to the common experiences and gratifications people derive from games, (location-based) ARGs can afford, for example outdoor adventures, communal activities, and health benefits, but also create problems stemming from, for example privacy concerns and poor usability. This raises some important research questions as to what drives people to use these new applications, and why they may be willing to spend money on the content sold within them. In this study, we investigate the various gratifications people derive from ARGs (Pokémon Go) and the relationship of these gratifications with the players' intentions to continue playing and spending money on them. We employ data drawn from players of Pokémon Go (N = 1190) gathered through an online survey. The results indicate that game enjoyment, outdoor activity, ease of use, challenge, and nostalgia are positively associated with intentions to reuse (ITR), meanwhile outdoor activity, challenge, competition, socializing, nostalgia and ITR are associated with in-app purchase intentions (IPI). In contrast with our expectations, privacy concerns or trendiness were not associated with reuse intentions or IPI.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Pervasive Computing, Gamification Group, George Mason University, University of Turku School of Cultural Production and Landscape Studies
Contributors: Hamari, J., Malik, A., Koski, J., Johri, A.
Publication date: 2019
Peer-reviewed: Yes
Early online date: 2018

Publication information
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Ratings:

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Original language: English
ASJC Scopus subject areas: Human Factors and Ergonomics, Human-Computer Interaction, Computer Science Applications
Keywords: Augmented reality, freemium, gamification, location-based games, Uses and Gratifications
DOIs:

10.1080/10447318.2018.1497115
Source: Scopus
Source ID: 85050562939
Research output: Contribution to journal › Article › Scientific › peer-review

SCIP: a single-cell image processor toolbox
Summary: Each cell is a phenotypically unique individual that is influenced by internal and external processes, operating in parallel. To characterize the dynamics of cellular processes one needs to observe many individual cells from multiple points of view and over time, so as to identify commonalities and variability. With this aim, we engineered a software, 'SCIP', to analyze multi-modal, multi-process, time-lapse microscopy morphological and functional images. SCIP is capable of automatic and/or manually corrected segmentation of cells and lineages, automatic alignment of different microscopy channels, as well as detect, count and characterize fluorescent spots (such as RNA tagged by MS2-GFP), nucleoids, Z rings, Min system, inclusion bodies, undefined structures, etc. The results can be exported into *mat files and all results can be jointly analyzed, to allow studying not only each feature and process individually, but also find potential relationships. While we exemplify its use on Escherichia coli, many of its functionalities are expected to be of use in analyzing other prokaryotes and eukaryotic cells as well. We expect SCIP to facilitate the finding of relationships between cellular processes, from small-scale (e.g. gene expression) to large-scale (e.g. cell division), in single cells and cell lineages. Availability and implementation: http://www.ca3-uninova.org/project_scip. Supplementary information: Supplementary data are available at Bioinformatics online.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Campus FCT-UNL
Contributors: Martins, L., Neeli-Venkata, R., Oliveira, S. M., Häkkinen, A., Ribeiro, A. S., Fonseca, J. M.
Number of pages: 3
Pages: 4318-4320
Publication date: 15 Dec 2018
Peer-reviewed: Yes

Publication information
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Issue number: 24
ISSN (Print): 1367-4803
Ratings:

Scopus rating (2018): CiteScore 9.7 SJR 4.549 SNIP 1.908
Original language: English
ASJC Scopus subject areas: Statistics and Probability, Biochemistry, Molecular Biology, Computer Science Applications, Computational Theory and Mathematics, Computational Mathematics
DOIs:

10.1093/bioinformatics/bty505

Research output: Contribution to journal › Article › Scientific › peer-review

Active scanner control on paper machines

The cross-directional (CD) basis weight control on paper machines is improved by optimizing the path of the scanning measurement. The optimal path results from an LQG problem and depends on how the uncertainty of the present estimate of the basis weight and the intensity of process noise vary in CD. These factors are assessed by how accurately the CD basis weight estimate predicts the measured optical transmittance with a linear adaptive model on synchronized basis weight and transmittance data. Simulations on optimized scanner path in disturbance scenarios are presented, and the practical implementation of scanner control is discussed.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Automation and Hydraulic Engineering
Contributors: Raunio, J., Ritala, R.
Number of pages: 17
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Publication information

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Volume: 72
ISSN (Print): 0959-1524
Ratings:

Scopus rating (2018): CiteScore 5.9 SJR 0.967 SNIP 2.027
Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Modelling and Simulation, Computer Science Applications , Industrial and Manufacturing Engineering
Keywords: basis weight, linear-quadratic-Gaussian, optimal measurement, paper machine, scanner, transmittance, variance estimation, web-wide measurement
DOIs:

10.1016/j.jprocont.2018.09.012
Source: Scopus
Source ID: 85056176314
Research output: Contribution to journal › Article › Scientific › peer-review

A Portable Microscale Cell Culture System with Indirect Temperature Control

A physiologically relevant environment is essential for successful long-term cell culturing in vitro. Precise control of temperature, one of the most crucial environmental parameters in cell cultures, increases the fidelity and repeatability of the experiments. Unfortunately, direct temperature measurement can interfere with the cultures or prevent imaging of the cells. Furthermore, the assessment of dynamic temperature variations in the cell culture area is challenging with the methods traditionally used for measuring temperature in cell culture systems. To overcome these challenges, we integrated a microscale cell culture environment together with live-cell imaging and a precise local temperature control that is based on an indirect measurement. The control method uses a remote temperature measurement and a mathematical model for estimating temperature at the desired area. The system maintained the temperature at 37±0.3 °C for more than 4 days. We also showed that the system precisely controls the culture temperature during temperature transients and compensates for the disturbance when changing the cell cultivation medium, and presented the portability of the heating system. Finally, we demonstrated a successful long-term culturing of human induced stem cell–derived beating cardiomyocytes, and analyzed their beating rates at different temperatures.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Computational Biophysics and Imaging Group, Research group: Sensor Technology and Biomeasurements (STB), Research group: Micro and Nanosystems Research Group, Tampere University Hospital
Contributors: Mäki, A. J., Verho, J., Kreutzer, J., Ryynänen, T., Rajan, D., Pekkanen-Mattila, M., Ahola, A., Hyttinen, J., Aalto-Setälä, K., Lekkala, J., Kallio, P.
Pages: 566-579
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Early online date: 1 Apr 2018

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Journal: SLAS Technology
Volume: 23
Issue number: 6
ISSN (Print): 2472-6303
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Scopus rating (2018): CiteScore 2.1 SJR 0.511 SNIP 0.523
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Medical Laboratory Technology
Keywords: cell culture, feedback control, microfluidics, modeling, temperature
Electronic versions:
Revised_Manuscript_AnttiMaki_TUTCRISversio
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URLs:
http://urn.fi/URN:NBN:fi:tty-201809052273
Source: Scopus
Source ID: 85046801632
Research output: Contribution to journal › Article › Scientific › peer-review

Empirical Effects of Dynamic Human-Body Blockage in 60 GHz Communications

The millimeter-wave (mmWave) bands and other high frequencies above 6 GHz have emerged as a central component of fifth generation cellular standards to deliver high data rates and ultra-low latency. A key challenge in these bands is blockage from obstacles, including the human body. In addition to the reduced coverage, blockage can result in highly intermittent links where the signal quality varies significantly with motion of obstacles in the environment. The blockages have widespread consequences throughout the protocol stack including beam tracking, link adaptation, cell selection, handover, and congestion control. Accurately modeling these blockage dynamics is therefore critical for the development and evaluation of potential mmWave systems. In this work, we present a novel spatial dynamic channel sounding system based on phased array transmitters and receivers operating at 60 GHz. Importantly, the sounder can measure multiple directions rapidly at high speed to provide detailed spatial dynamic measurements of complex scenarios. The system is demonstrated in an indoor home entertainment type setting with multiple moving blockers. Preliminary results are presented on analyzing this data with a discussion of the open issues toward developing statistical dynamic models.

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Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, NYU Tandon School of Engineering, Peoples' Friendship University of Russia
Contributors: Slezak, C., Semkin, V., Andreev, S., Koucheryavy, Y., Rangan, S.
Number of pages: 7
Pages: 60-66
Publication date: 1 Dec 2018
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Issue number: 12
ISSN (Print): 0163-6804
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
DOIs:
10.1109/MCOM.2018.1800232
Source: Scopus
Source ID: 85058494833
Research output: Contribution to journal › Article › Scientific › peer-review

Organizing for openness: six models for developer involvement in hybrid OSS projects

This article examines organization and governance of commercially influenced Open Source Software development communities by presenting a multiple-case study of six contemporary, hybrid OSS projects. The findings provide in-depth understanding on how to design the participatory nature of the software development process, while understanding the

factors that influence the delicate balance of openness, motivations, and governance. The results lay ground for further research on how to organize and manage developer communities where needs of the stakeholders are competing, yet complementary.

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MoE publication type: A1 Journal article-refereed
Organisations: Pervasive Computing, University of Helsinki, Lappeenranta University of Technology
Contributors: Mäenpää, H., Mäkinen, S., Kilamo, T., Mikkonen, T., Männistö, T., Ritala, P.
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Journal: Journal of Internet Services and Applications
Volume: 9
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Article number: 17
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Scopus rating (2018): CiteScore 5.2 SJR 0.397 SNIP 1.602
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications
Keywords: Community management, Governance, Hybrid open source, Open source, Software development process
Electronic versions:

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URLs:

http://urn.fi/URN:NBN:fi:tty-201809032258
Source: Scopus
Source ID: 85051727092
Research output: Contribution to journal › Article › Scientific › peer-review

Benefits of Positioning-Aided Communication Technology in High-Frequency Industrial IoT
The future of industrial applications is shaped by intelligent moving IoT devices, such as flying drones, advanced factory robots, and connected vehicles, which may operate (semi-)autonomously. In these challenging scenarios, dynamic radio connectivity at high frequencies, augmented with timely positioning-related information, becomes instrumental to improve communication performance and facilitate efficient computation offloading. Our work reviews the main research challenges and reveals open implementation gaps in IIoT applications that rely on location awareness and multi-connectivity in super high and extremely high frequency bands. It further conducts a rigorous numerical investigation to confirm the potential of precise device localization in the emerging IIoT systems. We focus on positioning- aided benefits made available to multi-connectivity IIoT device operation at 28 GHz, which notably improve data transfer rates, communication latency, and the extent of control overhead.

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MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Wireless Communications and Positioning , Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Univ of Oulu, Huawei Technologies Oy (Finland). Co. Ltd.
Contributors: Lohan, E. S., Koivisto, M., Galinina, O., Andreev, S., Tölli, A., Destino, G., Costa, M., Leppänen, K., Koucheryavy, Y., Valkama, M.
Number of pages: 7
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Journal: IEEE Communications Magazine
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Issue number: 12
Article number: 8535084
ISSN (Print): 0163-6804
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Scopus rating (2018): CiteScore 19.3 SJR 2.373 SNIP 4.903

Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
Electronic versions:

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Source: Scopus
Source ID: 85056574017
Research output: Contribution to journal › Article › Scientific › peer-review

Kalman-Type Filters and Smoothers for Pedestrian Dead Reckoning
In this paper, we present a method for device localization based on the fusion of location data from Global Navigation Satellite System and data from inertial sensors. We use a Kalman filter as well as its non-linear variants for realtime position estimation, and corresponding smoothers for offline position estimation. In all filters we use information about changes of user's heading, which are computed from the acceleration and gyroscope data. Models used with Extended and Unscented Kalman filters also take into account information about step length, whereas Kalman Filter does not, because the measurement is non-linear. In order to overcome this shortcoming, we introduce a modified Kalman Filter which adjusts the state vector according to the step length measurements. Our experiments show that use of step length information does not significantly improve performance when location measurements are constantly available. However, in real situations, when location data is partially unavailable, information about step length and its appropriate integration into the filter design is important, and improve localization accuracy considerably.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Automation and Hydraulic Engineering, HERE Technologies, Deprtment of Electrical Engineering and Automation, Aalto University
Contributors: Ivanov, P., Raitoharju, M., Piché, R.
Number of pages: 7
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ISBN (Electronic): 9781538656358
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Control and Optimization
Electronic versions:

PID5487111
DOIs:

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URLs:

http://urn.fi/URN:NBN:fi:tty-201901161101

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jufoid=72210
Source: Scopus
Source ID: 85059102314
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Chromatographic studies of n-Propyl Propionate: Adsorption equilibrium, modelling and uncertainties determination
The n-Propyl Propionate (ProPro) is a compound that has several possible industrial applications. However, the current production route of this component presents several problems, such as the downstream purification. In this way, chromatographic separation could be an alternative solution to the downstream purification. In this work experimental studies of the ProPro reaction system separation in a chromatographic fixed bed unit packed with Amberlyst 46 were performed. The adsorption equilibrium isotherms and the corresponding Langmuir model parameters were determined. A phenomenological model to represent the process was developed and validated through the experimental data. Meanwhile, it is proposed the characterization of the uncertainties of all steps and its extension to the model prediction, which allowed to estimate the model parameters with a reduced number of experiments, when compared with other reports in the literature; nevertheless, the final results lead to a statistically more reliable model.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Automation and Hydraulic Engineering, Research group: Automation and Systems Theory, Universidade do Porto, Federal Univ. of Bahia
Contributors: Nogueira, I. B., Faria, R. P., Requião, R., Koivisto, H., Martins, M. A., Rodrigues, A. E., Loureiro, J. M., Ribeiro, A. M.
Number of pages: 12
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Publication date: 2 Nov 2018
Peer-reviewed: Yes

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ISSN (Print): 0098-1354
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Scopus rating (2018): CiteScore 6.1 SJR 0.932 SNIP 1.562
Original language: English
ASJC Scopus subject areas: Chemical Engineering(all), Computer Science Applications
Keywords: Adsorption equilibrium isotherms, Confidence region, Fixed bed adsorptive unit, n-Propyl Propionate, Particle swarm optimization
DOIs:

10.1016/j.compchemeng.2018.09.020
Source: Scopus
Source ID: 85054180293
Research output: Contribution to journal › Article › Scientific › peer-review

Computation of Dynamic Polarizabilities and van der Waals Coefficients from Path-Integral Monte Carlo
We demonstrate computation of total dynamic multipole polarizabilities using path-integral Monte Carlo method (PIMC). The PIMC approach enables accurate thermal and nonadiabatic mixing of electronic, rotational, and vibrational degrees of freedom. Therefore, we can study the thermal effects, or lack thereof, in the full multipole spectra of the chosen one- and two-electron systems: H, Ps, He, Ps_2, H_2, and HD^+. We first compute multipole-multipole correlation functions up to octupole order in imaginary time. The real-domain spectral function is then obtained by analytical continuation with the maximum entropy method. In general, sharpness of the active spectra is limited, but the obtained off-resonant polarizabilities are in good agreement with the existing literature. Several weak and strong thermal effects are observed. Furthermore, the polarizabilities of Ps_2 and some higher multipole and higher frequency data have not been published before. In addition, we compute isotropic dispersion coefficients C_6, C_8, and C_{10} between pairs of species using the simplified Casimir-Polder formulas.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Physics, Research group: Electronic Structure Theory, Research area: Computational Physics
Contributors: Tiihonen, J., Kylänpää, I., Rantala, T. T.
Number of pages: 14
Pages: 5750-5763
Publication date: 2 Oct 2018
Peer-reviewed: Yes

Publication information
Journal: Journal of Chemical Theory and Computation
Volume: 14
ISSN (Print): 1549-9618
Ratings:

Scopus rating (2018): CiteScore 9.5 SJR 2.236 SNIP 1.585
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Physical and Theoretical Chemistry
Electronic versions:

dynamicpolarizability_achemso. Embargo ended: 2/10/19
DOIs:

10.1021/acs.jctc.8b00859
URLs:

http://urn.fi/URN:NBN:fi:tty-201811162595. Embargo ended: 2/10/19

Source: Scopus
Source ID: 85055154322
Research output: Contribution to journal › Article › Scientific › peer-review

Olfactory display prototype for presenting and sensing authentic and synthetic odors

The aim was to study if odors evaporated by an olfactory display prototype can be used to affect participants' cognitive and emotion-related responses to audio-visual stimuli, and whether the display can benefit from objective measurement of the odors. The results showed that odors and videos had significant effects on participants' responses. For instance, odors increased pleasantness ratings especially when the odor was authentic and the video was congurent with odors. The objective measurement of the odors was shown to be useful. The measurement data was classified with 100 % accuracy removing the need to speculate whether the odor presentation apparatus is working properly.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, Faculty of Biomedical Sciences and Engineering, Research group: Sensor Technology and Biomeasurements (STB), Research group: Micro and Nanosystems Research Group
Contributors: Salminen, K., Rantala, J., Isokoski, P., Lehtonen, M., Müller, P., Karjalainen, M., Väliaho, J., Kontunen, A., Nieminen, V., Leivo, J., Telembeci, A. A., Lekkala, J., Kallio, P., Surakka, V.
Number of pages: 5
Pages: 73-77
Publication date: 2 Oct 2018

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ASJC Scopus subject areas: Computer Science Applications, Computer Vision and Pattern Recognition, Hardware and Architecture, Human-Computer Interaction
Keywords: Emotions, Multimodal interaction, Olfaction
Electronic versions:

olfactory-display-prototype
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URLs:

http://urn.fi/URN:NBN:fi:tuni-201909233451

Bibliographical note

INT=tut-bmt,"Nieminen, Ville"
Source: Scopus
Source ID: 85056660798
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Breaking the limits in urban video monitoring: Massive crowd sourced surveillance over vehicles

Contemporary urban environments are in prompt need of the means for intelligent decision- making, where a crucial role belongs to smart video surveillance systems. While existing deployments of stationary monitoring cameras already deliver notable societal benefits, the proposed concept of massive video surveillance over connected vehicles that we contribute in this article may further augment these important capabilities. We therefore introduce the envisioned system concept, discuss its implementation, outline the high-level architecture, and identify major data flows, while also offering insights into the corresponding design and deployment aspects. Our conducted case study confirms the potential of the described crowd sourced vehicular system to effectively complement and eventually surpass even the best of today's static video surveillance setups. We expect that our proposal will become of value and integrate seamlessly into the future Internetof-Things landscape, thus enabling a plethora of advanced urban applications.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Electrical Engineering Department, University of California, Los Angeles (UCLA), National Research University Higher School of Economics
Contributors: Petrov, V., Andreev, S., Gerla, M., Koucheryavy, Y.
Number of pages: 9
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Publication date: 1 Oct 2018
Peer-reviewed: Yes

Publication information
Journal: IEEE Wireless Communications
Volume: 25
Issue number: 5
ISSN (Print): 1536-1284
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Scopus rating (2018): CiteScore 17.4 SJR 2.352 SNIP 4.212
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
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Source: Scopus
Source ID: 85054226112
Research output: Contribution to journal › Article › Scientific › peer-review

Focus model for metric depth estimation in standard plenoptic cameras

In recent years, a lot of efforts have been devoted to the problem of depth estimation from lightfield images captured by standard plenoptic cameras. However, most of the metric depth estimation methods in the state-of-the-art leverage pixel disparity only. In this paper, we tackle the problem of focus-based metric depth estimation in standard plenoptic cameras. For this purpose we propose a closed-form model that relates the refocusing parameter with the focus distance of a plenoptic camera in order to allow for metric depth estimation. Based on the proposed model, we develop a calibration procedure that allows finding the parameters of the model. Using measurements of a time-of-flight sensor as ground-truth, experimental validation in a distance range of 0.2–1.6 m shows that focus-based depth estimation is feasible with a root-mean-squared error of less than 5 cm.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing, Universidad Industrial de Santander, Universidad Antonio Nariño
Contributors: Pertuz, S., Pulido-Herrera, E., Kämäräinen, J.
Number of pages: 10
Pages: 38-47
Publication date: 1 Oct 2018
Peer-reviewed: Yes

Publication information
Journal: ISPRS Journal of Photogrammetry and Remote Sensing
Volume: 144
ISSN (Print): 0924-2716
Ratings:
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Original language: English
ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Engineering (miscellaneous), Computer Science Applications, Computers in Earth Sciences
Keywords: Calibration, Depth estimation, Focus, Lightfield, Plenoptic camera
DOIs:
10.1016/j.isprsjprs.2018.06.020
Source: Scopus
Source ID: 85049523458
Research output: Contribution to journal › Article › Scientific › peer-review

Graph measures with high discrimination power revisited: A random polynomial approach

Finding graph measures with high discrimination power has been triggered by searching for so-called complete graph invariants. In a series of papers, we have already investigated highly discriminating measures to distinguish graphs (networks) based on their topology. In this paper, we propose an approach where the graph measures are based on the roots of random graph polynomials. The polynomial coefficients have been defined by utilizing information functionals which capture structural information of the underlying networks. Our numerical results obtained by employing exhaustively generated graphs reveal that the new approach outperforms earlier results in the literature.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Computational Medicine and Statistical Learning Laboratory (CMSL), Research group: Predictive Society and Data Analytics (PSDA), University of Applied Sciences Upper Austria, School of Management, Nankai University

Contributors: Dehmer, M., Chen, Z., Emmert-Streib, F., Shi, Y., Tripathi, S.
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Publication date: 1 Oct 2018
Peer-reviewed: Yes

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Volume: 467
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Original language: English
ASJC Scopus subject areas: Software, Control and Systems Engineering, Theoretical Computer Science, Computer Science Applications, Information Systems and Management, Artificial Intelligence
Keywords: Data science, Graphs, Networks, Quantitative graph theory, Statistics
DOIs:

10.1016/j.ins.2018.07.072

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EXT="Tripathi, Shailesh"
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Research output: Contribution to journal › Article › Scientific › peer-review

Guest Editorial Special Issue on Multimedia Big Data in Internet of Things

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MoE publication type: B1 Article in a scientific magazine
Organisations: Signal Processing, Research group: Multimedia Research Group - MRG, Beijing University of Posts and Telecommunications, University of Technology Sydney, IBM Research
Contributors: Ma, H., Yu, S., Gabbouj, M., Mueller, P.
Number of pages: 3
Pages: 3405-3407
Publication date: Oct 2018
Peer-reviewed: No

Publication information
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Volume: 5
Issue number: 5
Article number: 8534720
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Original language: English
ASJC Scopus subject areas: Signal Processing, Information Systems, Hardware and Architecture, Computer Science Applications, Computer Networks and Communications
DOIs:

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Source: Scopus
Source ID: 85056768996
Research output: Contribution to journal › Editorial › Scientific

Molecular Communications Pulse-based Jamming Model for Bacterial Biofilm Suppression
Studies have recently shown that the bacteria survivability within biofilms is responsible for the emergence of superbugs. The combat of bacterial infections, without enhancing its resistance to antibiotics, includes the use of nanoparticles to quench the quorum sensing of these biofilm-forming bacteria. Several sequential and parallel multi-stage communication processes are involved in the formation of biofilms. In this paper, we use proteomic data from a wet lab experiment to identify the communication channels that are vital to these processes.We also identified the main proteins from each channel and propose the use of jamming signals from synthetically engineered bacteria to suppress the production of those proteins. This biocompatible technique is based on synthetic biology and enables the inhibition of biofilm formation. We analyse the communications performance of the jamming process, by evaluating the path loss for a number of conditions that include different engineered bacterial population sizes, distances between the populations and molecular

signal power. Our results show that sufficient molecular pulsebased jamming signals are able to prevent the biofilm formation by creating lossy communications channels (almost -3 dB for certain scenarios). From these results, we define the main design parameters to develop a fully operational bacteria-based jamming system.

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MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Waterford Institute of Technology, Kasetsart University
Contributors: Martins, D. P., Leetanasaksakul, K., Barros, M. T., Thamchaipenet, A., Donnelly, W., Balasubramaniam, S.
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Publication date: Oct 2018
Peer-reviewed: Yes
Early online date: 19 Sep 2018

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Journal: IEEE Transactions on Nanobioscience
Volume: 17
Issue number: 4
ISSN (Print): 1536-1241
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Original language: English
ASJC Scopus subject areas: Biotechnology, Bioengineering, Medicine (miscellaneous), Biomedical Engineering, Pharmaceutical Science, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Biofilm suppression, Communications systems, Jamming, Synthetic logic circuits
DOIs:
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Source: Scopus
Source ID: 85053611196
Research output: Contribution to journal › Article › Scientific › peer-review

Comparative analysis of tissue reconstruction algorithms for 3D histology
Motivation: Digital pathology enables new approaches that expand beyond storage, visualization or analysis of histological samples in digital format. One novel opportunity is 3D histology, where a three-dimensional reconstruction of the sample is formed computationally based on serial tissue sections. This allows examining tissue architecture in 3D, for example, for diagnostic purposes. Importantly, 3D histology enables joint mapping of cellular morphology with spatially resolved omics data in the true 3D context of the tissue at microscopic resolution. Several algorithms have been proposed for the reconstruction task, but a quantitative comparison of their accuracy is lacking. Results: We developed a benchmarking framework to evaluate the accuracy of several free and commercial 3D reconstruction methods using two whole slide image datasets. The results provide a solid basis for further development and application of 3D histology algorithms and indicate that methods capable of compensating for local tissue deformation are superior to simpler approaches.

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Organisations: Faculty of Biomedical Sciences and Engineering, Mechanical Engineering and Industrial Systems, Signal Processing, Research group: Data-analytics and Optimization, Tampere University Hospital, Faculty of Medicine and Life Sciences, BioMediTech, Fimlab Laboratories Ltd, BioMediTech Institute
Contributors: Kartasalo, K., Latonen, L., Vihinen, J., Visakorpi, T., Nykter, M., Ruusuvuori, P.
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Intellectual capital and bi-tools in private healthcare value creation

The demand for data-driven decision making in the healthcare sector has increased, not only on the clinical side, but also from the managerial perspective; this is especially true in the private healthcare sector. Utilisation of internal and external data requires certain capabilities, such as intellectual capital (IC), as different data sources (structural capital) and organisational competences (human capital) can become organisational value. We study the utilisation of business intelligence (BI) tools and IC dimensions in creating value in the Finnish private healthcare sector. IC components and a modified value creation capabilities model are used as a framework for considering data utilisation and BI tools' role in value creation. Our study includes private healthcare organisations in Finland and management and BI technology consulting representatives. Thematic interviews of key personnel responsible for BI were conducted to elucidate the value creation capabilities, IC components and BI tool utilisation in the Finnish private healthcare industry. Data-driven decision making is currently one of the most discussed topics in private healthcare sector organisations. By analysing the current data source utilisation and organisational competences in data utilisation, we gain a better understanding of IC and BI tool-enabled value creation in private healthcare organisations. The study's outcomes will provide valuable information and a deep understanding concerning the influence of BI tools and IC dimensions on value creation in private health care in Finland. In addition, it will provide insight into future-oriented value creation factors that can enable new business concepts for private healthcare companies. Advanced capability of data utilisation will increase the value creation ability in private healthcare sector companies. However, in addition to the technology and data, human capital or capability of BI tool utilisation and data-driven decision making are crucial.

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Contributors: Ratia, M.
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Research output: Contribution to journal › Article › Scientific › peer-review

Nocturnal Heart Rate Variability Spectrum Characterization in Preschool Children with Asthmatic Symptoms

Asthma is a chronic lung disease that usually develops during chilhood. Despite that symptoms can almost be controlled with medication, early diagnosis is desirable in order to reduce permanent airway obstruction risk. It has been suggested that abnormal parasympathetic nervous system (PSNS) activity might be closely related with the pathogenesis of asthma, and that this PSNS activity could be reflected in cardiac vagal control. In this work, an index to measure the spectral regularity of the high frequency (HF) component of heart rate variability (HRV) spectrum, named peakness (P), is

proposed. Three different implementations of P, based on electrocardiogram (ECG) recordings, impedance pneumography (IP) recordings and a combination of both, were employed in the characterization of a group of pre-school children classified attending to their risk of developing asthma. Peakier componentswere observed in the HF band of those children classified as high-risk (p < 0.005), who also presented reduced sympathvoagal balance. Results suggest that high-risk of developing asthma might be related with a lack of adaptability of PSNS.

General information

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Physiological Measurement Systems and Methods Group, University of Zaragoza, KU Leuven, University of Helsinki
Contributors: Milagro, J., Gil, E., Lazaro, J., Seppae, V. P., Malmberg, L. P., Pelkonen, A. S., Kotaniemi-Syrjanen, A., Makela, M., Viik, J., Bailon, R.
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ASJC Scopus subject areas: Biotechnology, Computer Science Applications, Electrical and Electronic Engineering, Health Information Management
Keywords: asthma, children, Electrocardiography, Heart rate variability, heart rate variability, Informatics, parasympathetic nervous system, peakness, Pediatrics, Pregnancy, Respiratory system, Signal to noise ratio
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Research output: Contribution to journal › Article › Scientific › peer-review

Inertial Sensor-Based State Estimation of Flexible Links Subject to Bending and Torsion

In this study, we propose an observer design based on inertial sensors and the finite element (FE) method to estimate the flexural states of a long-reach and highly flexible manipulator in a 3D plane of motion. Vertical and lateral dynamic bendings are considered, along with deformation due to torsion. The aim is to achieve accurate end-point positioning by using the estimated flexural degrees-of-freedom, which are formulated using an FE model. The states are reconstructed based on angular velocity measurements, which are obtained from strap-on inertial sensors placed along the flexible link. For validation, a motion-capture setup consisting of three OptiTrack cameras is used. The experiments are conducted on a hydraulic manipulator that has a single 4.5-m long flexible link with a tip mass. The validation is carried out by comparing the estimates to the OptiTrack reference measurements. The results demonstrate that this method provides satisfactory end-point positioning, while also being convenient for use in heavy-duty mobile manipulators.

General information

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MoE publication type: A4 Article in a conference publication
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Contributors: Mäkinen, P., Mononen, T., Mattila, J.
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Real-time and Robust Collaborative Robot Motion Control with Microsoft Kinect ® v2

Recent development in depth sensing provide various opportunities for the development of new methods for Human Robot Interaction (HRI). Collaborative robots (co-bots) are redefining HRI across the manufacturing industry. However, little work has been done yet in the field of HRI with Kinect sensor in this industry. In this paper, we will present a HRI study using nearest-point approach with Microsoft Kinect v2 sensor's depth image (RGB-D). The approach is based on the Euclidean distance which has robust properties against different environments. The study aims to improve the motion performance of Universal Robot-5 (UR5) and interaction efficiency during the possible collaboration using the Robot Operating System (ROS) framework and its tools. After the depth data from the Kinect sensor has been processed, the nearest points differences are transmitted to the robot via ROS.

General information

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Contributors: Teke, B., Lanz, M., Kämäräinen, J., Hietanen, A.
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Role-based visualization of industrial IoT-based systems

The competition among manufacturers in the global markets calls for the enhancement of the agility and performance of the production process and the quality of products. As a result, the production systems should be designed in such a way to provide decision makers with visibility and analytics. To fulfill these objectives, the development of information systems in manufacturing industries has intensified in the past few years. On the other hand, the volume of data which is being generated on the shop floor is rising. To improve the efficiency of manufacturing processes, this amount of data should be analyzed by decision makers. To cope with this challenge, advanced visualization is needed to assist users to gain insight into data and make effective decisions faster. This paper describes an approach for building a role-based visualization of industrial IoT. We propose an extendible architecture that anticipates the future growth of data. By using the IoT platform introduced in this paper, selected Key Performance Indicators(KPI) can be monitored by different levels of enterprise. The prototype IoT dashboard has been implemented for a pilot production line 'Festo didactic training line' located in Seinäjoki University of Applied Sciences(SeAMK) and results have been validated.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Mechanical Engineering and Industrial Systems, Research area: Manufacturing and Automation, Seinäjoki University of Applied Sciences
Contributors: Mahmoodpour, M., Lobov, A., Lanz, M., Mäkelä, P., Rundas, N.
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Dimensional analysis conceptual modeling supporting adaptable reasoning in simulation-based training

How to measure and train for adaptability has emerged as a priority in military contexts in response to emergent threats and technologies associated with asymmetric warfare. While much research effort has attempted to characterize adaptability in terms of accuracy and response time using traditional executive function cognitive tests, it remains unclear and undefined how adaptability should be measured and thus how simulation-based training should be designed to instigate and modulate adaptable behavior and skills. Adaptable reasoning is well-exemplified in the rescue effort of Apollo 13 by NASA engineers who repurposed available materials available in the spacecraft to retrieve the astronauts safely back to earth. Military leaders have anecdotally referred to adaptability as 'improvised thinking' that repurposes 'blocks of knowledge' to device alternative solutions in response to changes in conditions affecting original tasks while maintaining end-state commander's intent. We review a previous feasibility study that explored the specification of Reusable Modeling Primitives for models and simulation systems building on Dimensional Analysis and Design Structure Matrix for Complexity Management formal methods. This Dimensional Analysis Conceptual Modeling (DACM) paradigm is rooted in science and engineering critical thinking and is consistent with the stated anecdotal premises as it facilitates the objective dimensional decomposition of a problem space to guide the corresponding dimensional composition of possible solutions. Arguably, adaptability also concerns the capability to overcome contradictions, detections, and reductions, which we present in an exemplar addressing the contradiction of increased drag due to increased velocity inherent to torpedoes. We propose that the DACM paradigm may be repurposed as a critical thinking framework for teaching the identification of relevant components in a theater of military operations and how the properties of those components may be repurposed to fashion alternative solutions to tasks involving navigation, call-for-fires, line-of-sight cover, weather and atmospheric effect responses, and others.

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Contributors: Coatanea, E., Roca, R.
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Hardware and Architecture, Control and Systems Engineering, Information Systems and Management
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High surface quality welding of aluminum using adjustable ring-mode fiber laser

A method to improve penetration and stabilize the welding phenomenon at a high welding speed has been described through experimental and numerical investigations. Using a high power laser beam consisting of a center and a ring part, influences of shielding gas direction and flow rate, laser power density, and welding mode defined by variable intensity distribution have been clarified. The weld bead was evaluated in terms of width, height, shape and roughness. Dual-mode laser irradiation of center and ring power made it possible to stabilize the welding process. The center power helps to achieve sufficient deep penetration, while ring power ensures good temperature distribution. Good surface quality and deep penetration welding could be achieved with dual-mode welding, using low flow rate of shielding gas supplied from the backside direction.

General information

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Organisations: Mechanical Engineering and Industrial Systems, Okayama University, Corelase Oy
Contributors: Maina, M. R., Okamoto, Y., Okada, A., Närhi, M., Kangastupa, J., Vihinen, J.
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10.1016/j.jmatprotec.2018.03.030
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Source ID: 85044959061
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Summarization of User-Generated Sports Video by Using Deep Action Recognition Features

Automatically generating a summary of sports video poses the challenge of detecting interesting moments, or highlights, of a game. Traditional sports video summarization methods leverage editing conventions of broadcast sports video that facilitate the extraction of high-level semantics. However, user-generated videos are not edited, and thus traditional methods are not suitable to generate a summary. In order to solve this problem, this work proposes a novel video summarization method that uses players' actions as a cue to determine the highlights of the original video. A deep neural network-based approach is used to extract two types of action-related features and to classify video segments into interesting or uninteresting parts. The proposed method can be applied to any sports in which games consist of a succession of actions. Especially, this work considers the case of Kendo (Japanese fencing) as an example of a sport to evaluate the proposed method. The method is trained using Kendo videos with ground truth labels that indicate the video highlights. The labels are provided by annotators possessing different experience with respect to Kendo to demonstrate how the proposed method adapts to different needs. The performance of the proposed method is compared with several combinations of different features, and the results show that it outperforms previous summarization methods.

General information

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Organisations: Signal Processing, University of Tokyo, Osaka University, Graduate School of Information Science, Univ of Oulu
Contributors: Tejero-de-Pablos, A., Nakashima, Y., Sato, T., Yokoya, N., Linna, M., Rahtu, E.
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A multi-purpose automated vehicular platform with multi-radio connectivity capabilities

Internet access has become commonplace in the modern world. As the number of users and the amount of data traffic in the Internet keep rising exponentially, while the requirements of novel applications are becoming more stringent, there is a clear need for new networking solutions. Therefore, one of the key concepts in resolving the challenges of the upcoming 5G era of communications will be represented by multi-radio heterogeneous networks, where the users can gain benefits by either being connected to multiple different radio technologies simultaneously or seamlessly changing from one network to another based on their needs. In this work, we propose a multi-purpose automated vehicular platform prototype equipped with multiple radio access technologies, which was constructed to demonstrate the potential performance gains provided by the use of multi-radio heterogeneous networks in terms of network throughput, latency, and reliability. We discuss the potential drawbacks of using multiple radio interfaces at the same time. The constructed vehicular platform prototype constitutes a flexible research framework for communications technology within heterogeneous networks and becomes helpful for supporting future use cases of industrial IoT applications.

General information

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Organisations: Electronics and Communications Engineering, Brno University of Technology
Contributors: Urama, J., Gerasimenko, M., Stusek, M., Masek, P., Andreev, S., Hosek, J., Koucheryavy, Y.
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Source: Scopus
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Ergodic Capacity Analysis of Wireless Transmission over Generalized Multipath/Shadowing Channels

Novel composite fading models were recently proposed based on inverse gamma distributed shadowing conditions. These models were extensively shown to provide remarkable modeling of the simultaneous occurrence of multipath fading and shadowing phenomena in emerging wireless scenarios such as cellular, off-body and vehicle-to-vehicle communications. Furthermore, the algebraic representation of these models is rather tractable, which renders them convenient to handle both analytically and numerically. Based on this, the present contribution analyzes the ergodic capacity over the recently proposed κ-μ inverse gamma composite fading channels, which were shown to characterize excellently multipath fading and shadowing in line-of-sight communication scenarios, including realistic vehicular communications. Novel analytic expressions are derived which are subsequently used in the analysis of the corresponding system performance. In this context, the offered results are compared with respective results from cases assuming

conventional fading conditions, which leads to the development of numerous insights on the effect of the multipath fading and shadowing severity on the achieved capacity levels. It is expected that these results will be useful in the design of timely and demanding wireless technologies such as wearable, cellular and inter-vehicular communications.

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Organisations: Research group: Wireless Communications and Positioning, Electronics and Communications Engineering , Department of Electrical and Computer Engineering, Khalifa University, Queen's University, Belfast, Northern Ireland, University of Surrey, Aristotle University of Thessaloniki
Contributors: Sofotasios, P. C., Yoo, S. K., Muhaidat, S., Cotton, S. L., Matthaiou, M., Valkama, M., Karagiannidis, G. K.
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Source ID: 85050971918
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Optical Asymmetric Modulation for VLC Systems - Invited Paper
The explosive growth of connected devices and the increasing number of broadband users have led to an unprecedented growth in traffic demand. To this effect, the next generation wireless systems are envisioned to meet this growth and offer a potential data rate of 10 Gbps or more. In this context, an attractive solution to the current spectrum crunch issue is to exploit the visible light spectrum for the realization of high-speed commutation systems. However, this requires solutions to certain challenges relating to visible light communications (VLC), such as the stringent requirements of VLC-based intensity modulation and direct detection (IM/DD), which require signals to be real and unipolar. The present work proposes a novel power-domain multiplexing based optical asymmetric modulation (OAM) scheme for indoor VLC systems, which is particularly adapted to transmit high-order modulation signals using linear real and unipolar constellations that fit into the restrictions of IM/DD systems. It is shown that the proposed scheme provides improved system performance that outperforms alternative modulation schemes, at no extra complexity.

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Organisations: Research group: Wireless Communications and Positioning, Electronics and Communications Engineering , Khalifa University, University of Glasgow, Aristotle University of Thessaloniki
Contributors: Marshoud, H., Muhaidat, S., Sofotasios, P. C., Imran, M., Sharif, B. S., Karagiannidis, G. K.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Performance Analysis of Single Carrier Coherent and Noncoherent Modulation under I/Q Imbalance
In-phase/quadrature-phase Imbalance (IQI) is considered a major performance-limiting impairment in direct-conversion transceivers. Its effects become even more pronounced at higher carrier frequencies such as the millimeter-wave frequency bands considered for 5G systems. In this work, we quantify the effects of IQI on the performance of different modulations under multipath fading channels. This is realized by developing a comprehensive framework for the symbol error rate (SER) analysis of coherent phase shift keying (PSK), noncoherent differential phase shift keying (DPSK) and

noncoherent frequency shift keying (FSK) under IQI effects. In this context, the moment generating function of the signal-to-interference-plus-noise-ratio is first derived for single-carrier systems suffering from transmitter (TX) IQI only, receiver (RX) IQI only and joint TX/RX IQI. Capitalizing on this, we derive analytic expressions for the SER of the different modulation schemes considered. These expressions are corroborated with simulation results and they provide insights into the dependence of IQI on the system parameters. We further demonstrate that, while in some cases, IQI can cause a slight degradation of the SER performance and, hence, it can be neglected, in other cases it should be compensated in order to achieve a reliable communication link.

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Contributors: Selim, B., Muhaidat, S., Sofotasios, P. C., Sharif, B. S., Stouraitis, T., Karagiannidis, G. K., Al-Dhahir, N.
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Performance Evaluation of Coordinated Multipoint Transmission at 28 GHz Frequency Using 3D Ray Tracing
The main target of this paper is to evaluate the performance of Coordinated Multipoint (CoMP) transmission technique at Millimeter Wave (mmWave) frequency through a comprehensive set of simulations. A new metric for the performance evaluation of CoMP functionality called the Net CoMP utilization gain is introduced in this paper that takes into account the expected loading of the coordinating cells. Other performance metrics considered are the Signal to Interference plus Noise Ratio (SINR), throughput and dominance area. The acquired results show that the adoption of CoMP functionality provides higher gain in improving the Quality of Service (QoS) for the cell edge users compared with the other users. The net CoMP utilization gain as well as the overhead increases with the increase in number of transmission points (TPs). However, in highly loaded networks the risk of having negative impact (capacity loss) also increases with the increase in number of transmission points.

General information
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Organisations: Electronics and Communications Engineering
Contributors: Sheikh, M. U., Biswas, R., Lempiäinen, J.
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Source ID: 85050982698
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Ray-based evaluation of dual-polarized MIMO in (Ultra-)dense millimeter-wave urban deployments
Dense deployments of millimeter-wave (mmWave) base stations (BSs) are being considered as the most feasible solution to meet the steadily growing data rate demands of mobile users. Accordingly, the achievable performance gains of

mmWave-based dense networks in real deployments have to be studied carefully, since mmWave radio technology features specific transceiver, antenna, and propagation properties. In this paper, we contribute an accurate performance evaluation of single- versus dual-polarized MIMO systems operating over the mmWave channel in typical urban scenarios as well as address the impact of device- and network-centric parameters on the performance gains enabled by MIMO in dense to ultra-dense BS deployments. This study relies on our in-house ray-based modeler and takes into account the key mmWave system effects, such as multi-path propagation, utilization of dual-polarized antennas, and characteristic interference models. Our results show that the benefit of using mmWave- MIMO grows with increasing BS density, thus encouraging a further study of this technology especially for (ultra-)dense setups. We also demonstrate that non-coherent non-polarized diffuse scattering component may reduce the capacity gain of dual-polarized vs. single- polarized MIMO.

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Contributors: Solomitckii, D., Petrov, V., Nikopour, H., Akdeniz, M., Orhan, O., Himayat, N., Talwar, S., Andreev, S., Koucheryavy, Y.
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10.1109/VTCSpring.2018.8417788
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Source: Scopus
Source ID: 85050986035
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Effects of blockage in deploying mmWave drone base stations for 5g networks and beyond
Due to their unconstrained mobility and capability to carry goods or equipment, unmanned aerial vehicles (UAVs) or drones are considered as a part of the fifth-generation (5G) wireless networks and become attractive candidates to carry a base station (BS). As 5G requirements apply to a broad range of uses cases, it is of particular importance to satisfy those during spontaneous and temporary events, such as a marathon or a rural fair. To be able to support these scenarios, mobile operators need to deploy significant radio access resources quickly and on demand. Accordingly, by focusing on 5G cellular networks, we investigate the use of drone-assisted communication, where a drone is equipped with a millimeter-wave (mmWave) BS. Being a key technology for 5G, mmWave is able to facilitate the provisioning of the desired per-user data rates as drones arrive at the service area whenever needed. Therefore, in order to maximize the benefits of mmWave-drone-BS utilization, this paper proposes a methodology for its optimized deployment, which delivers the optimal height, coordinates, and coverage radius of the drone-BS by taking into account the human body blockage effects over a mmWave-specific channel model. Moreover, our methodology is able to maximize the number of offloaded users by satisfying the target signal quality at the cell edge and considering the maximum service capacity of the drone-BS. It was observed that the mmWave-specific features are extremely important to consider when targeting efficient drone-BS utilization and thus should be carefully incorporated into analysis.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, Carleton University
Contributors: Gapeyenko, M., Bor-Yaliniz, I., Andreev, S., Yanikomeroglu, H., Koucheryavy, Y.
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Source ID: 85050308378
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Modeling and cancellation of self-interference in full-duplex radio transceivers: Volterra series-based approach

This paper presents a novel digital self-interference canceller for inband full-duplex radio transceivers. The proposed digital canceller utilizes a Volterra series with sparse memory to model the residual SI signal, and it can thereby accurately reconstruct the self-interference even under a heavily nonlinear transmitter power amplifier. To the best of our knowledge, this is the first time such a sparse-memory Volterra series has been used to model the self-interference within an inband full-duplex device. The performance of the Volterra-based canceller is evaluated with real-life measurements that incorporate also an active analog canceller. The results show that the novel digital canceller suppresses the SI by 34 dB in the digital domain, outperforming the state- of-the-art memory polynomial-based solution by a margin of 5 dB. The total amount of cancellation is nearly 110 dB with a transmit power of +30 dBm, even though a shared transmit/receive antenna is used. To the best of our knowledge, this is the highest reported cancellation performance for a shared-antenna full-duplex device with such a high transmit power level.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering
Contributors: Korpi, D., Turunen, M., Anttila, L., Valkama, M.
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Bibliographical note

INT=elt,"Turunen, Matias"
Source: Scopus
Source ID: 85050263594
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Optimizing wirelessly powered crowd sensing: Trading energy for data

To overcome the limited coverage in traditional wireless sensor networks, mobile crowd sensing (MCS) has emerged as a new sensing paradigm. To achieve longer battery lives of user devices and incentivize human involvement, this paper presents a novel approach that seamlessly integrates MCS with wireless power transfer, named wirelessly powered crowd sensing (WPCS), for supporting crowd sensing with energy consumption and offering rewards as incentives. An optimization problem is formulated to simultaneously maximize the data utility and minimize the energy consumption for service operator, by jointly controlling wireless-power allocation at the access point (AP) as well as sensing-data size, compression ratio, and sensor transmission duration at the mobile sensor (MS). Given the fixed compression ratios, the optimal power allocation policy is shown to have a threshold-based structure with respect to a defined crowd-sensing priority function for each MS. Given fixed sensing-data utilities, the compression policy achieves the optimal compression ratio. Extensive simulations are also presented to verify the efficiency of the contributed mechanisms.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, University of Hong Kong, Southern University of Science and Technology
Contributors: Li, X., You, C., Andreev, S., Gong, Y., Huang, K.
Number of pages: 6
Pages: 1-6
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Hardware and Architecture
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Source ID: 85050274665
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Cybersecurity Attacks and Defences for Unmanned Smart Ships
By 2020, unmanned ships such as remotely controlled boats and autonomous vessels would become operational, marking a technological revolution for the maritime industry. Such ships are expected to serve needs ranging from coastal ferries to open sea cargo handling. In this paper we detail the security vulnerabilities of such unmanned ships. The attack surface as well as motivations for attack attempts also are discussed to provide a perspective of how and why attacks are undertaken. Finally defence strategies are proposed as countermeasures.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research area: Information security, Computing Sciences, Ericsson, F-Secure
Contributors: Silverajan, B., Ocak, M., Nagel, B.
Number of pages: 6
Pages: 15-20
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Publisher: IEEE
ISBN (Electronic): 9781538679753
ASJC Scopus subject areas: Business, Management and Accounting (miscellaneous), Artificial Intelligence, Computer Networks and Communications, Computer Science Applications, Hardware and Architecture, Information Systems and Management, Health Informatics, Communication
Keywords: Autonomous vehicles, IoT, Security, Smart Ships
DOIs:
10.1109/Cybermatics_2018.2018.00037
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Secure Firmware Updates for IoT: A Survey
The evolution of the Internet to an ubiquitous computing environment where massive amounts of devices will be connected. Sharing, receiving and acting upon data has brought in a problem of security. There are as many firmware and software update procedures as there are manufacturers. Therefore it would be good if a common solution could be found. We looked for suitable mechanisms in the past three years, to be used in Internet of Things networks as well as an up and coming research and standardization work. Our findings show that there indeed are good options for firmware update mechanisms that use state-of-The-Art technologies to deliver updates in a secure manner. While not all the mechanisms were specifically targeting deployment scenarios found in the Internet of Things, we still believe the concept of such update mechanism is suitable also for IoT use and thus can be adapted trivially to IoT networks and devices. We also propose a generic four-element model for secure firmware updates.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Research area: Information security, Computing Sciences
Contributors: Kolehmainen, A.
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Publisher: IEEE
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Keywords: Firmware updates, IoT, Lifecycle Management
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Wireless Communications for Optogenetics-Based Brain Stimulation: Present Technology and Future Challenges

The ability to decipher brain functions and understand the neuronal communication networking properties to develop innovative solutions to treat neurodegenerative diseases remains one of the biggest challenges in biomedicine. Since the early days, numerous solutions have been proposed for BMI, largely concentrating on the use of tethered electrodes that are inserted into the brain to either stimulate or suppress neural activities. In recent years, the field of optogenetics has provided a new alternative of utilizing light to stimulate genetically engineered neurons. While the original approach proposed the use of tethered optical cables inserted into the skull to transfer light into the brain for stimulation, numerous advances have been made to incorporate wireless technologies that will allow these devices to be attached to the skull or implanted in the brain. This article presents a review on the current technologies that have been proposed for different wireless optogenetics solutions, ranging from devices that are head mounted to miniature devices that can be embedded deep in the brain. We focus on a comparative analysis of the architecture and structure of the devices, the wireless technology used for signaling to the unit, as well as the energy consumption profile for each of the devices. Finally, the article presents future challenges to further miniaturize wireless optogenetic devices, concentrating specifically on the communication properties.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Waterford Institue of Technology, State University of New York
Contributors: Balasubramaniam, S., Wirdatmadja, S. A., Barros, M. T., Koucheryavy, Y., Stachowiak, M., Jornet, J. M.
Number of pages: 7
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ISSN (Print): 0163-6804
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ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
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Source: Scopus
Source ID: 85051078230
Research output: Contribution to journal › Article › Scientific › peer-review

Activation game for older adults - Development and initial user experiences

The purpose of this study is to introduce a new type of activation game and evaluate the attitudes and user experiences of Chinese elderly people. The game controlling is done with a specific 3D-printed handle and is based on an acceleration sensor. The developed activation game, which requires both cognitive and motor skills was tested with test groups in three Chinese eldercare homes. The game was played by the residents and user feedback was collected by researchers' observations and players' comments in the gaming event. The most significant finding was the positive user experience of the elderly and the experience of the game being both cognitively stimulating and supportive for player activation. The game controller handle was found to be convenient for elderly people as it supports active use of hands, which was seen important by the players. Based on the observations, the developed game also seemed to provide great potential for social interaction. However, also some challenges were noticed, related to the game controller handle and game implementation. These positive finding as well as the discovered challenges are reported in this study. As a conclusion, the results are a strong encouragement for continuing activation game development for older adults.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Satakunta University of Applied Sciences
Contributors: Merilampi, S., Koivisto, A., Virkki, J.
Number of pages: 5
Pages: 1-5
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ASJC Scopus subject areas: Health(social science), Computer Science Applications, Human-Computer Interaction
Keywords: Activation, cognitive impairment, mobile game, motor impairment, older adults, recreation, self-managed rehabilitation, serious games
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Source: Scopus
Source ID: 85050242350
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Effect of surfactant type and sonication energy on the electrical conductivity properties of nanocellulose-CNT nanocomposite films

We present a detailed study on the influence of sonication energy and surfactant type on the electrical conductivity of nanocellulose-carbon nanotube (NFC-CNT) nanocomposite films. The study was made using a minimum amount of processing steps, chemicals and materials, to optimize the conductivity properties of free-standing flexible nanocomposite films. In general, the NFC-CNT film preparation process is sensitive concerning the dispersing phase of CNTs into a solution with NFC. In our study, we used sonication to carry out the dispersing phase of processing in the presence of surfactant. In the final phase, the films were prepared from the dispersion using centrifugal cast molding. The solid films were analyzed regarding their electrical conductivity using a four-probe measuring technique. We also characterized how conductivity properties were enhanced when surfactant was removed from nanocomposite films; to our knowledge this has not been reported previously. The results of our study indicated that the optimization of the surfactant type clearly affected the formation of freestanding films. The effect of sonication energy was significant in terms of conductivity. Using a relatively low 16 wt. % concentration of multiwall carbon nanotubes we achieved the highest conductivity value of 8.4 S/cm for nanocellulose-CNT films ever published in the current literature. This was achieved by optimizing the surfactant type and sonication energy per dry mass. Additionally, to further increase the conductivity, we defined a preparation step to remove the used surfactant from the final nanocomposite structure.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Materials Science, Faculty of Biomedical Sciences and Engineering, VTT Technical Research Centre of Finland
Contributors: Siljander, S., Keinänen, P., Räty, A., Ramakrishnan, K. R., Tuukkanen, S., Kunnari, V., Harlin, A., Vuorinen, J., Kanerva, M.

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Article number: 1819
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Original language: English
ASJC Scopus subject areas: Catalysis, Molecular Biology, Spectroscopy, Computer Science Applications, Physical and Theoretical Chemistry, Organic Chemistry, Inorganic Chemistry
Keywords: Carbon nanotubes, Conductivity, Nanocellulose, Nanocomposite, Surfactant
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Bibliographical note
INT=mol,"Räty, Anna"
EXT="Harlin, Ali"
Source: Scopus
Source ID: 85048936349
Research output: Contribution to journal › Article › Scientific › peer-review

Caching-Aided Collaborative D2D Operation for Predictive Data Dissemination in Industrial IoT

Industrial automation deployments constitute challenging environments where moving IoT machines may produce high-definition video and other heavy sensor data during surveying and inspection operations. Transporting massive contents to the edge network infrastructure and then eventually to the remote human operator requires reliable and high-rate radio links supported by intelligent data caching and delivery mechanisms. In this work, we address the challenges of contents dissemination in characteristic factory automation scenarios by proposing to engage moving industrial machines as D2D caching helpers. With the goal of improving the reliability of high-rate mmWave data connections, we introduce alternative contents dissemination modes and then construct a novel mobility-aware methodology that helps develop predictive mode selection strategies based on the anticipated radio link conditions. We also conduct a thorough system-level evaluation of representative data dissemination strategies to confirm the benefits of predictive solutions that employ D2D-enabled collaborative caching at the wireless edge to lower contents delivery latency and improve data acquisition reliability.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering
Contributors: Orsino, A., Kovalchukov, R., Samuylov, A., Moltchanov, D., Andreev, S., Koucheryavy, Y., Valkama, M.
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Volume: 25
Issue number: 3
ISSN (Print): 1536-1284
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Original language: English
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Caching-Aided Collaborative D2D Operation 2018
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http://urn.fi/URN:NBN:fi:tuni-202001311719
Source: Scopus
Source ID: 85049615601
Research output: Contribution to journal › Article › Scientific › peer-review

Last Meter Indoor Terahertz Wireless Access: Performance Insights and Implementation Roadmap

The terahertz band, 0.1-10 THz, has sufficient resources not only to satisfy the 5G requirements of 10 Gb/s peak data rate but to enable a number of tempting rate-greedy applications. However, the terahertz band brings novel challenges, never addressed at lower frequencies. Among others, the scattering of terahertz waves from any object, including walls and furniture, and ultra-wideband highly directional links lead to fundamentally new propagation and interference structures. In this article, we review the recent progress in terahertz propagation modeling, and antenna and testbed designs, and propose a step-by-step roadmap for wireless terahertz Ethernet extension for indoor environments. As a side effect, the described concept provides a second life to the currently underutilized Ethernet infrastructure by using it as a universally available backbone. By applying real terahertz band propagation, reflection, and scattering measurements as well as ray-tracing simulations of a typical office, we analyze two representative scenarios at 300 GHz and 1.25 THz frequencies, illustrating that extremely high rates can be achieved with realistic system parameters at room scales.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, University of Oulu
Contributors: Petrov, V., Kokkoniemi, J., Moltchanov, D., Lehtomäki, J., Koucheryavy, Y., Juntti, M.
Number of pages: 8
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ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
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Source ID: 85048785161
Research output: Contribution to journal › Article › Scientific › peer-review

Conformai mapping of the human scapula to generate dense landmark features

This study presents preliminary work in the detection of shape features through conformal mapping of the surface of the human scapula. The approach employs Ricci-flow based uniformization of the surface topology towards its canonical domain a sphere. The resulting evolution of the surface generates a distribution of conformal factors over the surface. The local maxima and minima of this distributed parameter are used as candidates for representations of local shape features. The procedure was tested on 5 scapulae and the detected features were compared to manual annotations 16 on each scapula. 3 out of 16 landmarks were closely approximated by the detected features with an average distance less than 2.1 mm. Visual inspection reveals other detected features that show apparent consistency in their anatomical location on the surface of the scapula.

General information
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MoE publication type: Not Eligible
Organisations: University of Cape Town
Contributors: Narra, N., Fouefack, J. R., Douglas, T., Mutsvangwa, T.
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Source: Scopus
Source ID: 85048419164
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

PIVO: Probabilistic inertial-visual odometry for occlusion-robust navigation
This paper presents a novel method for visual-inertial odometry. The method is based on an information fusion framework employing low-cost IMU sensors and the monocular camera in a standard smartphone. We formulate a sequential inference scheme, where the IMU drives the dynamical model and the camera frames are used in coupling trailing sequences of augmented poses. The novelty in the model is in taking into account all the cross-terms in the updates, thus propagating the inter-connected uncertainties throughout the model. Stronger coupling between the inertial and visual data sources leads to robustness against occlusion and feature-poor environments. We demonstrate results on data collected with an iPhone and provide comparisons against the Tango device and using the EuRoC data set.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Aalto University
Contributors: Solin, A., Cortés, S., Rahtu, E., Kannala, J.
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ISBN (Electronic): 9781538648865
ASJC Scopus subject areas: Computer Vision and Pattern Recognition, Computer Science Applications
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Source: Scopus
Source ID: 85050916529
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Preface: Special Issue on 'New Hydraulic Components for Tough Robots'

General information
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MoE publication type: B1 Article in a scientific magazine
Organisations: Automation and Hydraulic Engineering, Research group: Innovative Hydraulic Automation, Tokyo Institute of Technology, Ritsumeikan University, Italian Institute of Technology, Okayama University
Contributors: Suzumori, K., Hyon, S. H., Semini, C., Mattila, J., Kanda, T.
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ASJC Scopus subject areas: Control and Systems Engineering, Software, Human-Computer Interaction, Hardware and Architecture, Computer Science Applications

DOIs:
10.1080/01691864.2018.1466427
Source: Scopus
Source ID: 85047515551
Research output: Contribution to journal › Editorial › Scientific

The effect of percutaneous transluminal angioplasty of superficial femoral artery on pulse wave features

We aimed to analyze the effects of percutaneous transluminal angioplasty (PTA) of the superficial femoral artery (SFA) on arterial pulse waves (PWs). Altogether 24 subjects i.e. 48 lower limbs were examined including 26 treated lower limbs having abnormal ankle-to-brachial pressure index (ABI) (ABI<0.9 or ABI>1.3) and 22 non-treated lower limbs. The measurements were conducted in pre-, peri- and post-treatment phases as well as in follow-up visit after 1 month. Both ABI and toe pressures measured by standard equipment were used as reference values. PW-derived parameters include ratios of different peaks of the PW and time differences between them as well as aging index. Both treated and non-treated limbs were compared in pre- and post-treatment as well as follow-up visit conditions. The results were evaluated in terms of statistical tests, Bland-Altman-plots, free-marginal multirater κ-analysis and multiple linear regression analysis. PTA was found to cause small changes to the studied PW-derived parameters of the treated limb which were observed immediately after the treatment, but the changes were more pronounced in the follow-up visit. In addition, we observed that the endovascular instrumentation itself does not cause significant changes to the PW-derived parameters. The results show that PW-analysis could be a useful tool for monitoring the treatment-effect of the PTA. However, because the pre-treatment differences of the treated and non-treated limb were small, further studies with subjects having no arterial diseases are required. The study demonstrates the potential of the PW analysis in monitoring vascular abnormalities.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Sensor Technology and Biomeasurements (STB), Tampere University Hospital
Contributors: Peltokangas, M., Suominen, V., Vakhitov, D., Verho, J., Korhonen, J., Lekkala, J., Vehkaoja, A., Oksala, N.
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Health Informatics
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Electronic versions:
The_effect_of_percutaneous. Embargo ended: 14/04/19
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URLs:
http://urn.fi/URN:NBN:fi:tty-201805021587. Embargo ended: 14/04/19
Source: Scopus
Source ID: 85045471212
Research output: Contribution to journal › Article › Scientific › peer-review

Backshoring of production in the context of a small and open Nordic economy

Purpose – The purpose of this paper is to investigate the extent, drivers, and conditions underlying backshoring in the Finnish manufacturing industry, comparing the results to the wider ongoing relocation of production in the international context. Design/methodology/approach – The survey of 229 Finnish manufacturing firms reveals the background, drivers, and patterns of offshoring and backshoring. Findings – Companies that had transferred their production back to Finland were more commonly in industries with relatively higher technology intensity and they were typically larger than the no-movement companies, and with a higher number of plants. They also reported more commonly having a corporate-wide strategy for guiding production location decisions. Research limitations/implications – Backshoring activity in the small and open economy of Finland seems to be higher compared to earlier studies in larger countries. The findings suggest that there is a transformation in the manufacturing industries with some gradual replacement of labor-intensive and lower technology-intensive industries toward higher technology-intensive industries. Practical implications – Moving production across national borders is one option in the strategies of firms to stay competitive. Companies must carefully consider the

relevance of various decision-making drivers when determining strategies for their production networks. Social implications – Manufacturing industries have traditionally been important for employment in the relatively small and open economies of the Nordic countries. From the social perspective, it is important to understand the ongoing transformation and its implications. Originality/value – There are few empirical studies available of the ongoing backshoring movement, utilizing data from company decision makers instead of macroeconomic factors.

General information
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MoE publication type: A1 Journal article-refereed
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Contributors: Heikkilä, J., Martinsuo, M., Nenonen, S.
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Original language: English
ASJC Scopus subject areas: Software, Control and Systems Engineering, Computer Science Applications, Strategy and Management, Industrial and Manufacturing Engineering
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URLs:

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Source: Scopus
Source ID: 85039840754
Research output: Contribution to journal › Article › Scientific › peer-review

Photovoltaic plant cloud shadowing and energy drops in Northern Europe
In this paper the effect of shadowing due to clouds on the energy production of a photovoltaic power plant installed in northern latitudes in Finland is analyzed. Numerical techniques, which can be also implemented on an embedded system because of their low computational and memory requirements, have been used for having an efficient processing of millions of experimental current vs. voltage curves acquired on the photovoltaic plant. The analysis allows to affirm that, at high latitudes, clouds can have a significant instantaneous effect on the power produced by the plant, but the time duration of the power drop is so short that the energy production is only marginally affected. This result is in full agreement with other studies appeared in the recent literature and suggests that, in such contexts, control electronics producers should avoid to implement related maximum power point tracking techniques for facing mismatched conditions, since their effect on energy production appears to be negligible.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Electrical Energy Engineering, Università di Salerno
Contributors: Petrone, G., Romanelli, S., Spagnuolo, G., Valkealahti, S.
Number of pages: 6
Pages: 1055-1060
Publication date: 27 Apr 2018

Host publication information
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Publisher: IEEE
ISBN (Electronic): 9781509059492
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
Keywords: Energy production, Maximum power point tracking, Mismatching effect, Photovoltaic, Shadowing
DOIs:

10.1109/ICIT.2018.8352324

Source: Scopus
Source ID: 85046942161
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Towards secure cloud orchestration for multi-cloud deployments

Cloud orchestration frameworks are commonly used to deploy and operate cloud infrastructure. Their role spans both vertically (deployment on infrastructure, platform, application and microservice levels) and horizontally (deployments from many distinct cloud resource providers). However, despite the central role of orchestration, the popular orchestration frameworks lack mechanisms to provide security guarantees for cloud operators. In this work, we analyze the security landscape of cloud orchestration frameworks for multi-cloud infrastructure. We identify a set of attack scenarios, define security enforcement enablers and propose an architecture for a security-enabled cloud orchestration framework for multi-cloud application deployments.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, RISE SICS, University of Westminster
Contributors: Paladi, N., Michalas, A., Dang, H. V.
Publication date: 23 Apr 2018

Host publication information

Title of host publication: CrossCloud 2018 - 5th Workshop on CrossCloud Infrastructures and Platforms, colocated with EuroSys 2018
Publisher: ACM
Article number: a4
ISBN (Electronic): 9781450356534
ASJC Scopus subject areas: Information Systems, Software, Computer Science Applications
Keywords: Cloud infrastructure, Microser-vices, Orchestration, Security, Virtualization
DOIs:
10.1145/3195870.3195874
Source: Scopus
Source ID: 85049685222
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Detection of beat-to-beat intervals from wrist photoplethysmography in patients with sinus rhythm and atrial fibrillation after surgery

Wrist photoplethysmography (PPG) allows unobtrusive monitoring of the heart rate (HR). PPG is affected by the capillary blood perfusion and the pumping function of the heart, which generally deteriorate with age and due to the presence of cardiac arrhythmia. The performance of wrist PPG in monitoring beat-to-beat HR in older patients with arrhythmia has not been reported earlier. We monitored PPG from wrist in 18 patients recovering from surgery in the post-anesthesia care unit, and evaluated the inter-beat interval (IBI) detection accuracy against ECG based R-to-R intervals (RRI). Nine subjects had sinus rhythm (SR, 68.0y ± 10.2y, 6 males) and nine subjects had atrial fibrillation (AF, 71.3y ± 7.8y, 4 males) during the recording. For the SR group, 99.44% of the beats were correctly identified, 2.39% extra beats were detected, and the mean absolute error (MAE) was 7.34 ms. For the AF group, 97.49% of the heartbeats were correctly identified, 2.26% extra beats were detected, and the MAE was 14.31 ms. IBI from the PPG were hence in close agreement with the ECG reference in both groups. The results suggest that wrist PPG provides a comfortable alternative to ECG during low motion and can be used for long-term monitoring and screening of AF episodes.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Faculty of Biomedical Sciences and Engineering, PulseOn SA, Tampere University Hospital, Pulseon Oy, Centre Suisse d'Electronique et de Microtechnique SA
Contributors: Tarniceriu, A., Harju, J., Vehkaoja, A., Parak, J., Delgado-Gonzalo, R., Renevey, P., Yli-Hankala, A., Korhonen, I.
Number of pages: 4
Pages: 133-136
Publication date: 6 Apr 2018

Host publication information

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Publisher: IEEE
ISBN (Electronic): 9781538624050
ASJC Scopus subject areas: Computer Science Applications, Biomedical Engineering, Health Informatics
Electronic versions:

Detection of Beat-to-Beat Intervals from Wrist Photoplethysmography in Patients with Sinus Rhythm and Atrial Fibrillation after Surgery - post-print

DOIs:
10.1109/BHI.2018.8333387
URLs:
http://urn.fi/URN:NBN:fi:tty-201809252333
Source: Scopus
Source ID: 85050860184
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Wirelessly powered urban crowd sensing over wearables: Trading energy for data

In this article, we put forward the paradigm of mobile crowd sensing based on ubiquitous wearable devices carried by human users. The key challenge for mass user involvement in prospective urban crowd sensing applications, such as monitoring of large-scale phenomena (e.g., traffic congestion and air pollution levels), is the appropriate sources of motivation. We thus advocate for the use of wireless power transfer provided in exchange for sensed data to incentivize the owners of wearables to participate in collaborative data collection. Based on this construction, we develop a novel concept of wirelessly powered crowd sensing and offer the corresponding network architecture considerations together with a systematic review of wireless charging techniques to support implementation. Further, we contribute a detailed system-level feasibility study that reports on the achievable performance levels for the envisioned setup. Finally, the underlying energy- data trading mechanisms are discussed, and the work concludes with outlining open research opportunities.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Peoples' Friendship University of Russia, Univ of Oulu, University of Hong Kong
Contributors: Galinina, O., Mikhaylov, K., Huang, K., Andreev, S., Koucheryavy, Y.
Number of pages: 10
Pages: 140-149
Publication date: 1 Apr 2018
Peer-reviewed: Yes

Publication information

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Volume: 25
Issue number: 2
ISSN (Print): 1536-1284
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Scopus rating (2018): CiteScore 17.4 SJR 2.352 SNIP 4.212
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
DOIs:
10.1109/MWC.2018.1600468
Source: Scopus
Source ID: 85046828147
Research output: Contribution to journal › Article › Scientific › peer-review

Generic platform for manufacturing execution system functions in knowledge-driven manufacturing systems

Information technologies grow rapidly nowadays with the advance and extension of computing capabilities. This growth affects several fields, which consume these technologies. Industrial Automation is not an exception. This publication describes a general and flexible architecture for implementing Manufacturing Execution System (MES) function, which can be deployed in multiple industrial cases. These features are achieved by combining the flexibility of knowledge-driven systems with the vendor-independent property of RESTful web services. With deployment of this solution, MES functions may gain more versatility and independency. This research work is a continuation of the development of the OKD-MES (Open Knowledge-Driven Manufacturing Execution System) framework during the execution of the eScop project. The OKD-MES framework consists on a semantic-based solution for controlling and enhancing the flexibility and re-configurability of MES. In such scope, this research presents MES functions architecture that might be implemented in the OKD-MES framework in order to increase the flexibility of event-driven manufacturing systems.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed

Organisations: Automation and Hydraulic Engineering, Research group: Factory automation systems technology, Politecnico di Milano
Contributors: Mohammed, W. M., Ramis Ferrer, B., Iarovyi, S., Negri, E., Fumagalli, L., Lobov, A., Martinez Lastra, J. L.
Number of pages: 13
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Publication date: 4 Mar 2018
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Journal: International Journal of Computer Integrated Manufacturing
ISSN (Print): 0951-192X
Ratings:

Scopus rating (2018): CiteScore 4.8 SJR 0.878 SNIP 1.447
Original language: English
ASJC Scopus subject areas: Aerospace Engineering, Mechanical Engineering, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Knowledge-driven manufacturing systems, manufacturing execution system functions, semantics
DOIs:

10.1080/0951192X.2017.1407874
Source: Scopus
Source ID: 85034843058
Research output: Contribution to journal › Article › Scientific › peer-review

Noise minimized high resolution digital holographic microscopy applied to surface topography
The topography of surface relief gratings was studied by digital holographic microscopy. The applicability of the method for quantitative measurements of surface microstructure at nanoscale was demonstrated. The method for wavefront reconstruction of surface relief from a digital hologram recorded in off-axis configuration was also applied. The main feature is noise filtration due to the presence of noise in the recorded intensity distribution and the use of all orders of the hologram. Reconstruction results proved a better effectiveness of our approach for topography studying of relief grating patterned on a ChG As_2S_3 - Se nanomultilayers in comparison with standard Fourier Transform and Atom Force Microscope methods.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing, Research group: Computational Imaging-CI, Institute of Applied Physics Academy of Sciences of Moldava, University of Stuttgart, St. Petersburg State University, Department of Signal Processing
Contributors: Achimova, E., Abaskin, V., Claus, D., Pedrini, G., Shevkunov, I., Katkovnik, V.
Number of pages: 6
Pages: 267-272
Publication date: 1 Mar 2018
Peer-reviewed: Yes

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Journal: Computer Optics
Volume: 42
Issue number: 2
ISSN (Print): 0134-2452
Ratings:

Scopus rating (2018): CiteScore 3.3 SJR 0.535 SNIP 2.365
Original language: English
ASJC Scopus subject areas: Atomic and Molecular Physics, and Optics, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Diffraction gratings, Digital holography, Digital image processing
DOIs:

10.18287/2412-6179-2018-42-2-267-272
Source: Scopus
Source ID: 85046122008
Research output: Contribution to journal › Article › Scientific › peer-review

A multi-agent approach for processing industrial enterprise data
The C2NET project aims to provide cloud-based platform for the supply chain interactions. The architecture of such platform includes a Data Collection Framework (DCF) for managing the collection of the company's data. The DCF collects, transforms and stores data from both Internet of Things (IoT) devices in the factory shopfloor and company enterprises data via two types of hub; Legacy system hub (LSH) and IoT hub. Since the C2NET, targets the Small and

Medium-sized Enterprises (SMEs), the enterprise data, or legacy data as called in the C2NET project, can be provided via excel files. Thus, this research work highlights a technique for processing the excel files in the LSHs. This technique adopts the concept of Multi-Agent Systems for processing the data as table in the excel files in the LSH. The multi-agent approach allows the LSH to process any excel file regardless the complexity in the data structure or in the file table. Furthermore, the presented approach enhances the processing of the excel files in different aspects, such as the size of the excel file or the required processing power.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Automation and Hydraulic Engineering, Research group: Automation and Systems Theory, Universitat Politècnica de València, Instituto de Desenvolvimento de Novas Tecnologias
Contributors: Mohammed, W. M., Ferrer, B. R., Martinez, J. L., Sanchis, R., Andres, B., Agostinho, C.
Number of pages: 7
Pages: 1209-1215
Publication date: 2 Feb 2018

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Publisher: IEEE
ISBN (Electronic): 9781538607749
ASJC Scopus subject areas: Computer Science Applications, Software, Engineering (miscellaneous), Computer Networks and Communications
Keywords: Cloud Based, Data Collection, Enterprise, Multi-Agent Systems, supply Chain
DOIs:
10.1109/ICE.2017.8280018
Source: Scopus
Source ID: 85047492606
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

An approach to production scheduling optimization a case of an oil lubrication and hydraulic systems manufacturer
Cloud-enabled tools developed in the Cloud Collaborative Manufacturing Networks (C2NET) project address the needs of small and medium enterprises with respect to information exchange and visibility across the collaboration partners in the supply network, coupled with automated and collaborative production planning and supply management. This paper analyses a case of an oil lubrication and hydraulic systems manufacturer and describes a pilot application of C2NET where the production schedule is optimized according to the priorities of the pilot company. In this case the goal is a highly adaptive just-in-time manufacturing schedule with guaranteed on time delivery.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Automation and Hydraulic Engineering, VTT Technical Research Centre of Finland, Roberto Camp Fluidhouse Ltd.
Contributors: Katasonov, A., Lastusilta, T., Korvola, T., Saari, L., Bendas, D., Mohammed, W. M., Lee, A. N.
Number of pages: 8
Pages: 1123-1130
Publication date: 2 Feb 2018

Host publication information
Title of host publication: 2017 International Conference on Engineering, Technology and Innovation : Engineering, Technology and Innovation Management Beyond 2020: New Challenges, New Approaches, ICE/ITMC 2017 - Proceedings
Publisher: IEEE
ISBN (Electronic): 9781538607749
ASJC Scopus subject areas: Computer Science Applications, Software, Engineering (miscellaneous), Computer Networks and Communications
Keywords: cloud-supported manufacturing, enterprise collaboration, information exchange, just-in-time manufacturing, Mixed-Integer Linear Programming, on time delivery, optimization, production scheduling, Small and Medium size Enterprise, supply network
DOIs:
10.1109/ICE.2017.8280007
Source: Scopus
Source ID: 85047524893

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Configuring and visualizing the data resources in a cloud-based data collection framework

The Manufacturing Enterprise Solutions Association (MESA) provided the abstract and general definition of the Manufacturing Execution Systems (MES). A dedicated function has been reserved for the data collection activities. In this matter, the Cloud Collaborative Manufacturing Networks (C2NET) project tends to provide a cloud based platform for hosting the interactions of the supply chain in a collaborative network. Within the architecture of the C2NET project, a Data Collection Framework (DCF) is designed to fulfill the function of data collection. This allows the companies to provide their data, which can be both enterprise and Internet of Things (IoT) devices type of data to the platform for further use. The collection of the data is achieved by a specific third party application, i.e., the Legacy System Hub (LSH). This research work presents the approach of configuring and visualizing the data resources in the C2NET platform. This approach employs the web-based applications and the help of the LSH. This permits the C2NET platform to adapt to any kind of third party application, which manipulates enterprise data, following the generic and flexible solution of this approach.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Automation and Hydraulic Engineering, Research group: Automation and Systems Theory, Instituto de Desenvolvimento de Novas Tecnologias
Contributors: Mohammed, W. M., Ferrer, B. R., Jose, L., Lastra, M., Aleixo, D., Agostinho, C.
Number of pages: 8
Pages: 1201-1208
Publication date: 2 Feb 2018

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Publisher: IEEE
ISBN (Electronic): 9781538607749
ASJC Scopus subject areas: Computer Science Applications, Software, Engineering (miscellaneous), Computer Networks and Communications
Keywords: Cloud Based, Data Collection, Data Resources, Supply Chain, Visualization
DOIs:
10.1109/ICE.2017.8280017

Bibliographical note

INT=aut,"Jose, L."
Source: Scopus
Source ID: 85047476305

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Exploiting suppliers' potential in construction innovations

There is a need to understand ways to enhance innovations in the construction industry. It is argued that suppliers have potential to develop new innovations, but they are largely neglected in earlier construction-related research. This research focuses on suppliers' role in construction innovations, and the aim of the research is to increase understanding of practices for exploiting suppliers' potential in that context. A qualitative, explanatory research strategy is employed in the context of construction industry in Finland. Eighteen interviews are conducted with contractors to discover experiences and practices related to suppliers' potential in construction innovations. The results reveal practices for exploiting supplier's potential in construction innovations. As a key contribution, the research shows that suppliers have an important role in construction innovation but exploitation of suppliers' potential is still rather underdeveloped.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research group: Center for Research on Operations Projects and Services, Industrial and Information Management
Contributors: Sariola, R.
Number of pages: 7
Pages: 678-684
Publication date: 2 Feb 2018

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ISBN (Electronic): 9781538607749
ASJC Scopus subject areas: Computer Science Applications, Software, Engineering (miscellaneous), Computer Networks and Communications
Keywords: construction innovation, project networks, supplier management
DOIs:
10.1109/ICE.2017.8279950
Source: Scopus
Source ID: 85047528988
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Analyzing Effects of Directional Deafness on mmWave Channel Access in Unlicensed Bands

Directional deafness problem is one of the most important challenges in beamforming-based channel access at mmWave frequencies, which is believed to have detrimental effects on system performance in form of excessive delays and significant packet drops. In this paper, we contribute a quantitative analysis of deafness in directional random access systems operating in unlicensed bands by relying on stochastic geometry formulations. We derive a general numerical approach that captures the behavior of deafness probability as well as provide a closed-form solution for a typical sector-shaped antenna model, which is then may be extended to a more realistic two-sector pattern. Finally, employing contemporary IEEE 802.11ad modeling numerology, we illustrate our analysis revealing the importance of deafness-related considerations and their system- level impact.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, Intel Corporation
Contributors: Galinina, O., Pyattaev, A., Johnsson, K., Andreev, S., Koucheryavy, Y.
Number of pages: 7
Pages: 1-7
Publication date: 24 Jan 2018

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Publisher: IEEE
ISBN (Electronic): 9781538639207
ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Hardware and Architecture, Safety, Risk, Reliability and Quality
Electronic versions:
Analyzing Effects of Directional Deafness 2017
DOIs:
10.1109/GLOCOMW.2017.8269183
URLs:
http://urn.fi/URN:NBN:fi:tuni-202002252341
Source: Scopus
Source ID: 85050472068
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Detailed Interference Analysis in Dense mmWave Systems Employing Dual-Polarized Antennas

The use of extremely high frequency (EHF) bands, known as millimeter-wave (mmWave) frequencies, requires densification of cells to maintain system performance at required levels. This may lead to potential increase of interference in practical mmWave networks, thus making it the limiting factor. On the other hand, attractive utilization of dual-polarized antennas may improve over this situation by mitigating some of the interfering components, which can be employed as part of interference control techniques. In this paper, an accurate two-stage ray-based characterization is conducted that models interference-related metrics while taking into account a detailed dual- polarized antenna model. In particular, we confirm that narrower pencil-beam antennas (HPBW = 13) have significant advantages as compared to antennas with relatively narrow beams (HPBW = 20 and HPBW = 50) in the environments with high levels of interference. Additionally, we demonstrate that in the Manhattan grid deployment a transition from interference- to noise-limited regime and back occurs at the cell inter-site distances of under 90 m and over 180 m, respectively.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, Intel Corporation
Contributors: Solomitckii, D., Petrov, V., Nikopour, H., Akdeniz, M., Orhan, O., Himayat, N., Talwar, S., Andreev, S., Koucheryavy, Y.

Number of pages: 6
Pages: 1-6
Publication date: 24 Jan 2018

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Publisher: IEEE
ISBN (Electronic): 9781538639207
ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Hardware and Architecture, Safety, Risk, Reliability and Quality
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Detailed Interference Analysis in Dense mmWave 2018
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URLs:

http://urn.fi/URN:NBN:fi:tuni-202002041814
Source: Scopus
Source ID: 85050464132
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Dual Structured Convolutional Neural Network with Feature Augmentation for Quantitative Characterization of Tissue Histology

We present a dual convolutional neural network (dCNN) architecture for extracting multi-scale features from histological tissue images for the purpose of automated characterization of tissue in digital pathology. The dual structure consists of two identical convolutional neural networks applied to input images with different scales, that are merged together and stacked with two fully connected layers. It has been acknowledged that deep networks can be used to extract higher-order features, and therefore, the network output at final fully connected layer was used as a deep dCNN feature vector. Further, engineered features, shown in previous studies to capture important characteristics of tissue structure and morphology, were integrated to the feature extractor module. The acquired quantitative feature representation can be further utilized to train a discriminative model for classifying tissue types. Machine learning based methods for detection of regions of interest, or tissue type classification will advance the transition to decision support systems and computer aided diagnosis in digital pathology. Here we apply the proposed feature-augmented dCNN method with supervised learning in detecting cancerous tissue from whole slide images. The extracted quantitative representation of tissue histology was used to train a logistic regression model with elastic net regularization. The model was able to accurately discriminate cancerous tissue from normal tissue, resulting in blockwise AUC=0.97, where the total number of analyzed tissue blocks was approximately 8.3 million that constitute the test set of 75 whole slide images.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Faculty of Biomedical Sciences and Engineering, Signal Processing
Contributors: Valkonen, M., Kartasalo, K., Liimatainen, K., Nykter, M., Latonen, L., Ruusuvuori, P.
Number of pages: 9
Pages: 27-35
Publication date: 19 Jan 2018

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Publisher: IEEE
ISBN (Electronic): 9781538610343
ASJC Scopus subject areas: Computer Science Applications, Computer Vision and Pattern Recognition
DOIs:

10.1109/ICCVW.2017.10

Bibliographical note

EXT="Nykter, Matti"
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Image-Based Localization Using Hourglass Networks

In this paper, we propose an encoder-decoder convolutional neural network (CNN) architecture for estimating camera pose (orientation and location) from a single RGB-image. The architecture has a hourglass shape consisting of a chain of convolution and up-convolution layers followed by a regression part. The up-convolution layers are introduced to preserve the fine-grained information of the input image. Following the common practice, we train our model in end-to-end manner utilizing transfer learning from large scale classification data. The experiments demonstrate the performance of the approach on data exhibiting different lighting conditions, reflections, and motion blur The results indicate a clear

improvement over the previous state-of-the-art even when compared to methods that utilize sequence of test frames instead of a single frame.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Aalto University
Contributors: Melekhov, I., Ylioinas, J., Kannala, J., Rahtu, E.
Number of pages: 8
Pages: 870-877
Publication date: 19 Jan 2018

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Title of host publication: 2017 IEEE International Conference on Computer Vision Workshops, ICCVW 2017
Publisher: IEEE
ISBN (Electronic): 9781538610343
ASJC Scopus subject areas: Computer Science Applications, Computer Vision and Pattern Recognition
DOIs:

10.1109/ICCVW.2017.107
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Multiwavelength surface contouring from phase-coded diffraction patterns
We propose a new algorithm for absolute phase retrieval from multiwavelength noisy phase coded diffraction patterns in the task of surface contouring. A lensless optical setup is considered with a set of successive single wavelength experiments. The phase masks are applied for modulation of the multiwavelength object wavefronts. The algorithm uses the forward and backward propagation for coherent light beams and sparsely encoding wavefronts which leads to the complex-domain block-matching 3D filtering. The key-element of the algorithm is an original aggregation of the multiwavelength object wavefronts for high-dynamic-range profile measurement. Numerical experiments demonstrate that the developed approach leads to the effective solutions explicitly using the sparsity for noise suppression and high-accuracy object profile reconstruction.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Research group: Computational Imaging-CI, ITMO University
Contributors: Katkovnik, V., Shevkunov, I., Petrov, N. V., Eguiazarian, K.
Publication date: 1 Jan 2018

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Title of host publication: Unconventional Optical Imaging 2018. Strasbourg, France
Publisher: SPIE
Article number: 106771B
ISBN (Print): 978-1-5106-1880-0

Publication series
Name: Proceedings of SPIE - The International Society for Optical Engineering
Volume: 10677
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: absolute phase retrieval, discrete optical signal processing, Multiwavelength phase retrieval, phase imaging, surface contouring
Electronic versions:

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DOIs:

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URLs:

http://urn.fi/URN:NBN:fi:tuni-202001231493
Source: Scopus
Source ID: 85052446644
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Technologies for Efficient Amateur Drone Detection in 5G Millimeter-Wave Cellular Infrastructure
Unmanned aerial vehicles, also called drones, are recently gaining increased research attention across various fields due to their flexibility and application potential. The steady increase in the number of amateur drones demands more stringent

regulations on their allowed route, mass, and load. However, these regulations may be violated accidentally or deliberately. In these cases, spying with drones, transfer of dangerous payloads, or losing reliable drone control can represent a new hazard for people, governments, and business sector. The technologies to detect, track, and disarm possible aerial threats are therefore in prompt demand. To this end, ubiquitous cellular networks, and especially 5G infrastructures based on the use of millimeter-wave radio modules, may be efficiently leveraged to offer the much needed drone detection capabilities. In this work, we propose to exploit 5G millimeter-wave deployments to detect violating amateur drones. We argue that the prospective 5G infrastructure may provide all the necessary technology elements to support efficient detection of small-sized drones. We therefore outline a novel technology and system design perspective, including such considerations as the density of base stations, their directional antennas, and the available bandwidth, among others, as well as characterize their impact with our ray-based modeling methods.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Aalto University
Contributors: Solomitckii, D., Gapeyenko, M., Semkin, V., Andreev, S., Koucheryavy, Y.
Number of pages: 8
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Publication date: 1 Jan 2018
Peer-reviewed: Yes

Publication information
Journal: IEEE Communications Magazine
Volume: 56
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Scopus rating (2018): CiteScore 19.3 SJR 2.373 SNIP 4.903
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
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Technologies for Efficient Amateur Drone Detection 2018
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URLs:
http://urn.fi/URN:NBN:fi:tuni-202002041813
Source: Scopus
Source ID: 85040720734
Research output: Contribution to journal › Article › Scientific › peer-review

Ultra-large mode area single frequency anisotropic MOPA with double clad Yb-doped tapered fiber
We demonstrates all-fiber master oscillator - power amplifier delivered 70W output power at 1033.33nm with 8 kHz FWHM linewidth without any problems with SBS. The anisotropic ytterbium doped tapered double clad amplifier with 50 μm MFD and polarization extinction ratio about 30 dB is developed as a burst stage. The output radiation demonstrated perfect beam quality (M^2=1.03/1.08).

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Ampliconyx Ltd, Institute of Radio Engineering and Electronics of the Russian Academy of Sciences, St. Petersburg State Polytechnical University
Contributors: Noronen, T., Fedotov, A., Rissanen, J., Gumenyuk, R., Butov, O., Chamorovskii, Y., Golant, K., Odnoblyudov, M., Filippov, V.
Number of pages: 6
Publication date: 1 Jan 2018

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ISSN (Print): 0277-786X
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: active fiber, fiber amplifier, Fiber laser
Electronic versions:

Noronen T. Ultra-large mode area single frequency anisotropic MOPA with double clad Yb-doped tapered fiber
DOIs:

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URLs:

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Bibliographical note
EXT="Noronen, Teppo"
EXT="Fedotov, Andrei"
INT=fot, "Rissanen, Joona"
EXT="Gumenyuk, Regina"
EXT="Filippov, Valery"
Source: Scopus
Source ID: 85045656071
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Action recognition using the 3D dense microblock difference
This paper describes a framework for action recognition which aims to recognize the goals and activities of one or more human from a series of observations. We propose an approach for the human action recognition based on the 3D dense micro-block difference. The proposed algorithm is a two-stage procedure: (a) image preprocessing using a 3D Gabor filter and (b) a descriptor calculation using 3D dense micro-block difference with SVM classifier. At the first step, an efficient spatial computational scheme designed for the convolution with a bank of 3D Gabor filters is present. This filter intensifies motion using a convolution for a set of 3D patches and arbitrarily-oriented anisotropic Gaussian. For preprocessed frames, we calculate the local features such as 3D dense micro-block difference (3D DMD), which capture the local structure from the image patches at high scales. This approach is processing the small 3D blocks with different scales from frames which capture the microstructure from it. The proposed image representation is combined with fisher vector method and linear SVM classifier. We evaluate the proposed approach on the UCF50, HMDB51 and UCF101 databases. Experimental results demonstrate the effectiveness of the proposed approach on video with a stochastic textures background with comparisons of the state-of-The-Art methods.

General information
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Organisations: Signal Processing, Don State Technical University, Moscow State University of Technology 'Stankin', Beijing Jiaotong University
Contributors: Voronin, V., Pismenskova, M., Zelensky, A., Cen, Y., Nadykto, A., Egiazarian, K.
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: 3D Gabor filter., Action recognition, Micro-block difference, Texture
DOIs:

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Bibliographical note
jufoid=71479
Source: Scopus

Source ID: 85057423236
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

A Primal Neural Network for Online Equality-Constrained Quadratic Programming

This paper aims at solving online equality-constrained quadratic programming problem, which is widely encountered in science and engineering, e.g., computer vision and pattern recognition, digital signal processing, and robotics. Recurrent neural networks such as conventional GradientNet and ZhangNet are considered as powerful solvers for such a problem in light of its high computational efficiency and capability of circuit realisation. In this paper, an improved primal recurrent neural network and its electronic implementation are proposed and analysed. Compared to the existing recurrent networks, i.e. GradientNet and ZhangNet, our network can theoretically guarantee superior global exponential convergence. Robustness performance of our such neural model is also analysed under a large model implementation error, with the upper bound of stead-state solution error estimated. Simulation results demonstrate theoretical analysis on the proposed model, which also verify the effectiveness of the proposed model for online equality-constrained quadratic programming.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing, Research group: Vision, Shanghai Institute of Ceramics Chinese Academy of Sciences , Institute of Automation Chinese Academy of Sciences
Contributors: Chen, K., Zhang, Z.
Number of pages: 8
Pages: 381–388
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Peer-reviewed: Yes

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Original language: English
ASJC Scopus subject areas: Computer Vision and Pattern Recognition, Computer Science Applications, Cognitive Neuroscience
Keywords: Global exponential convergence, Online equality-constrained quadratic programming, Recurrent neural networks, Robustness analysis
DOIs:

10.1007/s12559-017-9510-4
Source: Scopus
Source ID: 85030320446
Research output: Contribution to journal › Article › Scientific › peer-review

Architectural patterns for microservices: A systematic mapping study

Microservices is an architectural style increasing in popularity. However, there is still a lack of understanding how to adopt a microservice-based architectural style. We aim at characterizing different microservice architectural style patterns and the principles that guide their definition. We conducted a systematic mapping study in order to identify reported usage of microservices and based on these use cases extract common patterns and principles. We present two key contributions. Firstly, we identified several agreed microservice architecture patterns that seem widely adopted and reported in the case studies identified. Secondly, we presented these as a catalogue in a common template format including a summary of the advantages, disadvantages, and lessons learned for each pattern from the case studies. We can conclude that different architecture patterns emerge for different migration, orchestration, storage and deployment settings for a set of agreed principles.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, Free University of Bolzano-Bozen
Contributors: Taibi, D., Lenarduzzi, V., Pahl, C.
Number of pages: 12
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ASJC Scopus subject areas: Computer Science (miscellaneous), Software, Computer Science Applications
Keywords: Architectural style, Architecture pattern, Cloud migration, Cloud native, DevOps, Microservices
DOIs:
10.5220/0006798302210232
Source: Scopus
Source ID: 85046716130
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Blind estimation of white Gaussian noise variance in highly textured images

In the paper, a new method of blind estimation of noise variance in a single highly textured image is proposed. An input image is divided into 8x8 blocks and discrete cosine transform (DCT) is performed for each block. A part of 64 DCT coefficients with lowest energy calculated through all blocks is selected for further analysis. For the DCT coefficients, a robust estimate of noise variance is calculated. Corresponding to the obtained estimate, a part of blocks having very large values of local variance calculated only for the selected DCT coefficients are excluded from the further analysis. These two steps (estimation of noise variance and exclusion of blocks) are iteratively repeated three times. For the verification of the proposed method, a new noise-free test image database TAMPERE17 consisting of many highly textured images is designed. It is shown for this database and different values of noise variance from the set {25, 49, 100, 225}, that the proposed method provides approximately two times lower estimation root mean square error than other methods.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Don State Technical University
Contributors: Ponomarenko, M., Gapon, N., Voronin, V., Egiazarian, K.
Publication date: 2018

Host publication information

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ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
Keywords: Blind estimation of noise characteristics, Discrete cosine transform (DCT), Noise free test image database
DOIs:
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Bibliographical note

jufoid=84313
Source: Scopus
Source ID: 85052856410
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Combined local and global image enhancement algorithm

We present a new image enhancement algorithm based on combined local and global image processing. The basic idea is to apply α-rooting image enhancement approach for different image blocks. For this purpose, we split image in moving windows on disjoint blocks with different size (8 by 8, 16 by 16, 32 by 32 and, i.e.). The parameter alfa for every block driven through optimization of measure of enhancement (EME). The resulting image is a weighted mean of all processing blocks. This strategy for image enhancement allows getting more contrast image with the following properties: irregular lighting and brightness gradient. Some experimental results are presented to illustrate the performance of the proposed algorithm.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Don State Technical University, College of Staten Island
Contributors: Voronin, V., Semenishchev, E., Ponomarenko, M., Agaian, S.
Publication date: 2018

Host publication information

Title of host publication: Electronic Imaging : Image Processing: Algorithms and Systems XVI
Publisher: Society for Imaging Science and Technology

ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
DOIs:
10.2352/ISSN.2470-1173.2018.13.IPAS-220

Bibliographical note
jufoid=84313
Source: Scopus
Source ID: 85052861928
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Compression of signs of DCT coefficients for additional lossless compression of JPEG images
One of the main approaches to additional lossless compression of JPEG images is decoding of quantized values of discrete cosine transform (DCT) coefficients and further more effective recompression of the coefficients. Values of amplitudes of DCT coefficients are highly correlated and it is possible to effectively compress them. At the same time, signs of DCT coefficients, which occupy up to 20% of compressed image, are often considered unpredictable. In the paper, a new and effective method for compression of signs of quantized DCT coefficients is proposed. The proposed method takes into account both correlation between DCT coefficients of the same block and correlation between DCT coefficients of neighbor blocks. For each of 64 DCT coefficients, positions of 3 reference coefficients inside the block are determined and stored in the compressed file. Four reference coefficients with fixed positions are used from the neighbor blocks. For all reference coefficients, 15 frequency models to predict signs of a given coefficient are used. All 7 probabilities (that the sign is negative) are mixed by logistic mixing. For test set of JPEG images, we show that the proposed method allows compressing signs of DCT coefficients by 1.1 ⋯ 1.3 times, significantly outperforming nearest analogues.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Kharkiv National Aerospace University
Contributors: Miroshnichenko, O., Ponomarenko, M., Lukin, V., Egiazarian, K.
Publication date: 2018

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ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
Keywords: Discrete cosine transform, JPEG, JPEG additional compression, Sign compression
DOIs:
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Bibliographical note
jufoid=84313
EXT="Lukin, Vladimir"
Source: Scopus
Source ID: 85052859716
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Conversion of sparsely-captured light field into alias-free fullparallax multiview content
We propose shearlet decomposition based light field (LF) reconstruction and filtering techniques for mitigating artifacts in the visualized contents of 3D multiview displays. Using the LF reconstruction capability, we first obtain the densely sampled light field (DSLF) of the scene from a sparse set of view images. We design the filter via tiling the Fourier domain of epipolar image by shearlet atoms that are directionally and spatially localized versions of the desired display passband. In this way, it becomes possible to process the DSLF in a depth-dependent manner. That is, the problematic areas in the 3D scene that are outside of the display depth of field (DoF) can be selectively filtered without sacrificing high details in the areas near the display, i.e. inside the DoF. The proposed approach is tested on a synthetic scene and the improvements achieved by means of the quality of the visualized content are verified, where the visualization process is simulated using a geometrical optics model of the human eye.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Electronics and Telecommunication Research Institute (ETRI)
Contributors: Sahin, E., Vagharshakyan, S., Bregovic, R., Lee, G., Gotchev, A.
Number of pages: 5

Pages: 1441-1445
Publication date: 2018

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ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
DOIs:
10.2352/ISSN.2470-1173.2018.04.SDA-144

Bibliographical note
jufoid=84313
Source: Scopus
Source ID: 85052854954
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Deep p-Fibonacci scattering networks
Recently, the use of neural networks for image classification has become widely spread. Thanks to the availability of increased computational power, better performing architectures have been designed, such as the Deep Neural networks. In this work, we propose a novel image representation framework exploiting the Deep p- Fibonacci scattering network. The architecture is based on the structured p-Fibonacci scattering over graph data. This approach allows to provide good accuracy in classification while reducing the computational complexity. Experimental results demonstrate that the performance of the proposed method is comparable to state-of-the-art unsupervised methods while being computationally more efficient.

General information
Publication status: Published
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Organisations: Signal Processing, University “Roma Tre”
Contributors: Battisti, F., Carli, M., De Paola, E., Egiazarian, K.
Publication date: 2018

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Publisher: Society for Imaging Science and Technology
ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
DOIs:
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Bibliographical note
jufoid=84313
EXT="Battisti, F."
EXT="Carli, M."
Source: Scopus
Source ID: 85052873638
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Effect of paint baking treatment on the properties of press hardened boron steels
This study comprehends the effect of a typical paint baking process on the properties of press hardened boron steels. Bake hardening response of four 22MnB5 steels with different production histories and two other boron steels of 30MnB5 and 34MnB5 type were analyzed. In particular, the effect of steel carbon content and prior austenite grain size on the strength of the bake hardening treated steels was investigated. Press hardened steels showed a relatively strong bake hardening effect, 80–160 MPa, in terms of yield strength. In addition, a clear decrease in ultimate tensile strength, 30–150 MPa, was observed due to baking. The changes in tensile strength showed a dependency on the carbon content of the steel: higher carbon content led to a larger decrease in tensile strength in general. Smaller prior austenite grain size resulted in a higher increase in yield strength despite the micro-alloyed 34MnB5. Transmission electron microscopy analysis carried out for the 34MnB5 revealed niobium rich mixture carbides of (Nb, Ti)C, which have most likely influenced the different bake hardening response. The present results indicate that the bake hardening response of press hardened steels depends on both prior austenite grain size and carbon content, but is also affected by other alloying elements. The observed correlation between prior austenite grain size and bake hardening response can be used to optimize the production of the standard grades of 22MnB5 and 30MnB5. In addition, our study suggests that baking process improves the post-uniform elongation and ductile fracture behavior of 34MnB5, but do not significantly influence the ductile fracture mechanisms of 22MnB5 and 30MnB5 representing lower strength levels.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Metals Technology, SSAB
Contributors: Järvinen, H., Honkanen, M., Järvenpää, M., Peura, P.
Number of pages: 15
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ASJC Scopus subject areas: Ceramics and Composites, Modelling and Simulation, Computer Science Applications, Metals and Alloys, Industrial and Manufacturing Engineering
Keywords: Bake hardening, EBSD, Martensite, Paint baking, Press hardening, Prior austenite grain size
Electronic versions:

Effect of paint baking treatment 2017. Embargo ended: 11/09/19
DOIs:

10.1016/j.jmatprotec.2017.08.027
URLs:

http://urn.fi/URN:NBN:fi:tuni-202002182174. Embargo ended: 11/09/19
Source: Scopus
Source ID: 85029389667
Research output: Contribution to journal › Article › Scientific › peer-review

Elementary math to close the digital skills gap
All-encompassing digitalization and the digital skills gap pressure the current school system to change. Accordingly, to 'digi-jump', the Finnish National Curriculum 2014 (FNC-2014) adds programming to K-12 math. However, we claim that the anticipated addition remains too vague and subtle. Instead, we should take into account education recommendations set by computer science organizations, such as ACM, and define clear learning targets for programming. Correspondingly, the whole math syllabus should be critically viewed in the light of these changes and the feedback collected from SW professionals and educators. These findings reveal an imbalance between supply and demand, i.e., what is over-taught versus under-taught, from the point of view of professional requirements. Critics claim an unnecessary surplus of calculus and differential equations, i.e., continuous mathematics. In contrast, the emphasis should shift more towards algorithms and data structures, flexibility in handling multiple data representations, logic; in summary - discrete mathematics.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, Jyväskylän yliopisto
Contributors: Niemelä, P., Valmari, A.
Number of pages: 12
Pages: 154-165
Publication date: 2018

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ASJC Scopus subject areas: Computer Science Applications, Information Systems, Education
Keywords: Computing in math syllabus, Continuous vs. discrete math, Digital skills gap, Effectiveness of education, K-12 computer science education, Professional development of software professionals
DOIs:

10.5220/0006800201540165

Bibliographical note
EXT="Valmari, Antti"

Source: Scopus
Source ID: 85047771637
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Gamification, quantified-self or social networking? Matching users' goals with motivational technology

Systems and services we employ in our daily life have increasingly been augmented with motivational designs which fall under the classes of (1) gamification, (2) quantified-self and (3) social networking features that aim to help users reach their goals via motivational enforcement. However, users differ in terms of their orientation and focus toward goals and in terms of the attributes of their goals. Therefore, different classes of motivational design may have a differential fit for users. Being able to distinguish the goal profiles of users, motivational design could be better tailored. Therefore, in this study we investigate how different goal foci (outcome and focus), goals orientation (mastery, proving, and avoiding), and goal attributes (specificity and difficulty) are associated with perceived importance of gamification, social networking and quantified-self features. We employ survey data ((Formula presented.)) from users of HeiaHeia; a popular exercise encouragement app. Results indicate that goal-setting related factors of users and attributes of goals are connected with users' preference over motivational design classes. In particular, the results reveal that being outcome-focused is associated with positive evaluations of gamification and quantified-self design classes. Users with higher proving-orientation perceived gamification and social networking design classes as more important, users with lower goal avoidance-orientation perceived social networking design as more important, whereas users with higher mastery-orientation perceived quantified-self design more important. Users with difficult goals were less likely to perceive gamification and social networking design important, whereas for users with high goal specificity quantified-self features were important. The findings provide insights for the automatic adaptation of motivational designs to users' goals. However, more research is naturally needed to further investigate generalizability of the results.

General information

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Organisations: Pervasive Computing, Swedish School of Economics and Business Administration, Aalto University
Contributors: Hamari, J., Hassan, L., Dias, A.
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DOIs:

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Source: Scopus
Source ID: 85040920827
Research output: Contribution to journal › Article › Scientific › peer-review

Highly-efficient Ho:KY(WO4)2 thin-disk lasers at 2.06 μm

The recent advances in the development of Holmium monoclinic double tungstate thin-disk lasers are reviewed. The thin-disk is based on a 250-μm-thick 3 at. % Ho:KY$(WO_4)_2$ active layer grown on a (010)-oriented KY$(WO_4)_2$ substrate. When pumped by a Tm-fiber laser at 1960 nm with a single-bounce pump geometry, the continuous-wave Ho:KY$(WO_4)_2$ thin-disk laser generates an output power of 1.01 W at 2057 nm corresponding to a slope efficiency η of 60% and a laser threshold of only 0.15 W. The thin-disk laser is passively Q-switched with a GaSb-based quantum-well semiconductor saturable absorber mirror. In this regime, it generates an average output power of 0.551 W at ~2056 nm with η = 44%. The best pulse characteristics are 4.1 μJ/201 ns at a repetition rate of 135 kHz. The laser performance, beam quality and thermo-optic aberrations of such lasers are strongly affected by the Ho^{3+} doping concentration. For the 3 at.% Ho^{3+}-doped thin-disk, the thermal lens is negative (the sensitivity factors for the two principal meridional planes are-1.7 and-0.6 m^{-1}/W) and astigmatic. The Ho:KY$(WO_4)_2$ epitaxial structures are promising as active elements in mode-locked thin-disk lasers at ~2060 nm.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Photonics, Research group: ORC, Max Born Institute, Universitat Rovira i Virgili, LISA Laser Products OHG , ITMO University, Institute of Laser Physics of the Siberian Branch of the RAS
Contributors: Mateos, X., Loiko, P., Lamrini, S., Scholle, K., Fuhrberg, P., Suomalainen, S., Härkönen, A., Guina, M., Vatnik, S., Vedin, I., Aguiló, M., Diáz, F., Wang, Y., Griebner, U., Petrov, V.
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ISBN (Electronic): 9781510619920

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Name: Proceedings of SPIE
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: 2-micron lasers, Ho-lasers, monoclinic double tungstates, Q-switched lasers, thin-disk lasers
DOIs:
10.1117/12.2316822

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jufoid=71479
Source: Scopus
Source ID: 85051249536
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

How to design gamification? A method for engineering gamified software

Context: Since its inception around 2010, gamification has become one of the top technology and software trends. However, gamification has also been regarded as one of the most challenging areas of software engineering. Beyond traditional software design requirements, designing gamification requires the command of disciplines such as (motivational/behavioral) psychology, game design, and narratology, making the development of gamified software a challenge for traditional software developers. Gamification software inhabits a finely tuned niche of software engineering that seeks for both high functionality and engagement; beyond technical flawlessness, gamification has to motivate and affect users. Consequently, it has also been projected that most gamified software is doomed to fail. Objective: This paper seeks to advance the understanding of designing gamification and to provide a comprehensive method for developing gamified software. Method: We approach the research problem via a design science research approach; firstly, by synthesizing the current body of literature on gamification design methods and by interviewing 25 gamification experts, producing a comprehensive list of design principles for developing gamified software. Secondly, and more importantly, we develop a detailed method for engineering of gamified software based on the gathered knowledge and design principles. Finally, we conduct an evaluation of the artifacts via interviews of ten gamification experts and implementation of the engineering method in a gamification project. Results: As results of the study, we present the method and key design principles for engineering gamified software. Based on the empirical and expert evaluation, the developed method was deemed as comprehensive, implementable, complete, and useful. We deliver a comprehensive overview of gamification guidelines and shed novel insights into the nature of gamification development and design discourse. Conclusion: This paper takes first steps towards a comprehensive method for gamified software engineering.

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Organisations: Research group: TUT Game Lab, Pervasive Computing, University of Duisburg-Essen
Contributors: Morschheuser, B., Hassan, L., Werder, K., Hamari, J.
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Publication information
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ASJC Scopus subject areas: Software, Information Systems, Computer Science Applications
Keywords: Design science research, Game design, Gameful design, Gamification, Persuasive technology, Playfulness, Software engineering
DOIs:
10.1016/j.infsof.2017.10.015
Source: Scopus
Source ID: 85035150495
Research output: Contribution to journal › Article › Scientific › peer-review

Integrated multi-wavelength mid-IR light source for gas sensing

Cost effective multi-wavelength light sources are key enablers for spectroscopic applications at Mid-IR wavelength range. Utilizing a novel Mid-IR Si-based photonic integrated circuit filter and wide-band Mid-IR SLEDs, we show the concept of a light source that covers 2.7.3.5 µm wavelength range with a resolution <1nm. The spectral bands are switchable and tunable and they can be modulated. The source allows for the fabrication of an affordable multi-band gas sensor with good selectivity and sensitivity. The unit price can be lowered in high volumes by utilizing tailored molded IR lens technology and automated packaging and assembling technologies. The status of the development of the key components of the light source are reported. The Mid-IR PIC is based on the use of thick-SOI technology, SLED is based on AlGaInAsSb materials and the lenses are tailored single crystal, nonoxide glass and heavy metal oxide glasses fabricated by the use of hot-embossing. The packaging concept utilizing automated assembly tools are depicted. In safety and security applications, the Mid-IR wavelength range covered by the source allows for the detection of several harmful gas components with a single sensor. At the moment, affordable sources are not available. The market impact is expected to be disruptive, since the devices currently in the market are either complicated, expensive and heavy instruments, or the applied measurement principles are inadequate in terms of stability and selectivity.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Photonics, Research group: ORC, VTT Technical Research Centre of Finland, Institute of Electronic Materials Technology, Vaisala Oyj, Airoptic Sp. z o.o., GasSecure, VIGO System S.A.
Contributors: Karioja, P., Alajoki, T., Cherchi, M., Ollila, J., Harjanne, M., Heinilehto, N., Suomalainen, S., Zia, N., Tuorila, H., Viheriälä, J., Guina, M., Buczynski, R., Kasztelanic, R., Salo, T., Virtanen, S., Kluczynski, P., Borgen, L., Ratajczyk, M. , Kalinowski, P.
Publication date: 2018

Host publication information

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Publication series

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Keywords: gas sensing, Mid-IR integrated optics, Mid-IR lens, photonics packaging, PIC, Si photonics, SLED
DOIs:
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Bibliographical note

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Source: Scopus
Source ID: 85050701514
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Knowledge-based artificial neural network (KB-ANN) in engineering: Associating functional architecture modeling, dimensional analysis and causal graphs to produce optimized topologies for KB-ANNs

This article documents a study on artificial neural networks (ANNs) applied to the field of engineering and more specifically a study taking advantage of prior domain knowledge of engineering systems to improve the learning capabilities of ANNs by reducing the dimensionality of the ANNs. The proposed approach ultimately leads to training a smaller ANN, offering advantage in training performances such as lower Mean Squared Error, lower cost and faster convergence. The article proposes to associate functional architecture, Pi numbers, and causal graphs and presents a design process to generate

optimized knowledge-based ANN (KB-ANN) topologies. The article starts with a literature survey related to ANN and their topologies. Then, an important distinction is made between system behavior centered topologies and ANN centered topologies. The Dimensional Analysis Conceptual Modeling (DACM) framework is introduced as a way of implementing the system behavior centered topology. One case study is analyzed with the goal of defining an optimized KB-ANN topology. The study shows that the KB-ANN topology performed significantly better in term of the size of the required training set than a conventional fully-connected ANN topology. Future work will investigate the application of KB-ANNs to additive manufacturing.

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Organisations: Mechanical Engineering and Industrial Systems, Research area: Manufacturing and Automation, Simon Fraser University
Contributors: Coatanéa, E., Wu, D., Tsarkov, V., Gary Wang, G., Modi, S., Jafarian, H.
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ASJC Scopus subject areas: Mechanical Engineering, Computer Graphics and Computer-Aided Design, Computer Science Applications, Modelling and Simulation
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DOIs:
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INT=mei,"Jafarian, Hesam"
Source: Scopus
Source ID: 85056903740
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Making the cloud work for software producers: Linking architecture, operating cost and revenue
Cloud migration is concerned with moving an on-premise software system into the cloud. In this paper, we focus on software producers adopting the cloud to provide their solutions to enterprise customers. Their challenge is to migrate a software product, developed in-house and traditionally delivered on-premise, to an Infrastructure-as-a-Service or Platform-as-a-Service solution, while also mapping an existing traditional licensing model on to a cloud monetization model. The analysis of relevant cost types and factors of cloud computing generate relevant information for the software producers when deciding to adopt cloud computing, and defining software pricing. We present an integrated framework for informing cloud monetization based on operational cost factors for migrating to the cloud and test it in a real-life case study. Differences between basic virtualization of the software product and using fully cloud-native platform services for re-architecting the product in question are discussed.

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MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, Dublin City University, Free University of Bolzano-Bozen, Human-Centered Technology (IHTE)
Contributors: Rosati, P., Fowley, F., Pahl, C., Taibi, D., Lynn, T.
Number of pages: 12
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ASJC Scopus subject areas: Computer Science (miscellaneous), Software, Computer Science Applications
Keywords: Architecture migration, Cloud migration, Monetization, Software producer, Total cost of ownership
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Methods and tools for denoising of complex-valued images based on block-matching and high order singular value decomposition

Noise suppression in complex-valued data is an important task for a wide class of applications, in particular concerning the phase retrieval in coherent imaging. The approaches based on BM3D techniques are ones of the most successful in the field. In this paper, we propose and develop a new class of BM3Dstyle algorithms, which use high order (3D and 4D) singular value decomposition (HOSVD) for transform design in complex domain. This set of the novel algorithms is implemented as a toolbox In Matlab. This development is produced for various types of the complex-domain sparsity: directly in complex domain, real/imaginary and phase/ amplitude parts of complexvalued variables. The group-wise transform design is combined with the different kinds of thresholding including multivariable Wiener filtering. The toolbox includes iterative and non-iterative novel complex-domain algorithms (filters). The efficiency of the developed algorithms is demonstrated on denoising problems with an additive Gaussian complex-valued noise. A special set of the complex-valued test-images was developed with spatially varying correlated phase and amplitudes imitating data typical for optical interferometry and holography. It is shown that for this class of the test-images the developed algorithms demonstrate the stateof- the-art performance.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing
Contributors: Ponomarenko, M., Katkovnik, V., Egiazarian, K.
Publication date: 2018

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Title of host publication: Electronic Imaging : Image Processing: Algorithms and Systems XVI
Publisher: Society for Imaging Science and Technology
ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
Keywords: Block matching, Complex domain, Higher-order singular value decomposition, Image denoising, Phase imaging, Sparsity
DOIs:
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Bibliographical note

jufoid=84313
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Source ID: 85052877244
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Mixed-integer linear programming approach for global discrete sizing optimization of frame structures

This paper focuses on discrete sizing optimization of frame structures using commercial profile catalogs. The optimization problem is formulated as a mixed-integer linear programming (MILP) problem by including the equations of structural analysis as constraints. The internal forces of the members are taken as continuous state variables. Binary variables are used for choosing the member profiles from a catalog. Both the displacement and stress constraints are formulated such that for each member limit values can be imposed at predefined locations along the member. A valuable feature of the formulation, lacking in most contemporary approaches, is that global optimality of the solution is guaranteed by solving the MILP using branch-and-bound techniques. The method is applied to three design problems: a portal frame, a two-story frame with three load cases and a multiple-bay multiple-story frame. Performance profiles are determined to compare the MILP reformulation method with a genetic algorithm.

General information

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Organisations: Civil Engineering, KU Leuven
Contributors: van Mellaert, R., Mela, K., Tiainen, T., Heinisuo, M., Lombaert, G., Schevenels, M.
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Publication information

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ASJC Scopus subject areas: Control and Systems Engineering, Software, Computer Science Applications, Computer Graphics and Computer-Aided Design, Control and Optimization
Keywords: Discrete optimization, Frame structures, Global optimization, Mixed-integer linear programming, Sizing optimization
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Source: Scopus
Source ID: 85026724545
Research output: Contribution to journal › Article › Scientific › peer-review

Multisensor Time–Frequency Signal Processing MATLAB package: An analysis tool for multichannel non-stationary data

The Multisensor Time–FrequencySignal Processing (MTFSP) MATLAB package is an analysis tool for multichannel non-stationary signals collected from an array of sensors. By combining array signal processing for non-stationary signals and multichannel high resolution time–frequency methods, MTFSP enables applications such as cross-channel causality relationships, automated component separation and direction of arrival estimation, using multisensor time–frequency distributions (MTFDs). MTFSP can address old and new applications such as: abnormality detection in biomedical signals, source localization in wireless communications or condition monitoring and fault detection in industrial plants. It allows e.g. the reproduction of the results presented in Boashash and Aïssa-El-Bey (in press) [2].

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: University of Queensland
Contributors: Boashash, B., Aïssa-El-Bey, A., Al-Sa'd, M. F.
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Peer-reviewed: Yes

Publication information

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ASJC Scopus subject areas: Software, Computer Science Applications
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DOIs:
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Source: Scopus
Source ID: 85041238142
Research output: Contribution to journal › Article › Scientific › peer-review

On the degeneracy of the Randić entropy and related graph measures

Numerous quantitative graph measures have been defined and applied in various disciplines. Such measures may be differentiated according to whether they are information-theoretic or non-information-theoretic. In this paper, we examine an important property of Randić entropy, an information-theoretic measure, and examine some related graph measures based on random roots. In particular, we investigate the degeneracy of these structural graph measures and discuss numerical results. Finally, we draw some conclusions about the measures' applicability to deterministic and non-deterministic networks.

General information

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Computational Medicine and Statistical Learning Laboratory (CMSL), Research group: Predictive Society and Data Analytics (PSDA), University of Applied Sciences Upper Austria, School of Management, Nankai University, Hall in Tyrol, The City College of New York (CUNY), Production and Operations Management, Tianjin University of Technology

Contributors: Dehmer, M., Chen, Z., Mowshowitz, A., Jodlbauer, H., Emmert-Streib, F., Shi, Y., Tripathi, S., Xia, C.
Publication date: 2018
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Journal: Information Sciences
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Original language: English
ASJC Scopus subject areas: Software, Control and Systems Engineering, Theoretical Computer Science, Computer Science Applications, Information Systems and Management, Artificial Intelligence
Keywords: Data science, Graphs, Networks, Quantitative graph theory, Structural graph measures, Structural network analysis
DOIs:

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Bibliographical note
EXT="Tripathi, Shailesh"
Source: Scopus
Source ID: 85057760552
Research output: Contribution to journal › Article › Scientific › peer-review

Reduced Order Internal Models in the Frequency Domain
The internal model principle states that all robustly regulating controllers must contain a suitably reduplicated internal model of the signal to be regulated. Using frequency domain methods, we show that the number of the copies may be reduced if the class of perturbations in the problem is restricted. We present a two stage design procedure for a simple controller containing a reduced order internal model achieving robust regulation. The results are illustrated with an example of a five tank laboratory process where a restricted class of perturbations arises naturally.

General information
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Organisations: Mathematics, Research group: Computer Science and Applied Logics
Contributors: Laakkonen, P., Paunonen, L.
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ISSN (Print): 0018-9286
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Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Adaptive control, Aerospace electronics, Frequency control, Frequency-domain analysis, Linear systems, Mathematical model, model/controller reduction, output tracking, robust control, Robustness, Uncertainty
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URLs:

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Source: Scopus
Source ID: 85030308353
Research output: Contribution to journal › Article › Scientific › peer-review

Robust linearized combined metrics of image visual quality
Existing full-reference metrics still do not provide a desirable degree of adequacy to a human visual perception, for evaluation of images with different types and levels of distortions. One reason for this is that it is difficult to incorporate the

peculiarities of human visual system in the metrics design. In this paper, a robust approach to full-reference metrics' design is proposed, based on a combination of several existing full-reference metrics. A preliminary linearization (fitting) of the dependence of MOS with respect to the components metrics is performed in order to compensate shortcomings of each component. The proposed method is tested on several known databases, and demonstrate better performance than existing metrics.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Kharkiv National Aerospace University
Contributors: Ieremeiev, O., Lukin, V., Ponomarenko, N., Egiazarian, K.
Publication date: 2018

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Title of host publication: Electronic Imaging : Image Processing: Algorithms and Systems XVI
Publisher: Society for Imaging Science and Technology
ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Human-Computer Interaction, Software, Electrical and Electronic Engineering, Atomic and Molecular Physics, and Optics
Keywords: Combined metrics, Full-reference metrics, Image visual quality assessment, Robust metrics
DOIs:
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jufoid=84313
EXT="Ponomarenko, Nikolay"
EXT="Lukin, Vladimir"
Source: Scopus
Source ID: 85052901571
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Robust Regulation of Infinite-Dimensional Port-Hamiltonian Systems
We will give general sufficient conditions under which a controller achieves robust regulation for a boundary control and observation system. Utilizing these conditions we construct a minimal order robust controller for an arbitrary order impedance passive linear port-Hamiltonian system. The theoretical results are illustrated with a numerical example where we implement a controller for a one-dimensional Euler-Bernoulli beam with boundary controls and boundary observations.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Mathematics, Research group: Computer Science and Applied Logics
Contributors: Humaloja, J., Paunonen, L.
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Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Aerospace electronics, Closed loop systems, distributed parameter systems, Generators, Impedance, linear systems, port-Hamiltonian systems, robust control, Robustness, Transfer functions
Electronic versions:
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Source: Scopus
Source ID: 85029173308

Research output: Contribution to journal › Article › Scientific › peer-review

System-level analysis of IEEE 802.11ah technology for unsaturated MTC traffic

Enabling the Internet of Things, machine-type communications (MTC) is a next big thing in wireless innovation. In this work, we concentrate on the attractive benefits offered by the emerging IEEE 802.11ah technology to support a large number of MTC devices with extended communication ranges. We begin with a comprehensive overview of the novel features introduced by the latest IEEE 802.11ah specifications followed by the development of a powerful mathematical framework capturing the essential properties of a massive MTC deployment with unsaturated traffic patterns. Further, we compare our analytical findings for a characteristic MTC scenario against respective system-level simulations across a number of important performance indicators. Our analytical results provide adequate performance predictions even when simulations are challenged by the excessive computational complexity. In addition, we study the novel IEEE 802.11ah mechanisms offering improved support for massive device populations and conclude on their expected performance.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Ericsson Research
Contributors: Ometov, A., Daneshfar, N., Hazmi, A., Andreev, S., Del Carpio, L. F., Amin, P., Torsner, J., Koucheryavy, Y. , Valkama, M.
Number of pages: 14
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Volume: 26
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ISSN (Print): 1748-1279
Ratings:

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Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
Keywords: Analytical modelling, Delay, IEEE 802.11ah, MTC/M2M, Power consumption, Simulations, Throughput, Unsaturated traffic
Electronic versions:

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DOIs:

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URLs:

http://urn.fi/URN:NBN:fi:tuni-202002262390

Bibliographical note

INT=elt"Daneshfar, Nader"
Source: Scopus
Source ID: 85044277791
Research output: Contribution to journal › Article › Scientific › peer-review

Transmit Power Optimization and Feasibility Analysis of Self-backhauling Full-Duplex Radio Access Systems

We analyze an inband full-duplex access node that is serving mobile users while simultaneously connecting to a core network over a wireless backhaul link, utilizing the same frequency band for all communication tasks. Such wireless self-backhauling is an intriguing option for the next generation wireless systems since a wired backhaul connection might not be economically viable if the access nodes are deployed densely. In particular, we derive the optimal transmit power allocation for such a system in closed form under Quality-of-Service (QoS) requirements, which are defined in terms of the minimum data rates for each mobile user. For comparison, the optimal transmit power allocation is solved also for two reference scenarios: a purely half-duplex access node, and a relay-type full-duplex access node. Based on the obtained expressions for the optimal transmit powers, we then show that the systems utilizing a full-duplex capable access node have a fundamental feasibility boundary, meaning that there are circumstances under which the QoS requirements cannot be fulfilled using finite transmit powers. This fundamental feasibility boundary is also derived in closed form. The feasibility boundaries and optimal transmit powers are then numerically evaluated in order to compare the different communication schemes. In general, utilizing the purely full-duplex access node results in the lowest transmit powers for all the communicating parties, although there are some network geometries under which such a system is not capable of reaching the required minimum data rates. In addition, the numerical results indicate that a full-duplex capable access node is best suited for relatively small cells.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Rice University
Contributors: Korpi, D., Riihonen, T., Sabharwal, A., Valkama, M.
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Volume: 17
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Ratings:

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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics
Keywords: full-duplex wireless, massive MIMO, Self-backhauling, transmit power optimization
Electronic versions:

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URLs:

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Source: Scopus
Source ID: 85045199222
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Fast Water Simulation Methods for Games
Easy-To-use physics engines have created a whole new source of emergence and fun for digital games.Water simulation could add another similar emergent interaction element in 3D games. Several barriers that prevent this step for games with large playing areas are analysed. One of the most important problems is howto couple the water and physics simulations. Our implementation of the extremely fast virtual pipe method is compared with more sophisticated solvers. Also, two different implementations of physics coupling are compared.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Pervasive Computing
Contributors: Kellomäki, T.
Publication date: 1 Dec 2017
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Publication information
Journal: Computers in Entertainment
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Article number: 2
ISSN (Print): 1544-3574
Ratings:

Scopus rating (2017): CiteScore 0.7 SJR 0.133 SNIP 0.786
Original language: English
ASJC Scopus subject areas: Computer Science Applications
Keywords: Fluid simulation, Games, Pipe method, Realtime, Rigid body coupling, Water simulation
DOIs:

10.1145/2700533
Source: Scopus
Source ID: 85040027871
Research output: Contribution to journal › Article › Scientific › peer-review

How developers perceive smells in source code: A replicated study

Context. In recent years, smells, also referred to as bad smells, have gained popularity among developers. However, it is still not clear how harmful they are perceived from the developers' point of view. Many developers talk about them, but only few know what they really are, and even fewer really take care of them in their source code. Objective. The goal of this work is to understand the perceived criticality of code smells both in theory, when reading their description, and in practice. Method. We executed an empirical study as a differentiated external replication of two previous studies. The studies were conducted as surveys involving only highly experienced developers (63 in the first study and 41 in the second one). First the perceived criticality was analyzed by proposing the description of the smells, then different pieces of code infected by the smells were proposed, and finally their ability to identify the smells in the analyzed code was tested. Results. According to our knowledge, this is the largest study so far investigating the perception of code smells with professional software developers. The results show that developers are very concerned about code smells in theory, nearly always considering them as harmful or very harmful (17 out of 23 smells). However, when they were asked to analyze an infected piece of code, only few infected classes were considered harmful and even fewer were considered harmful because of the smell. Conclusions. The results confirm our initial hypotheses that code smells are perceived as more critical in theory but not as critical in practice.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Free University of Bolzano-Bozen, Free University of Bozen-Bolzano
Contributors: Taibi, D., Janes, A., Lenarduzzi, V.
Number of pages: 13
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Original language: English
ASJC Scopus subject areas: Software, Information Systems, Computer Science Applications
Keywords: Antipatterns, Bad smells, Code smells, Refactoring, Software maintenance
DOIs:

10.1016/j.infsof.2017.08.008
Source: Scopus
Source ID: 85028762206
Research output: Contribution to journal › Article › Scientific › peer-review

Quantitative Graph Theory: A new branch of graph theory and network science

In this paper, we describe some highlights of the new branch QUANTITATIVE GRAPH THEORY and explain its significant different features compared to classical graph theory. The main goal of quantitative graph theory is the structural quantification of information contained in complex networks by employing a measurement approach based on numerical invariants and comparisons. Furthermore, the methods as well as the networks do not need to be deterministic but can be statistic. As such this complements the field of classical graph theory, which is descriptive and deterministic in nature. We provide examples of how quantitative graph theory can be used for novel applications in the context of the overarching concept network science.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Research group: Computational Medicine and Statistical Learning Laboratory (CMSL), Faculty of Biomedical Sciences and Engineering, BioMediTech, Research group: Predictive Society and Data Analytics (PSDA), Nankai University
Contributors: Dehmer, M., Emmert-Streib, F., Shi, Y.
Number of pages: 6
Pages: 575-580
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Peer-reviewed: Yes

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ASJC Scopus subject areas: Control and Systems Engineering, Theoretical Computer Science, Software, Computer Science Applications, Information Systems and Management, Artificial Intelligence
Keywords: Data Science, Graphs, Networks, Quantitative Graph Theory, Statistics
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10.1016/j.ins.2017.08.009
URLs:
https://arxiv.org/abs/1710.05660
Source: Scopus
Source ID: 85027400753
Research output: Contribution to journal › Article › Scientific › peer-review

DoGlycans-Tools for Preparing Carbohydrate Structures for Atomistic Simulations of Glycoproteins, Glycolipids, and Carbohydrate Polymers for GROMACS

Carbohydrates constitute a structurally and functionally diverse group of biological molecules and macromolecules. In cells they are involved in, e.g., energy storage, signaling, and cell-cell recognition. All of these phenomena take place in atomistic scales, thus atomistic simulation would be the method of choice to explore how carbohydrates function. However, the progress in the field is limited by the lack of appropriate tools for preparing carbohydrate structures and related topology files for the simulation models. Here we present tools that fill this gap. Applications where the tools discussed in this paper are particularly useful include, among others, the preparation of structures for glycolipids, nanocellulose, and glycans linked to glycoproteins. The molecular structures and simulation files generated by the tools are compatible with GROMACS.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Physics, Research group: Biological Physics and Soft Matter, University of Helsinki, Institute of Organic Chemistry and Biochemistry, Academy of Sciences of the Czech Republic, MEMPHYS - Centre for Biomembrane Physics , University of Southern Denmark, Laboratory of Physics
Contributors: Danne, R., Poojari, C., Martinez-Seara, H., Rissanen, S., Lolicato, F., Róg, T., Vattulainen, I.
Number of pages: 6
Pages: 2401-2406
Publication date: 23 Oct 2017
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ISSN (Print): 1549-9596
Ratings:
Scopus rating (2017): CiteScore 6.9 SJR 1.349 SNIP 1.213
Original language: English
ASJC Scopus subject areas: Chemistry(all), Chemical Engineering(all), Computer Science Applications, Library and Information Sciences
DOIs:
10.1021/acs.jcim.7b00237
Source: Scopus
Source ID: 85031999962
Research output: Contribution to journal › Article › Scientific › peer-review

Adaptive and nonlinear control of discharge pressure for variable displacement axial piston pumps

This paper proposes, for the first time without using any linearization or order reduction, an adaptive and model-based discharge pressure control design for the variable displacement axial piston pumps (VDAPPs), whose dynamical behaviors are highly nonlinear and can be described by a fourth-order differential equation. The rigorous stability proof, with an asymptotic convergence, is given for the entire system. In the proposed novel controller design method, the specifically designed stabilizing terms constitute an essential core to cancel out all the stability-preventing terms. The experimental results reveal that rapid parameter adaptation significantly improves the feedback signal tracking precision compared to a known-parameter controller design. In the comparative experiments, the adaptive controller design demonstrates the state-of-the-art discharge pressure control performance, enabling a possibility for energy consumption reductions in hydraulic systems driven with VDAPP.

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MoE publication type: A1 Journal article-refereed
Organisations: Automation and Hydraulic Engineering, Research group: Mobile manipulation
Contributors: Koivumäki, J., Mattila, J.
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Peer-reviewed: Yes

Publication information
Journal: Journal of Dynamic Systems, Measurement and Control: Transactions of the ASME
Volume: 139
Issue number: 10
Article number: 101008
ISSN (Print): 0022-0434
Ratings:

Scopus rating (2017): CiteScore 3 SJR 0.618 SNIP 1.024
Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Information Systems, Instrumentation, Mechanical Engineering, Computer Science Applications
DOIs:

10.1115/1.4036537
Source: Scopus
Source ID: 85021623538
Research output: Contribution to journal › Article › Scientific › peer-review

An ensemble of visual features for Gaussians of local descriptors and non-binary coding for texture descriptors
This paper presents an improved version of a recent state-of-the-art texture descriptor called Gaussians of Local Descriptors (GOLD), which is based on a multivariate Gaussian that models the local feature distribution that describes the original image. The full rank covariance matrix, which lies on a Riemannian manifold, is projected on the tangent Euclidean space and concatenated to the mean vector for representing a given image. In this paper, we test the following features for describing the original image: scale-invariant feature transform (SIFT), histogram of gradients (HOG), and weber's law descriptor (WLD). To improve the baseline version of GOLD, we describe the covariance matrix using a set of visual features that are fed into a set of Support Vector Machines (SVMs). The SVMs are combined by sum rule. The scores obtained by an SVM trained using the original GOLD approach and the SVMs trained with visual features are then combined by sum rule. Experiments show that our proposed variant outperforms the original GOLD approach. The superior performance of the proposed system is validated across a large set of datasets. Particularly interesting is the performance obtained in two widely used person re-identification datasets, CAVIAR4REID and IAS, where the proposed GOLD variant is coupled with a state-of-the-art ensemble to obtain an improvement of performance on these two datasets. Moreover, we performed further tests that combine GOLD with non-binary features (local ternary/quinary patterns) and deep transfer learning. The fusion among SVMs trained with deep features and the SVMs trained using the ternary/quinary coding ensemble is demonstrated to obtain a very high performance across datasets. The MATLAB code for the ensemble of classifiers and for the extraction of the features will be publicly available[1] to other researchers for future comparisons.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Computational Biophysics and Imaging Group, BioMediTech, Universita degli Studi di Padova, Italy, BioMediTech Institute and Faculty of Biomedical Sciences and Engineering, Missouri State University
Contributors: Nanni, L., Paci, M., Brahnam, S., Ghidoni, S.
Number of pages: 13
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Publication date: 1 Oct 2017
Peer-reviewed: Yes

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Journal: Expert Systems with Applications
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Original language: English
ASJC Scopus subject areas: Engineering(all), Computer Science Applications, Artificial Intelligence
Keywords: Ensemble of descriptors, Image classification, Image processing, Person re-identification, Texture

DOIs:
10.1016/j.eswa.2017.03.065
Source: Scopus
Source ID: 85017166137
Research output: Contribution to journal › Article › Scientific › peer-review

Highly unique network descriptors based on the roots of the permanental polynomial

In this paper, we examine the zeros of permanental polynomials as highly unique network descriptors. We employ exhaustively generated networks and demonstrate that our defined graph measures based on the moduli of the zeros of permanental polynomials are quite efficient when distinguishing graphs structurally. In this work, we continue with a line of research that relates to the search of almost complete graph invariants. These highly unique network measures may serve as a powerful tool for tackling graph isomorphism.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Computational Medicine and Statistical Learning Laboratory (CMSL), BioMediTech, Research group: Predictive Society and Data Analytics (PSDA), Institute for Bioinformatics and Translational Research, Laboratory of Biosystem Dynamics, BioMediTech Institute and Faculty of Biomedical Sciences and Engineering, Universität der Bundeswehr München, Nankai University, Babes-Bolyai University
Contributors: Dehmer, M., Emmert-Streib, F., Hu, B., Shi, Y., Stefu, M., Tripathi, S.
Number of pages: 6
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Peer-reviewed: Yes

Publication information

Journal: Information Sciences
Volume: 408
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Scopus rating (2017): CiteScore 10 SJR 1.635 SNIP 2.304
Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Theoretical Computer Science, Software, Computer Science Applications, Information Systems and Management, Artificial Intelligence
Keywords: Data science, Graphs, Networks, Quantitative graph theory, Statistics
DOIs:
10.1016/j.ins.2017.04.041
Source: Scopus
Source ID: 85018769218
Research output: Contribution to journal › Article › Scientific › peer-review

On the Performance of Visible Light Communication Systems with Non-Orthogonal Multiple Access

Visible light communication (VLC) has been proposed as a promising and efficient solution to indoor ubiquitous broadband connectivity. In this paper, non-orthogonal multiple access, which has been recently introduced as an effective scheme for fifth generation (5G) wireless networks, is considered in the context of VLC systems under different channel uncertainty models. To this end, we first derive a novel closed-form expression for the bit-error-rate (BER) under perfect channel state information (CSI). Capitalizing on this, we then quantify the effect of noisy and outdated CSI by deriving a simple and accurate approximation for the former and a tight upper bound for the latter. The offered results are corroborated by respective results from extensive Monte Carlo simulations and assist in developing useful insights on the effect of imperfect CSI knowledge on the overall system performance. Furthermore, it was shown that while noisy CSI leads to slight degradation in the BER performance, outdated CSI can cause considerable performance degradation, if the order of the users' channel gains change due to the involved mobility.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Wireless Communications and Positioning , Khalifa University, Department of Electrical and Computer Engineering, University of Surrey, Aristotle University of Thessaloniki
Contributors: Marshoud, H., Sofotasios, P. C., Muhaidat, S., Karagiannidis, G. K., Sharif, B. S.
Number of pages: 15
Pages: 6350-6364
Publication date: 1 Oct 2017

Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Wireless Communications
Volume: 16
Issue number: 10
ISSN (Print): 1536-1276
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Scopus rating (2017): CiteScore 10 SJR 1.246 SNIP 2.405
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics
Keywords: bit-error-rate, dimming control, imperfect channel state information, non-orthogonal multiple access, Visible light communications
DOIs:

10.1109/TWC.2017.2722441
Source: Scopus
Source ID: 85023196523
Research output: Contribution to journal › Article › Scientific › peer-review

Predicting academic success based on learning material usage
In this work, we explore students' usage of online learning material as a predictor of academic success. In the context of an introductory programming course, we recorded the amount of time that each element such as a text paragraph or an image was visible on the students' screen. Then, we applied machine learning methods to study to what extent material usage predicts course outcomes. Our results show that the time spent with each paragraph of the online learning material is a moderate predictor of student success even when corrected for student time-on-task, and that the information can be used to identify at-risk students. The predictive performance of the models is dependent on the quantity of data, and the predictions become more accurate as the course progresses. In a broader context, our results indicate that course material usage can be used to predict academic success, and that such data can be collected in-situ with minimal interference to the students' learning process.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, Research area: Software engineering, University of Helsinki
Contributors: Leppänen, L., Leinonen, J., Ihantola, P., Hellas, A.
Number of pages: 6
Pages: 13-18
Publication date: 27 Sep 2017

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Publisher: ACM
ISBN (Electronic): 9781450351003
ASJC Scopus subject areas: Computational Theory and Mathematics, Artificial Intelligence, Computer Science Applications, Software
Keywords: Academic success prediction, Educational data mining, Element-level web logs, Online learning materials, Web log mining
DOIs:

10.1145/3125659.3125695
Source: Scopus
Source ID: 85037111531
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

The effect of lake bottom sediment layers on radionuclide transport from bedrock to biosphere and doses to humans

General information
Publication status: Published
Organisations: Pori, Research group: Data-analytics and Optimization
Contributors: Pohjola, J., Turunen, J., Lipping, T.
Number of pages: 2
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Peer-reviewed: Unknown
Event: Paper presented at 4th International Conference on Radioecology & Environmental Radioactivity, Berlin, Germany.

ASJC Scopus subject areas: Computer Science Applications

Bibliographical note
Abstracts Book ISBN: 978-2-9545237-7-4
Research output: Other conference contribution › Paper, poster or abstract › Scientific

Energy Efficiency Maximization of Full-Duplex Two-Way Relay with Non-Ideal Power Amplifiers and Non-Negligible Circuit Power
In this paper, we maximize the energy efficiency (EE) of full-duplex (FD) two-way relay (TWR) systems under non-ideal power amplifiers (PAs) and non-negligible transmission-dependent circuit power. We start with the case where only the relay operates full duplex and two timeslots are required for TWR. Then, we extend to the advanced case, where the relay and the two nodes all operate full duplex, and accomplish TWR in a single timeslot. In both cases, we establish the intrinsic connections between the optimal transmit powers and durations, based on which the original non-convex EE maximization can be convexified and optimally solved. Simulations show the superiority of FD-TWR in terms of EE, especially when traffic demand is high. The simulations also reveal that the maximum EE of FD-TWR is more sensitive to the PA efficiency, than it is to self-cancellation. The full FD design of FD-TWR is susceptible to traffic imbalance, while the design with only the relay operating in the FD mode exhibits strong tolerance.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Wireless Communications and Positioning , Beijing University of Posts and Telecommunications, CSIRO Energy Centre, Aalto University
Contributors: Cui, Q., Zhang, Y., Ni, W., Valkama, M., Jantti, R.
Number of pages: 15
Pages: 6264-6278
Publication date: 1 Sep 2017
Peer-reviewed: Yes

Publication information
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Energy efficiency, full-duplex, non-ideal power amplifier, non-negligible circuit power, two-way relay
Electronic versions:

Energy Efficiency Maximization of Full-Duplex 2017
DOIs:

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URLs:

http://urn.fi/URN:NBN:fi:tuni-202002061904
Source: Scopus
Source ID: 85023192668
Research output: Contribution to journal › Article › Scientific › peer-review

Robust Output Regulation for Continuous-Time Periodic Systems
We consider controller design for robust output tracking and disturbance rejection for continuous-time periodic linear systems with periodic reference and disturbance signals. As our main results, we present four different controllers: a feedforward control law and a discrete-time dynamic error feedback controller for output tracking and disturbance rejection, a robust discrete-time feedback controller, and finally a discrete-time feedback controller that achieves approximate robust output tracking and disturbance rejection. The presented constructions are also new for time-invariant finite and infinite-dimensional systems. The results are illustrated with two examples: a periodically time-dependent system of harmonic oscillators and a nonautonomous two-dimensional heat equation with boundary disturbance.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Mathematics, Research group: Computer Science and Applied Logics
Contributors: Paunonen, L.
Number of pages: 13

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Volume: 62
Issue number: 9
ISSN (Print): 0018-9286
Ratings:

Scopus rating (2017): CiteScore 8.5 SJR 3.433 SNIP 3.068
Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Controller design, feedback, periodic system, robust output regulation
Electronic versions:

Pau17a
DOIs:

10.1109/TAC.2017.2654968
URLs:

http://urn.fi/URN:NBN:fi:tuni-201910023646
Source: Scopus
Source ID: 85029869750
Research output: Contribution to journal › Article › Scientific › peer-review

The Effect of Ultrasonic Dispersion on the Surface Chemistry of Carbon Nanotubes in the Jeffamine D-230 Polyetheramine Medium

This paper studies changes in the surface chemistry of carbon nanotubes (CNTs) where they are under ultrasonication process in Jeffamine D-230 polyetheramine medium. Jeffamine is used as a curing agent in the nanocomposite manufacturing process. In the nanocomposite technology, ultrasonication process is employed as a method for dispersion of CNTs in a suspension. This research tries to investigate the effect of ultrasonic dispersion with different time and energy on the surface chemistry of CNTs by Fourier transform infrared spectroscopy. The results show ultrasonication of CNTs in the Jeffamine medium leads to significant oxidation and hydration along creating new chemical bonds on the CNTs surface.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Materials Science, Research group: Plastics and Elastomer Technology
Contributors: Shahshahan, M., Keinänen, P., Vuorinen, J.
Number of pages: 4
Pages: 741-744
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Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Nanotechnology
Volume: 16
Issue number: 5
ISSN (Print): 1536-125X
Ratings:

Scopus rating (2017): CiteScore 5 SJR 0.572 SNIP 1.146
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
Keywords: Carbon nanotubes, characterization of functional groups, dispersion of carbon nanotubes, Fourier transform infrared (FTIR) spectroscopy, functionalization, optical spectroscopy, sonicated carbon nanotubes, sonochemistry, surface chemistry of carbon nanotubes, ultrasonication
DOIs:

10.1109/TNANO.2017.2691904

Bibliographical note
EXT="Shahshahan, Mohsen"
Source: Scopus
Source ID: 85029628879

Research output: Contribution to journal › Article › Scientific › peer-review

Comparison of time metrics in programming

Research on the indicators of student performance in introductory programming courses has traditionally focused on individual metrics and specific behaviors. These metrics include the amount of time and the quantity of steps such as code compilations, the number of completed assignments, and metrics that one cannot acquire from a programming environment. However, the differences in the predictive powers of different metrics and the cross-metric correlations are unclear, and thus there is no generally preferred metric of choice for examining time on task or effort in programming. In this work, we contribute to the stream of research on student time on task indicators through the analysis of a multi-source dataset that contains information about students' use of a programming environment, their use of the learning material as well as self-reported data on the amount of time that the students invested in the course and per-Assignment perceptions on workload, educational value and difficulty. We compare and contrast metrics from the dataset with course performance. Our results indicate that traditionally used metrics from the same data source tend to form clusters that are highly correlated with each other, but correlate poorly with metrics from other data sources. Thus, researchers should utilize multiple data sources to gain a more accurate picture of students' learning.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, Research area: Software engineering, University of Helsinki
Contributors: Leinonen, J., Leppänen, L., Ihantola, P., Hellas, A.
Number of pages: 9
Pages: 200-208
Publication date: 14 Aug 2017

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ISBN (Electronic): 9781450349680
ASJC Scopus subject areas: Computational Theory and Mathematics, Computer Science Applications, Software, Education
DOIs:
10.1145/3105726.3106181
Source: Scopus
Source ID: 85030162903
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Indirect NO_x emission monitoring in natural gas fired boilers

New emission regulations will increase the need for inexpensive NO_x emission monitoring solutions also in smaller power plants. The objective in this study is to find easily maintainable and transparent but still valid models to predict NO_x emissions in natural gas fired hot water boilers utilizing existing process instrumentation. With a focus on long-term applicability in practical installations, the performance of linear regression is compared in two municipal 43 MW boilers with three widely used nonlinear methods: multilayer perceptron, support vector regression, and fuzzy inference system. The linear models were the most applicable providing the best estimation results (relative error of 1 applications in practise. However, each boiler model should be identified individually.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Automation and Hydraulic Engineering, Research area: Measurement Technology and Process Control, Helen Ltd.
Contributors: Korpela, T., Kumpulainen, P., Majanne, Y., Häyrinen, A., Lautala, P.
Number of pages: 15
Pages: 11-25
Publication date: 1 Aug 2017
Peer-reviewed: Yes

Publication information

Journal: Control Engineering Practice
Volume: 65
ISSN (Print): 0967-0661
Ratings:
Scopus rating (2017): CiteScore 5.8 SJR 1.069 SNIP 1.905

Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Combustion, Estimation, Modelling, Monitoring, Natural gas, NO, Soft sensor
Electronic versions:
Indirect NOx Emission Monitoring in Natural Gas Fired Boilers. Embargo ended: 29/05/19
DOIs:
10.1016/j.conengprac.2017.04.013
URLs:
http://urn.fi/URN:NBN:fi:tty-201708021643. Embargo ended: 29/05/19
Source: Scopus
Source ID: 85019718306
Research output: Contribution to journal › Article › Scientific › peer-review

Mobility aware eMBMS management in urban 5G-oriented systems

The demand for video services in mobile networks is rapidly increasing. In fact, is expected that video transmissions will account for more than 69% of mobile data traffic by 2018[1]. Along these lines, the challenging requirements of such multimedia applications and, at the same time, the centralized organization typical of current cellular technologies motivate the investigation of enhanced advanced driver assistance systems (ADAS) for supporting the driver experience in terms of safety driving comfort. In this context, in this paper we focus our attention of a new realistic scenario, in which all users share video contents from the surrounding environment with the aim to create a global 3D video content useful for ADAS systems. Once that such video content is created, we assume that the LTE eNodeB may come in help for making it available through streaming transmissions towards all vehicles in that area with the use of Multimedia Broadcast Multicast Services (MBMS). Obtained results, show that multicast transmissions based on subgrouping techniques are able to overcome the legacy solutions where conservative and opportunistic schemes are used.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, Dept. of Electrical and Electronic Engineering, Universita degli Studi di Reggio Calabria, Peoples' Friendship University of Russia
Contributors: Desogus, C., Fadda, M., Murroni, M., Araniti, G., Orsino, A.
Publication date: 19 Jul 2017

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ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Networks and Communications, Computer Science Applications, Human-Computer Interaction, Electrical and Electronic Engineering, Media Technology, Communication
Keywords: LTE, MBMS, Multicast Grouping, V2X, Video Streaming
DOIs:
10.1109/BMSB.2017.7986140

Bibliographical note

jufoid=72046
INT=ELT, "Orsino, A."
Source: Scopus
Source ID: 85027268444
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Monitoring pH, temperature and humidity in long-term stem cell culture in CO_2 incubator

Cell culture in stem cell research is on the rise, not only for basic research but also for its potential medical and therapeutic applications. Monitoring culture process using sensors throughout the culture helps to optimize culture conditions for optimal growth and maximize yield from the cells. Further, the sensor data gives insight into developing better cell culture systems. Typical stem cell culture platforms, e.g. well plates or flasks, cannot be easily equipped with sensors and impose many challenges in periodic process measurements in a CO_2 incubator. We present an incubator compatible modular measurement system with three sensors, to monitor pH, temperature and humidity continuously throughout the culture. Sensors are assembled around a flow through cuvette for highly sterile non-contact measurements. No sample preparation or sample extraction from the incubator is needed and the measurements are carried out in a closed flow loop without wasting any medium. The modular assembly is novel, reusable and feasible for humid incubator environments. The system has been tested, validated and used in mesenchymal stem cell expansion and differentiation, for periods ranging from two to three weeks. Once the measurement has commenced at the beginning of culture, continuous

measurements without sensor recalibration or special manual attention are carried out till the end of the culture. Measurement data clearly show the interplay between measured parameters, indicating a few stress sources present all through the culture. Additionally, it gives an overall picture of behavior of critical control parameters in an incubator and points out the need for bioprocess systems with automatic process monitoring and smart control for maximum yield, optimal growth and maintenance of the cells.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: BioMediTech, Faculty of Biomedical Sciences and Engineering, Research area: Microsystems, Research group: Sensor Technology and Biomeasurements (STB)
Contributors: Rajan, D. K., Verho, J., Kreutzer, J., Valimaki, H., Ihalainen, H., Lekkala, J., Patrikoski, M., Miettinen, S.
Number of pages: 5
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Publisher: IEEE
ISBN (Electronic): 9781509029839
ASJC Scopus subject areas: Instrumentation, Computer Science Applications, Medicine (miscellaneous)
Keywords: cell culture incubator environmental monitoring, incubator compatible sensors, long-term cell culture measurements, long-term optical cell culture pH measurements, non-contact cell culture measurements
DOIs:
10.1109/MeMeA.2017.7985922
Source: Scopus
Source ID: 85027990253
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Novel D2D-based relaying method for multicast services over 3GPP LTE-A systems

The fast proliferation of 'smart' devices with enhanced capabilities and, at the same time, new multimedia streaming services (i.e., providing high-resolution video and audio content) push the network operator to handle a tremendous increase in the traffic load that is difficult to cope with the current wireless/cellular infrastructures. For that reason, in this paper we consider a novel method based on multi-hop Device-to-Device (D2D) communications, where direct links are established among User Equipments (UEs) in proximity within a Long Term Evolution-Advanced (LTE-A)-based network. The aim of the proposed mechanism is to improve the multimedia multicast sessions and transmissions in terms of throughput and mean download time per user by delivering ubiquitous and reliable connectivity to the larger number of UEs. Our system-level analysis highlights that via proximity-based transmissions among the users, it is possible to provide multimedia content with higher data rates and lower delays w.r.t. The legacy cellular solutions.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, University Mediterranea of Reggio
Contributors: Araniti, G., Orsino, A., Militano, L., Putrino, G., Andreev, S., Koucheryavy, Y., Iera, A.
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Title of host publication: 2017 IEEE International Symposium on Broadband Multimedia Systems and Broadcasting, BMSB 2017
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ISBN (Electronic): 9781509049370
ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Networks and Communications, Computer Science Applications, Human-Computer Interaction, Electrical and Electronic Engineering, Media Technology, Communication
Keywords: 5G, D2D, LTE, MBMS, Multicast services, Networking and QoS, Performance evaluation
DOIs:
10.1109/BMSB.2017.7986137

Bibliographical note

jufoid=72046
INT=elt,"Orsino, A."
Source: Scopus
Source ID: 85027253110
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Optimal subgroup configuration for multicast services over 5G-satellite systems

The fast spreading of new multimedia services and applications is pushing telco operator to identify candidate technologies for handling the increasing traffic load expected in the coming years. Along this line, satellite communications integrated with terrestrial systems is gaining momentum as a possible solution to overcome the aforementioned challanges. In this paper, we analize a multicast subgroup configuration problem for providing multimedia services over 5G satellite systems. In particular, an optimization problem is considered in order to maximize the aggregate data rate (ADR) with an execution time that is sensibly smaller compared to other solutions available in literature. Obtanied results, demonstrated as the proposed approach, hereafter named as Optimal Multicast Subgroup Configuration (OMSC), is able to overcome the limitation of sub-optimal subgrouping solutions by providing higher performance and, at the same time, low complexity operations.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, Universita degli Studi di Reggio Calabria, Peoples' Friendship University of Russia
Contributors: Orsino, A., Araniti, G., Scopelliti, P., Gudkova, I. A., Samouylov, K. E., Iera, A.
Publication date: 19 Jul 2017

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Title of host publication: 2017 IEEE International Symposium on Broadband Multimedia Systems and Broadcasting, BMSB 2017
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ISBN (Electronic): 9781509049370
ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Networks and Communications, Computer Science Applications, Human-Computer Interaction, Electrical and Electronic Engineering, Media Technology, Communication
Keywords: 5G-Satellite, Multicast, Networking and QoS, Performance Evaluation, Satellite-LTE
DOIs:
10.1109/BMSB.2017.7986134

Bibliographical note

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INT=elt,"Orsino, A."
Source: Scopus
Source ID: 85027270587
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

sgnesR: An R package for simulating gene expression data from an underlying real gene network structure considering delay parameters

Background: sgnesR (Stochastic Gene Network Expression Simulator in R) is an R package that provides an interface to simulate gene expression data from a given gene network using the stochastic simulation algorithm (SSA). The package allows various options for delay parameters and can easily included in reactions for promoter delay, RNA delay and Protein delay. A user can tune these parameters to model various types of reactions within a cell. As examples, we present two network models to generate expression profiles. We also demonstrated the inference of networks and the evaluation of association measure of edge and non-edge components from the generated expression profiles. Results: The purpose of sgnesR is to enable an easy to use and a quick implementation for generating realistic gene expression data from biologically relevant networks that can be user selected. Conclusions: sgnesR is freely available for academic use. The R package has been tested for R 3.2.0 under Linux, Windows and Mac OS X.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: BioMediTech, Faculty of Biomedical Sciences and Engineering, Signal Processing, Research group: Laboratory of Biosystem Dynamics-LBD, Research group: Computational Systems Biology, Research group: Computational Medicine and Statistical Learning Laboratory (CMSL), Research group: Predictive Society and Data Analytics (PSDA), Harvard T.H. Chan School of Public Health, Harvard School of Public Health, Mathematics and Operations Research
Contributors: Tripathi, S., Lloyd-Price, J., Ribeiro, A., Yli-Harja, O., Dehmer, M., Emmert-Streib, F.
Publication date: 4 Jul 2017
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Publication information

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Article number: 325
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ASJC Scopus subject areas: Structural Biology, Biochemistry, Molecular Biology, Computer Science Applications, Applied Mathematics
Keywords: Gene expression data, Gene network, Simulation
Electronic versions:
sgnesR
DOIs:
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URLs:
http://urn.fi/URN:NBN:fi:tty-201708041653
Source: Scopus
Source ID: 85021637056
Research output: Contribution to journal › Article › Scientific › peer-review

A Proxy-Based Solution for Asynchronous Telemedical Systems

Asynchronous telemedicine systems face many challenges related to information security as the patient's sensitive information and data on medicine dosage is transmitted over a network when monitoring patients and controlling asynchronous telemedical IoT devices. This information may be modified or spied on by a malicious adversary. To make asynchronous telemedicine systems more secure, the authors present a proxy-based solution against data modification and spying attacks in web-based telemedical applications. By obfuscating the executable code of a web application and by continuously dynamically changing obfuscation, the authors' solution makes it more difficult for a piece of malware to attack its target. They use a constructive research approach. They characterize the threat and present an outline of a proposed solution. The benefits and limitations of the proposed solution are discussed. Cyber-Attacks targeted at the information related to patient's care are a serious threat in today's telemedicine. If disregarded, these attacks have negative implications on patient safety and quality of care.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research group: Software Engineering and Intelligent Systems, Pervasive Computing
Contributors: Rauti, S., Lahtiranta, J., Parisod, H., Hyrynsalmi, S., Salanterä, S., Aromaa, M. E., Smed, J., Leppänen, V.
Number of pages: 14
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Publication date: 1 Jul 2017
Peer-reviewed: Yes

Publication information

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Issue number: 3
Article number: 5
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Health Informatics
Keywords: Asynchronous Telemedicine, Man-in-The-Middle Attacks, Obfuscation, Telemedical IoT Devices, Web Application Security
DOIs:
10.4018/IJEHMC.2017070105
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Source ID: 85020175149
Research output: Contribution to journal › Article › Scientific › peer-review

The Fisher-Snedecor F Distribution: A Simple and Accurate Composite Fading Model

We consider the use of the Fisher-Snedecor F distribution, which is defined as the ratio of two chi-squared variates, to model composite fading channels. In this context, the root-mean-square power of a Nakagami- m signal is assumed to be subject to variations induced by an inverse Nakagami- m random variable. Comparisons with physical channel data

demonstrate that the proposed composite fading model provides as good, and in most cases better, fit to the data compared to the generalized- K composite fading model. Motivated by this result, simple novel expressions are derived for the key statistical metrics and performance measures of interest.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Wireless Communications and Positioning , Queen's University, Belfast, Northern Ireland, Aristotle University of Thessaloniki
Contributors: Yoo, S. K., Cotton, S. L., Sofotasios, P. C., Matthaiou, M., Valkama, M., Karagiannidis, G. K.
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ASJC Scopus subject areas: Modelling and Simulation, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Composite fading, inverse Nakagami-m distribution, Nakagami-m fading, shadowing.
DOIs:
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Source ID: 85029841155
Research output: Contribution to journal › Article › Scientific › peer-review

Using and collecting fine-grained usage data to improve online learning materials
As educators seek to create better learning materials, knowledge about how students actually use the materials is priceless. The advent of online learning materials has allowed tracking of student movement on levels not previously possible with on-paper materials: Server logs can be parsed for details on when students opened certain pages. But such data is extremely coarse and only allows for rudimentary usage analysis. How do students move within the course pages? What do they read in detail and what do they glance over? Traditionally, answering such questions has required complex setups with eye tracking labs. In this paper we investigate how fine-grained data about student movement within an online learning material can be used to improve said material in an informed fashion. Our data is collected by a JavaScript-component that tracks which elements of the online learning material are visible on the student's browser window as they study. The data is collected in situ, and no software needs to be installed on the student's computer. We further investigate how such data can be combined with data from a separate learning environment in which students work on course assignments and if the types of movements made by the students are correlated with student self-regulation metrics or course outcomes. Our results indicate that the use of rather simple and non-invasive tracking of students' movements in course materials allows material creators to quickly see major problem-areas in their materials and to highlight sections that students keep returning to. In addition, when the tracking data is combined with student course assignment data, inferring meaningful assignment-specific areas within the course material becomes possible. Finally, we determine that high-level statistics of user movements are not correlated with course outcomes or certain self-regulation related metrics.

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Organisations: Pervasive Computing, Research area: Software engineering, University of Helsinki
Contributors: Leppänen, L., Leinonen, J., Ihantola, P., Hellas, A.
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ASJC Scopus subject areas: Computer Science Applications, Software, Education
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Source: Scopus
Source ID: 85026769227
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

CNN-based edge filtering for object proposals

Recent advances in image-based object recognition have exploited object proposals to speed up the detection process by reducing the search space. In this paper, we present a novel idea that utilizes true objectness and semantic image filtering (retrieved within the convolutional layers of a Convolutional Neural Network) to propose effective region proposals. Information learned in fully convolutional layers is used to reduce the number of proposals and enhance their localization by producing highly accurate bounding boxes. The greatest benefit of our method is that it can be integrated into any existing approach exploiting edge-based objectness to achieve consistently high recall across various intersection over union thresholds. Experiments on PASCAL VOC 2007 and ImageNet datasets demonstrate that our approach improves two existing state-of-the-art models with significantly high margins and pushes the boundaries of object proposal generation.

General information

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Organisations: Signal Processing, Research group: Multimedia Research Group - MRG, Aarhus Universitet
Contributors: Waris, M. A., Iosifidis, A., Gabbouj, M.
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Cognitive Neuroscience, Artificial Intelligence
Keywords: Deep learning, Neural networks, Object detection, Object proposals, Region of interest
DOIs:
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Source ID: 85020766935
Research output: Contribution to journal › Article › Scientific › peer-review

Towards the Utilization of Crowdsourcing in Traffic Condition Reporting

The use of traffic information in map applications designed for stand-alone navigation devices as well as in mobile devices has become a common trend. This information is often governed by the various service providers with little or non-existent feedback from the users. Using a wide user base it is possible to collect information on traffic conditions faster and more efficiently. Additionally, many of the events faced on the road can be challenging to detect by automatic means, but are easily noticed by the road users – animals on the road and broken or missing road signs are only a few examples.
To better facilitate the utilization of information gathered from road users, simple and easy-to-use software solutions are required. This paper presents a prototype mobile application, which the road users can take advantage of for both following the on-going traffic conditions while driving and for collectively reporting traffic events other users might be interested in. The high-level architecture, application and data utilized in the reports are presented in addition to the preliminary findings of the on-going research. This paper will also discuss the challenges identified while developing the application.

General information

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Organisations: Research group: Software Engineering and Intelligent Systems, Pervasive Computing
Contributors: Rantanen, P., Sillberg, P., Soini, J.
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Information Systems
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URLs:
http://urn.fi/URN:NBN:fi:tty-201806212017
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Preventing keystroke based identification in open data sets
Large-scale courses such as Massive Online Open Courses (MOOCs) can be a great data source for researchers. Ideally, the data gathered on such courses should be openly available to all researchers. Studies could be easily replicated and novel studies on existing data could be conducted. However, very fine-grained data such as source code snapshots can contain hidden identifiers. For example, distinct typing patterns that identify individuals can be extracted from such data. Hence, simply removing explicit identifiers such as names and student numbers is not sufficient to protect the privacy of the users who have supplied the data. At the same time, removing all keystroke information would decrease the value of the shared data significantly. In this work, we study how keystroke data from a programming context could be modified to prevent keystroke latency based identification whilst still retaining information that can be used to e.g. infer programming experience. We investigate the degree of anonymization required to render identification of students based on their typing patterns unreliable. Then, we study whether the modified keystroke data can still be used to infer the programming experience of the students as a case study of whether the anonymized typing patterns have retained at least some informative value. We show that it is possible to modify data so that keystroke latency based identification is no longer accurate, but the programming experience of the students can still be inferred, i.e. the data still has value to researchers. In a broader context, our results indicate that information and anonymity are not necessarily mutually exclusive.

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Organisations: Pervasive Computing, Research area: Software engineering, University of Helsinki
Contributors: Leinonen, J., Ihantola, P., Hellas, A.
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Publisher: ACM
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ASJC Scopus subject areas: Computer Networks and Communications, Education, Software, Computer Science Applications
Keywords: Data anonymization, Data privacy, Keystroke dynamics, Programming experience inference, Source code snapshots
DOIs:
10.1145/3051457.3051458
Source: Scopus
Source ID: 85018432742
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

A Mixed Finite Element Method to Solve the EEG Forward Problem
Finite element methods have been shown to achieve high accuracies in numerically solving the EEG forward problem and they enable the realistic modeling of complex geometries and important conductive features such as anisotropic conductivities. To date, most of the presented approaches rely on the same underlying formulation, the continuous Galerkin (CG)-FEM. In this article, a novel approach to solve the EEG forward problem based on a mixed finite element method (Mixed-FEM) is introduced. To obtain the Mixed-FEM formulation, the electric current is introduced as an additional unknown besides the electric potential. As a consequence of this derivation, the Mixed-FEM is, by construction, current preserving, in contrast to the CG-FEM. Consequently, a higher simulation accuracy can be achieved in certain scenarios, e.g., when the diameter of thin insulating structures, such as the skull, is in the range of the mesh resolution. A theoretical derivation of the Mixed-FEM approach for EEG forward simulations is presented, and the algorithms

implemented for solving the resulting equation systems are described. Subsequently, first evaluations in both sphere and realistic head models are presented, and the results are compared to previously introduced CG-FEM approaches. Additional visualizations are shown to illustrate the current preserving property of the Mixed-FEM. Based on these results, it is concluded that the newly presented Mixed-FEM can at least complement and in some scenarios even outperform the established CG-FEM approaches, which motivates a further evaluation of the Mixed-FEM for applications in bioelectromagnetism.

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MoE publication type: A1 Journal article-refereed
Organisations: Mathematics, Research group: Inverse Problems, University of Utah, Cluster of Excellence EXC, University of Münster
Contributors: Vorwerk, J., Engwer, C., Pursiainen, S., Wolters, C. H.
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Original language: English
ASJC Scopus subject areas: Software, Radiological and Ultrasound Technology, Computer Science Applications, Electrical and Electronic Engineering
Keywords: EEG, forward problem, mixed finite element method, realistic head modeling, source analysis
DOIs:
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Source: Scopus
Source ID: 85017598893
Research output: Contribution to journal › Article › Scientific › peer-review

A survey on control of hydraulic robotic manipulators with projection to future trends
This paper presents the recent advancements in the control of multiple-degree-of-freedom hydraulic robotic manipulators. A literature review is performed on their control, covering both free-space and constrained motions of serial and parallel manipulators. Stability-guaranteed control system design is the primary requirement for all control systems. Thus, this paper pays special attention to such systems. An objective evaluation of the effectiveness of different methods and the state of the art in a given field is one of the cornerstones of scientific research and progress. For this purpose, the maximum position tracking error |e|max and a performance indicator ρ (the ratio of |e|max with respect to the maximum velocity) are used to evaluate and benchmark different free-space control methods in the literature. These indicators showed that stability-guaranteed nonlinear model based control designs have resulted in the most advanced control performance. In addition to stable closed-loop control, lack of energy efficiency is another significant challenge in hydraulic robotic systems. This paper pays special attention to these challenges in hydraulic robotic systems and discusses their reciprocal contradiction. Potential solutions to improve the system energy efficiency without control performance deterioration are discussed. Finally, for hydraulic robotic systems, open problems are defined and future trends are projected.

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Organisations: Automation and Hydraulic Engineering, Italian Institute of Technology
Contributors: Mattila, J., Koivumäki, J., Caldwell, D. G., Semini, C.
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ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Force control, hydraulic manipulators, motion control, performance evaluation, robotics
Electronic versions:
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10.1109/TMECH.2017.2668604
URLs:
http://urn.fi/URN:NBN:fi:tty-201709011863
Source: Scopus
Source ID: 85018476348
Research output: Contribution to journal › Review Article › Scientific › peer-review

Guest editorial introduction to the focused section on design and control of hydraulic robots

The papers in this special section focus on the design and control of hydraulic robots. Since the 1980s hydraulic robots have been a key technology allowing to push the state of the art in robotics by demonstrating new levels of performance in terms of rough terrain locomotion, balance, speed, dexterity, and robustness. Inspired by these results, an increasing number of academic groups are (re-)discovering hydraulic actuation for applications where high power density, robustness, and high control bandwidth are crucial requirements. The ultimate goal for legged robots is agility comparable to bi-/quadrupedal animals (walking, running, jumping), which requires high-performance control of the hydraulic actuators and sufficient power-to-weight ratio provided by the actuators. In addition to these advanced high-tech hydraulic robots, hydraulic actuation has been used for decades in a variety of mobile (off-highway) heavy-duty machines (e.g., construction, forestry, mining, and agricultural machines) due to their higher robustness and significantly larger power-to-weight ratio compared with electric actuators. It is highly expected that the development in robotics will revolutionize this heavy-duty machine industry just as is currently happening in the car industry.

General information

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MoE publication type: B1 Article in a scientific magazine
Organisations: Automation and Hydraulic Engineering, Research group: Mobile manipulation, Italian Institute of Technology, Sungkyunkwan University, HCI e 486.1, Ritsumeikan University, Biwako-Kusatsu, University of Minnesota Twin Cities, Purdue University
Contributors: Mattila, J., Semini, C., Moon, H., Buchli, J., Hyon, S., Li, P. Y., Yao, B.
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Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications, Electrical and Electronic Engineering
DOIs:
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Source: Scopus
Source ID: 85018508508
Research output: Contribution to journal › Editorial › Scientific

Interference and SINR in Millimeter Wave and Terahertz Communication Systems With Blocking and Directional Antennas

The fifth generation wireless systems are expected to rely on a large number of small cells to massively offload traffic from the cellular and even from the wireless local area networks. To enable this functionality, mm-wave (EHF) and Terahertz (THF) bands are being actively explored. These bands are characterized by unique propagation properties compared with microwave systems. As a result, the interference structure in these systems could be principally different to what we observed so far at lower frequencies. In this paper, using the tools of stochastic geometry, we study the systems operating

in the EHF/THF bands by explicitly capturing three phenomena inherent for these frequencies: 1) high directivity of the transmit and receive antennas; 2) molecular absorption; and 3) blocking of high-frequency radiation. We also define and compare two different antenna radiation pattern models. The metrics of interest are the mean interference and the signal-to-interference-plus-noise (SINR) ratio at the receiver. Our results reveal that: 1) for the same total emitted energy by a Poisson field of interferers, both the interference and SINR significantly increase when simultaneously both transmit and receive antennas are directive and 2) blocking has a profound impact on the interference and SINR creating much more favorable conditions for communications compared with no blocking case.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, State University of New York
Contributors: Petrov, V., Komarov, M., Moltchanov, D., Jornet, J. M., Koucheryavy, Y.
Number of pages: 18
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ISSN (Print): 1536-1276
Ratings:

Scopus rating (2017): CiteScore 10 SJR 1.246 SNIP 2.405
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: 5G systems, blocking, directional antennas, Interference, millimeter waves, terahertz band
DOIs:

10.1109/TWC.2017.2654351
Source: Scopus
Source ID: 85015301037
Research output: Contribution to journal › Article › Scientific › peer-review

Neighborhood Matching for Image Retrieval
In the last few years, large-scale image retrieval has attracted a lot of attention from the multimedia community. Usual approaches addressing this task first generate an initial ranking of the reference images using fast approximations that do not take into consideration the spatial arrangement of local features in the image (e.g., the bag-of-words paradigm). The top positions of the rankings are then re-estimated with verification methods that deal with more complex information, such as the geometric layout of the image. This verification step allows pruning of many false positives at the expense of an increase in the computational complexity, which may prevent its application to large-scale retrieval problems. This paper describes a geometric method known as neighborhood matching (NM), which revisits the keypoint matching process by considering a neighborhood around each keypoint and improves the efficiency of a geometric verification step in the image search system. Multiple strategies are proposed and compared to incorporate NM into a large-scale image retrieval framework. A detailed analysis and comparison of these strategies and baseline methods have been investigated. The experiments show that the proposed method not only improves the computational efficiency, but also increases the retrieval performance and outperforms state-of-the-art methods in standard datasets, such as the Oxford 5 k and 105 k datasets, for which the spatial verification step has a significant impact on the system performance.

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MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing, Universidad Carlos III de Madrid, Purdue University
Contributors: González-Díaz, I., Birinci, M., Díaz-De-María, F., Delp, E. J.
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Original language: English
ASJC Scopus subject areas: Signal Processing, Media Technology, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Geometric verification, image retrieval, neighborhood matching (NM), robust estimation
DOIs:

10.1109/TMM.2016.2616298
Source: Scopus
Source ID: 85013466531
Research output: Contribution to journal › Article › Scientific › peer-review

Towards a conceptual framework for privacy protection in the use of interactive 360° video surveillance
Interactive 360° video technology has not been embraced for surveillance purposes despite its ability to eliminate blind spots, which is an important attribute of video surveillance. Further, privacy invasion due to video surveillance has a negative impact, and this urges for attention. Hence, the paper authors considered these two aspects and proposed a conceptual design framework with its rationale for privacy protection in use within the infrastructure of the interactive 360° video surveillance system. This conceptual integration framework takes into account the next essential factors: i) the utilization of the positive characteristics of 360° video to improve surveillance; ii) the protection of people's privacy; iii) the assistance needed in crime investigation and forensics; and iv) the ease and cost-effectiveness for deployment. These are factors of paramount significance for public safety and social order and they can be guaranteed with proactive approaches of design, based on the latest developments of Internet of Things technology and digital watermarking advancements.

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Organisations: Pervasive Computing, Research area: Information security, University of Tampere, Monash University
Contributors: Chaudhary, S., Berki, E., Nykänen, P., Zolotavkin, Y., Helenius, M., Kela, J.
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ASJC Scopus subject areas: Computer Science Applications, Human-Computer Interaction, Media Technology, Radiology Nuclear Medicine and imaging
Keywords: conceptual framework, Interactive 360° video surveillance, Internet of Things, literature review, privacy and safety, security, steganography and digital watermarking
DOIs:

10.1109/VSMM.2016.7863179

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EXT="Chaudhary, Sunil"
Source: Scopus
Source ID: 85016023783
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Benchmarking DFT methods with small basis sets for the calculation of halogen-bond strengths
In recent years, halogen bonding has become an important design tool in crystal engineering, supramolecular chemistry and biosciences. The fundamentals of halogen bonding have been studied extensively with high-accuracy computational methods. Due to its non-covalency, the use of triple-zeta (or larger) basis sets is often recommended when studying halogen bonding. However, in the large systems often encountered in supramolecular chemistry and biosciences, large basis sets can make the calculations far too slow. Therefore, small basis sets, which would combine high computational speed and high accuracy, are in great demand. This study focuses on comparing how well density functional theory (DFT) methods employing small, double-zeta basis sets can estimate halogen-bond strengths. Several methods with triple-zeta basis sets are included for comparison. Altogether, 46 DFT methods were tested using two data sets of 18 and 33 halogen-bonded complexes for which the complexation energies have been previously calculated with the high-accuracy CCSD(T)/CBS method. The DGDZVP basis set performed far better than other double-zeta basis sets, and it even outperformed the triple-zeta basis sets. Due to its small size, it is well-suited to studying halogen bonding in large systems.

General information
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Organisations: Chemistry and Bioengineering, Research group: Supramolecular photochemistry

Contributors: Siiskonen, A., Priimägi, A.
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Article number: 50
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ASJC Scopus subject areas: Catalysis, Computer Science Applications, Physical and Theoretical Chemistry, Organic Chemistry, Computational Theory and Mathematics, Inorganic Chemistry
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Source: Scopus
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Research output: Contribution to journal › Article › Scientific › peer-review

Effects of Heterogeneous Mobility on D2D-and Drone-Assisted Mission-Critical MTC in 5G
mcMTC is starting to play a central role in the industrial Internet of Things ecosystem and have the potential to create high-revenue businesses, including intelligent transportation systems, energy/ smart grid control, public safety services, and high-end wearable applications. Consequently, in the 5G of wireless networks, mcMTC have imposed a wide range of requirements on the enabling technology, such as low power, high reliability, and low latency connectivity. Recognizing these challenges, the recent and ongoing releases of LTE systems incorporate support for lowcost and enhanced coverage, reduced latency, and high reliability for devices at varying levels of mobility. In this article, we examine the effects of heterogeneous user and device mobility-produced by a mixture of various mobility patterns-on the performance of mcMTC across three representative scenarios within a multi-connectivity 5G network. We establish that the availability of alternative connectivity options, such as D2D links and drone-Assisted access, helps meet the requirements of mcMTC applications in a wide range of scenarios, including industrial automation, vehicular connectivity, and urban communications. In particular, we confirm improvements of up to 40 percent in link availability and reliability with the use of proximate connections on top of the cellular-only baseline.

General information
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Organisations: Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Department of Chemistry and Bioengineering, Ericsson Research and Wireless KTH, Ericsson Research, King's College London, Antonio Iera Are with University Mediterranea of Reggio Calabria
Contributors: Orsino, A., Ometov, A., Fodor, G., Moltchanov, D., Militano, L., Andreev, S., Yilmaz, O. N. C., Tirronen, T., Torsner, J., Araniti, G., Iera, A., Dohler, M., Koucheryavy, Y.
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Electronic versions:

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URLs:
http://urn.fi/URN:NBN:fi:tty-201802141226
Source: Scopus
Source ID: 85012979681
Research output: Contribution to journal › Article › Scientific › peer-review

GSAR: Bioconductor package for Gene Set analysis in R

Background: Gene set analysis (in a form of functionally related genes or pathways) has become the method of choice for analyzing omics data in general and gene expression data in particular. There are many statistical methods that either summarize gene-level statistics for a gene set or apply a multivariate statistic that accounts for intergene correlations. Most available methods detect complex departures from the null hypothesis but lack the ability to identify the specific alternative hypothesis that rejects the null. Results: GSAR (Gene Set Analysis in R) is an open-source R/Bioconductor software package for gene set analysis (GSA). It implements self-contained multivariate non-parametric statistical methods testing a complex null hypothesis against specific alternatives, such as differences in mean (shift), variance (scale), or net correlation structure. The package also provides a graphical visualization tool, based on the union of two minimum spanning trees, for correlation networks to examine the change in the correlation structures of a gene set between two conditions and highlight influential genes (hubs). Conclusions: Package GSAR provides a set of multivariate non-parametric statistical methods that test a complex null hypothesis against specific alternatives. The methods in package GSAR are applicable to any type of omics data that can be represented in a matrix format. The package, with detailed instructions and examples, is freely available under the GPL (> = 2) license from the Bioconductor web site.

General information

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Predictive Society and Data Analytics (PSDA), University of Arkansas for Medical Sciences, Computational Medicine and Statistical Learning Laboratory
Contributors: Rahmatallah, Y., Zybailov, B., Emmert-Streib, F., Glazko, G.
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ASJC Scopus subject areas: Structural Biology, Biochemistry, Molecular Biology, Computer Science Applications, Applied Mathematics
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Electronic versions:
GSAR - Bioconductor package for Gene Set analysis in R
DOIs:
10.1186/s12859-017-1482-6
URLs:
http://urn.fi/URN:NBN:fi:tty-201703151179
Source: Scopus
Source ID: 85010460642
Research output: Contribution to journal › Article › Scientific › peer-review

Efficient coding of 360-degree pseudo-cylindrical panoramic video for virtual reality applications

Pseudo-cylindrical panoramas represent the data distribution of spherical coordinates closely in two-dimensional domain due to the equidistant sampling of 360-degree scene. Therefore, unlike the cylindrical projections, they do not suffer from the over stretching in the polar areas. However, due to the non-rectangular format in effective picture area and sharp edges at its borders, the compression performance is inefficient. In this paper, we propose two methods which improve the compression performance of both intra-frame and inter-frame coding of pseudo-cylindrical panoramic content and meanwhile reduce the coding artifacts. In the intra-frame coding method, border edges are smoothed by modifying the content of the image in the non-effective picture area, which are cropped at the receiver side. In the inter-frame coding method, gaining the benefit of 360-degree property of the content, non-effective picture area of reference frames at border

is filled with the content of the effective picture area from the opposite border to enhance the performance of motion compensation.

General information
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Organisations: Signal Processing, Research group: Video, Nokia
Contributors: Youvalari, R. G., Aminlou, A., Hannuksela, M. M., Gabbouj, M.
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Publication date: 18 Jan 2017

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ASJC Scopus subject areas: Artificial Intelligence, Computer Networks and Communications, Media Technology, Computer Science Applications
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Source: Scopus
Source ID: 85015196525
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Standard-compliant multiview video coding and streaming for virtual reality applications
Virtual reality (VR) systems employ multiview cameras or camera rigs to capture a scene from the entire 360- degree perspective. Due to computational or latency constraints, it might not be possible to stitch multiview videos into a single video sequence prior to encoding. In this paper we investigate the coding and streaming of multiview VR video content. We present a standard-compliant method where we first divide the camera views into two types: Primary views represent a subset of camera views with lower resolution and non-overlapping (minimally overlapping) content which cover the entire 360- degree field-of-view to guarantee immediate monoscopic viewing during very rapid head movements. Auxiliary views consist of remaining camera views with higher resolution which produce overlapping content with the primary views and are additionally used for stereoscopic viewing. Based on this categorization, we propose a coding arrangement in which, the primary views are independently coded in the base layer and the additional auxiliary views are coded as an enhancement layer, using inter-layer prediction from primary views. The proposed system not only meets the low latency requirements of VR systems, but also conforms to the existing multilayer extensions of the High Efficiency Video Coding standard. Simulation results show that the coding and streaming performance of the proposed scheme is significantly improved compared to earlier methods.

General information
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Organisations: Signal Processing, Nokia Technologies Oy
Contributors: Kammachi-Sreedhar, K., Aminlou, A., Hannuksela, M. M., Gabbouj, M.
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Publication date: 18 Jan 2017

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DOIs:
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Bibliographical note
EXT="Aminlou, Alireza"
Source: Scopus
Source ID: 85015245476
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Viewport-adaptive encoding and streaming of 360-degree video for virtual reality applications

Virtual reality applications use 360-degree videos and head mount displays (HMDs) with stereoscopic capabilities to provide full immersion experience. In these applications it is also common to use 4K resolution or higher per view for 360-degree videos. Consequently, this leads to technical challenges in handling the bandwidth requirements while keeping the system latency to the minimal. When the content is viewed with a HMD, a subset of the entire 360-degree video is displayed at a single point of time. To improve the resolution and picture quality of the displayed content, viewport based coding is desirable. In this regard, we investigated various viewport dependent projection schemes including the existing variants of Pyramidal projection. In this regard we propose the multi-resolution versions of Equirectangular and Cubemap projections. Additionally, we developed a methodology for comparing the rate-distortion performance of these projections. Based on the simulation results, it was observed that multi-resolution projections of Equirectangle and Cubemap outperform other projection schemes, significantly.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Research group: Computational Imaging-CI, Signal Processing, Research group: Video, Nokia, Nokia Technologies Oy
Contributors: Kammachi-Sreedhar, K., Aminlou, A., Hannuksela, M. M., Gabbouj, M.
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Bibliographical note

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Source: Scopus
Source ID: 85015244649
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Color-distribution similarity by information theoretic divergence for color images

The divergence similarity between two color images is presented based on the Jensen-Shannon divergence to measure the color-distribution similarity. Subjective assessment experiments were developed to obtain mean opinion scores (MOS) of test images. It was found that the divergence similarity and MOS values showed statistically significant correlations.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Research group: Vision, University of Niigata, KLab, Japan, K-JIST, Dongguk University, Seoul
Contributors: Murayama, M., Oguro, D., Kikuchi, H., Huttunen, H., Ho, Y. S., Shin, J.
Publication date: 17 Jan 2017

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Source: Scopus

Source ID: 85013813769
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Architectures and codecs for real-time light field streaming

Light field 3D displays represent a major step forward in visual realism, providing glasses-free spatial vision of real or virtual scenes. Applications that capture and process live imagery have to process data captured by potentially tens to hundreds of cameras and control tens to hundreds of projection engines making up the human perceivable 3D light field using a distributed processing system. The associated massive data processing is difficult to scale beyond a specific number and resolution of images, limited by the capabilities of the individual computing nodes. The authors therefore analyze the bottlenecks and data flow of the light field conversion process and identify possibilities to introduce better scalability. Based on this analysis they propose two different architectures for distributed light field processing. To avoid using uncompressed video data all along the processing chain, the authors also analyze how the operation of the proposed architectures can be supported by existing image/video codecs.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing, Research group: 3D MEDIA, Holografika, Nokia
Contributors: Kovács, P. T., Zare, A., Balogh, T., Bregovic, R., Gotchev, A.
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URLs:

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Source: Scopus
Source ID: 85016298177
Research output: Contribution to journal › Article › Scientific › peer-review

Advanced boundary electrode modeling for tES and parallel tES/EEG

This paper explores advanced electrode modeling in the context of separate and parallel transcranial electrical stimulation (tES) and electroencephalography (EEG) measurements.We focus on boundary condition based approaches that do not necessitate adding auxiliary elements, e.g. sponges, to the computational domain. In particular, we investigate the complete electrode model (CEM) which incorporates a detailed description of the skin-electrode interface including its contact surface, impedance and normal current distribution. The CEM can be applied for both tES and EEG electrodes which is advantageous when a parallel system is used. In comparison to the CEM, we test two important reduced approaches: the gap model (GAP) and the point electrode model (PEM). We aim to find out the differences of these approaches for a realistic numerical setting based on the stimulation of the auditory cortex. The results obtained suggest, among other things, that GAP and GAP/PEM are sufficiently accurate for the practical application of tES and parallel tES/EEG, respectively. Differences between CEM and GAP were observed mainly in the skin compartment, where only CEM explains the heating effects characteristic to tES.

General information

Publication status: Published
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Contributors: Pursiainen, S., Agsten, B., Wagner, S., Wolters, C. H.
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Keywords: Boundary conditions, Brain modeling, Complete electrode model (CEM), Computational modeling, Electric potential, Electrodes, Electroencephalography, Electroencephalography (EEG) electrode modeling, Finite element method (FEM)., Skin, Transcranial electrical stimulation (tES)
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Source: Scopus
Source ID: 85030762392
Research output: Contribution to journal › Article › Scientific › peer-review

A dynamical quality model to continuously monitor software maintenance

Context: several companies, particularly Small and Medium Sized Enterprises (SMEs), often face software maintenance issues due to the lack of Software Quality Assurance (SQA). SQA is a complex task that requires a lot of effort and expertise, often not available in SMEs. Several SQA models, including maintenance prediction models, have been defined in research papers. However, these models are commonly defined as "one-size-fits-All" and are mainly targeted at the big industry, which can afford software quality experts who undertake the data interpretation tasks. Objective: in this work, we propose an approach to continuously monitor the software operated by end users, automatically collecting issues and recommending possible fixes to developers. The continuous exception monitoring system will also serve as knowledge base to suggest a set of quality practices to avoid (re)introducing bugs into the code. Method: first, we identify a set of SQA practices applicable to SMEs, based on the main constraints of these. Then, we identify a set of prediction techniques, including regressions and machine learning, keeping track of bugs and exceptions raised by the released software. Finally, we provide each company with a tailored SQA model, automatically obtained from companies' bug/issue history. Developers are then provided with the quality models through a set of plug-ins for integrated development environments. These suggest a set of SQA actions that should be undertaken, in order to maintain a certain quality level and allowing to remove the most severe issues with the lowest possible effort. Conclusion: The collected measures will be made available as public dataset, so that researchers can also benefit of the project's results. This work is developed in collaboration with local SMEs and existing Open Source projects and communities.

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MoE publication type: A4 Article in a conference publication
Organisations: Free University of Bolzano-Bozen, Università degli Studi Dell'Insubria, Former organisation of the author
Contributors: Lenarduzzi, V., Stan, A. C., Taibi, D., Tosi, D., Venters, G.
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ASJC Scopus subject areas: Computer Science Applications, Information Systems, Management Information Systems
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Source: Scopus
Source ID: 85029853227
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Bayes Forest: A data-intensive generator of morphological tree clones

Detailed and realistic tree form generators have numerous applications in ecology and forestry. For example, the varying morphology of trees contributes differently to formation of landscapes, natural habitats of species, and eco-physiological characteristics of the biosphere. Here, we present an algorithm for generating morphological tree "clones" based on the detailed reconstruction of the laser scanning data, statistical measure of similarity, and a plant growth model with simple stochastic rules. The algorithm is designed to produce tree forms, i.e., morphological clones, similar (and not identical) in respect to tree-level structure, but varying in fine-scale structural detail. Although we opted for certain choices in our

algorithm, individual parts may vary depending on the application, making it a general adaptable pipeline. Namely, we showed that a specific multipurpose procedural stochastic growth model can be algorithmically adjusted to produce the morphological clones replicated from the target experimentally measured tree. For this, we developed a statistical measure of similarity (structural distance) between any given pair of trees, which allows for the comprehensive comparing of the tree morphologies by means of empirical distributions describing the geometrical and topological features of a tree. Finally, we developed a programmable interface to manipulate data required by the algorithm. Our algorithm can be used in a variety of applications for exploration of the morphological potential of the growth models (both theoretical and experimental), arising in all sectors of plant science research.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Mathematics, Research group: Inverse Problems, Department of Computer Science, Aalto University
Contributors: Potapov, I., Järvenpää, M., Åkerblom, M., Raumonen, P., Kaasalainen, M.
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Source: Scopus
Source ID: 85032857287
Research output: Contribution to journal › Article › Scientific › peer-review

BM3D-HVS: Content-Adaptive denoising for improved visual quality
We introduce a content-Adaptive approach to image denoising where the filter design is based on mean opinion scores (MOSs) from preliminary experiments with volunteers who evaluated the quality of denoised image fragments. This allows to tune the filter parameters so to improve the perceptual quality of the output image, implicitly accounting for the peculiarities of the human visual system (HVS). A modification of the BM3D image denoising filter (Dabov et al., IEEE TIP, 2007), namely BM3DHVS, is proposed based on this framework. We show that it yields a higher visual quality than the conventional BM3D. Further, we have also analyzed the MOSs against popular full-reference visual quality metrics such as SSIM (Wang et al., IEEE TIP, 2004), its extension FSIM (Zhang et al., IEEE TIP, 2011), and the noreference IL-NIQE (Zhang et al., IEEE TIP, 2015) over each image fragment. Both the Spearman and the Kendall rank order correlation show that these metrics do not correspond well to the human perception. This calls for new visual quality metrics tailored for the benchmarking and optimization of image denoising methods.

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Organisations: Signal Processing, Kharkiv National Aerospace University, Noiseless Imaging Ltd
Contributors: Egiazarian, K., Danielyan, A., Ponomarenkoa, N., Foia, A., Ieremeiev, O., Lukin, V.
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EXT="Lukin, Vladimir"
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Source: Scopus
Source ID: 85040604686
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Complex elevator system DSM-case for a DSM design sprint

In this paper we present a complex elevator system design structure matrix (DSM). The DSM is created with system experts to enable solving of complex system development problems via a product DSM. This data is created to be used as a case study in a DSM design sprint. It was created to show the diversity of findings that can be ascertained from a single DSM matrix. In the spirit of open science, we present both the DSM and the design sprint to enable other researched to replicate, reproduce or otherwise build on the same source of data.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Research area: Design, Development and LCM, Mechanical Engineering and Industrial Systems, Aalto University, Kone Oyj, Department of P5DC, University of Vaasa (UVA)
Contributors: Niutanen, V., Hölttä-Otto, K., Rahardjo, A., Stowe, H. M., Helo, P., Pulkkinen, A.
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Computational wavelength resolution for in-line lensless holography: Phase-coded diffraction patterns and wavefront group-sparsity

In-line lensless holography is considered with a random phase modulation at the object plane. The forward wavefront propagation is modelled using the Fourier transform with the angular spectrum transfer function. The multiple intensities (holograms) recorded by the sensor are random due to the random phase modulation and noisy with Poissonian noise distribution. It is shown by computational experiments that high-accuracy reconstructions can be achieved with resolution going up to the two thirds of the wavelength. With respect to the sensor pixel size it is a super-resolution with a factor of 32. The algorithm designed for optimal superresolution phase/amplitude reconstruction from Poissonian data is based on the general methodology developed for phase retrieval with a pixel-wise resolution in V. Katkovnik, "Phase retrieval from noisy data based on sparse approximation of object phase and amplitude", http://www.cs.tut.fi/~lasip/DDT/index3.html.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Department of Photonics and Optical Information Technology, ITMO University
Contributors: Katkovnik, V., Shevkunov, I., Petrov, N. V., Egiazarian, K.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Dimension reduction and decomposition using causal graph and qualitative analysis for aircraft concept design optimization

With the increasing design dimensionality, it is more difficult to solve Multidisciplinary design optimization (MDO) problems. To reduce the dimensionality of MDO problems, many MDO decomposition strategies have been developed. However, those strategies consider the design problem as a black-box function. In practice, the designers usually have certain knowledge of their problem. In this paper, a method leveraging causal graph and qualitative analysis is developed to reduce the dimensionality of the MDO problem by systematically modeling and incorporating knowledge of the design problem. Causal graph is employed to show the input-output relationships between variables. Qualitative analysis using design structure matrix (DSM) is carried out to automatically find the variables that can be determined without optimization. According to the weight of variables, the MDO problem is divided into two sub-problems, the optimization problem with respect to important variables, and the one with less important variables. The novel method is performed to solve an aircraft concept design problem and the results show that the new dimension reduction and decomposition method can significantly improve optimization efficiency.

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Contributors: Wu, D., Coatanea, E., Wang, G. G.
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ASJC Scopus subject areas: Mechanical Engineering, Computer Graphics and Computer-Aided Design, Computer Science Applications, Modelling and Simulation
Keywords: Aircraft concept design, Causal graph, Dimension reduction, Dimensional analysis, Multidisciplinary design optimization
DOIs:
10.1115/DETC201767601
Source: Scopus
Source ID: 85034658662
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Dynamic laser speckle metrology with binarization of speckle patterns

Dynamic laser speckle analysis is non-destructive detection of physical or biological activity through statistical processing of speckle patterns on the surface of diffusely reflecting objects. This method is sensitive to microscopic changes of the surface over time and needs simple optical means. Advances in computers and 2D optical sensors forced development of pointwise algorithms. They rely on acquisition of a temporal sequence of correlated speckle images and generate activity data as a 2D spatial contour map of the estimate of a given statistical parameter. The most widely used pointwise estimates are the intensity-based estimates which compose each map entry from a time sequence of intensity values taken at one and the same pixel in the acquired speckle images. Accuracy of the pointwise approach is strongly affected by the signal-dependent nature of the speckle data when the spread of intensity fluctuations depends on the intensity itself. The latter leads to erroneous activity determination at non-uniform distribution of intensity in the laser beam for the

non-normalized estimates. Normalization of the estimates, introduces errors. We propose to apply binarization to the acquired speckle images by comparing the intensity values in the temporal sequence for a given spatial point to the mean intensity value estimated for this point and to evaluate a polar correlation function. Efficiency of this new processing algorithm is checked both by simulation and experiment.

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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing, Research group: 3D MEDIA, Bulgarian Academy of Sciences
Contributors: Stoykova, E., Nazarova, D., Berberova, N., Gotchev, A., Ivanov, B., Mateev, G.
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Keywords: Binary patterns, Dynamic speckle, Intensity-based algorithms, Optical metrology, Pointwise processing
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Source: Scopus
Source ID: 85017345812
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Dynamic response to process disturbances—A comparison between TMB/SMB models in transient regime
The modelling and design of Simulated moving bed (SMB) processes is normally done using the True moving bed (TMB) approximation. Several studies show that average values obtained at cyclic steady state for SMB units approach the TMB unit at steady state and that this approach is better as the number of columns in the SMB increases. However, studies that evaluate this equivalence under dynamic conditions are scarce. The objective of this work is to perform an analysis of the transient behaviour of two SMB units, with four and eight columns, and compare the results with the ones obtained for a TMB unit. An analysis of the impact of operating variables on the processes performance parameters is performed. The results show that TMB/SMB equivalence is valid only for conditions that do not violate the regeneration/separation regions and that the transient behaviour of the four columns SMB can resemble more the TMB.

General information
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Organisations: Univ Porto, Universidade do Porto, Fac Med, Dept Med Imaging
Contributors: Nogueira, I. B., Ribeiro, A. M., Rodrigues, A. E., Loureiro, J. M.
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http://www.scopus.com/inward/record.url?scp=85012284107&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 85012284107
Research output: Contribution to journal › Article › Scientific › peer-review

Experimenting traditional and modern reliability models in a 3-years european software project

Reliability is a very important non-functional aspect for software systems and artefacts. In literature, several definitions of software reliability exist and several methods and approaches exist to measure reliability of a software project. However, in the literature no works focus on the applicability of these methods in all the development phases of real software projects. In this paper, we describe the methodology we adopted during the S-CASE FP7 European Project to predict reliability for both the S-CASE platform as well as for the software artefacts automatically generated by using the S-CASE platform. Two approaches have been adopted to compute reliability: The first one is the Rome Lab Model, a well adopted traditional approach in industry; the second one is an empirical approach defined by the authors in a previous work. An extensive dataset of results has been collected during all the phases of the project. The two approaches can complement each other, to support to prediction of reliability during all the development phases of a software system in order to facilitate the project management from a non-functional point-of-view.

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Organisations: Università degli Studi Dell'Insubria, Former organisation of the author
Contributors: Tosi, D., Lenarduzzi, V., Morasca, S., Taibi, D.
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URLs:
http://www.scopus.com/inward/record.url?scp=85039850001&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 85039850001
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Full-reference metrics multidistortional analysis

This paper is devoted to analysis and further improvement of full-reference metrics of image visual quality. The effectiveness of a metric is characterized by the rank correlation factors between the obtained array of mean opinion scores (MOS) and the corresponding array of given metric values. This allows to determine the correspondence of a considered metric to a human visual system (HVS). Results obtained on the database TID2013 show that Spearman correlation for the best existing metrics (PSNRHMA, FSIM, SFF, etc.) does not exceed 0.85. In this paper, extended verification tools that allow to detect the shortcomings of the metrics taking into account combined distortions is proposed. An example for further improvement of the PSNRHMA metric is presented.

General information

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Organisations: Signal Processing, Kharkiv National Aerospace University
Contributors: Ieremeiev, O., Lukin, V., Ponomarenko, N., Egiazarian, K.
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jufoid=84313
EXT="Ponomarenko, Nikolay"
EXT="Lukin, Vladimir"
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Source ID: 85040625876
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Internet of Things: Opportunities for vocational education and training: Presentation of the pilot project
In the Internet of Things (IoT), machines and devices are equipped with sensors and Internet connections that makes it possible to collect data and store this data to cloud services. In vocational education and training, the stored data can be used to improve decision-making processes. With the help of this data, a teacher can also get a more accurate picture of the current state of the education environment than before. IoT should be integrated into vocational education and training because IoT will help to achieve important educational objectives. IoT is able to promote students' preparation for working life, the safety of education environment, self-directed learning, and effective learning. It can also improve the efficient use of educational resources. In additional, IoT based solutions should be introduced so that students would have a vision of new types of IoT skill requirements before they enter the labour market. In this paper, we presents IoT related aspects that enable to meet the above-mentioned educational objectives. By implementing a pilot project, we aim to concretise IoT's possibilities in the education sector.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research group: Software Engineering and Intelligent Systems, Pervasive Computing, Facilities and Infrastructure
Contributors: Vihervaara, J., Alapaholuoma, T.
Number of pages: 5
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ASJC Scopus subject areas: Education, Computer Science Applications, Information Systems
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DOIs:
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Method for Simulating Dose Reduction in Digital Breast Tomosynthesis
This work proposes a new method of simulating dose reduction in digital breast tomosynthesis (DBT), starting from a clinical image acquired with a standard radiation dose. It considers both signal-dependent quantum and signal-independent electronic noise. Furthermore, the method accounts for pixel crosstalk, which causes the noise to be frequency-dependent, thus increasing the simulation accuracy. For an objective assessment, simulated and real images were compared in terms of noise standard deviation, signal-to-noise ratio (SNR) and normalized noise power spectrum (NNPS). A two-alternative forced-choice (2-AFC) study investigated the similarity between the noise strength of low-dose simulated and real images. Six experienced medical physics specialists participated on the study, with a total of 2,160 readings. Objective assessment showed no relevant trends with the simulated noise. The relative error in the standard deviation of the simulated noise was less than 2% for every projection angle. The relative error of the SNR was less than 1.5%, and the NNPS of the simulated images had errors less than 2.5%. The 2-AFC human observer experiment yielded no statistically significant difference (p=0.84) in the perceived noise strength between simulated and real images. Furthermore, the observer study also allowed the estimation of a dose difference at

which the observer perceived a just-noticeable difference (JND) in noise levels. The estimated JND value indicated that a change of 17% in the current-time product was sufficient to cause a noticeable difference in noise levels. The observed high accuracy, along with the flexible calibration, make this method an attractive tool for clinical image-based simulations of dose reduction.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing, Research group: Signal and Image Restoration-RST
Contributors: Borges, L. R., Guerrero, I., Bakic, P. R., Foi, A., Maidment, A. D., Vieira, M. A.
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ISSN (Print): 0278-0062
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Keywords: Biomedical imaging, Breast, Calibration, digital breast tomosynthesis, dose reduction, Electronic noise, Estimation, Image reconstruction, quantum noise, Signal to noise ratio, Standards
Electronic versions:

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URLs:

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Source ID: 85023177059
Research output: Contribution to journal › Article › Scientific › peer-review

Nanodevice Arrays for Peripheral Nerve Fascicle Activation Using Ultrasound Energy-harvesting
We propose the use of wireless, energy-harvesting, implanted nanodevice arrays with electrodes for selective stimulation of peripheral nerves in the human body. We calculate the input ultrasound energy and harvested power for single fixed-size nanowire-based nanodevices at different tissue depths and compare these with the current and voltage levels required for peripheral neural stimulation. We model the dimensioning of arrays of nanodevices, embedded in biocompatible tissue patches, to meet these neural stimulation requirements. Selectivity of activation of particular nerve bundles requires that the output voltage and current of the array can be varied to increase or decrease penetration into the neural tissue. This variation can be achieved by changing the energised area of the array and/or by decreasing the incident ultrasound power. However, the array must be implanted horizontally relative to the incident ultrasound as any tilting of the nanodevices will reduce the harvested energy. The proposed approach provides a long-term implant solution for nerve stimulation that allows the patient greater freedom of movement than with embedded tethered electrodes.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno
Contributors: Donohoe, M., Jennings, B., Jornet, J. M., Balasubramaniam, S.
Pages: 919-930
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Peer-reviewed: Yes

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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
Keywords: Crystals, Electrodes, Energy harvesting, Energy Harvesting, Nanoscale devices, Nanowires, Nerve stimulation , Resonant frequency, Substrates, Ultrasonic imaging, Ultrasound
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http://urn.fi/URN:NBN:fi:tty-201712212450
Source: Scopus
Source ID: 85023197296
Research output: Contribution to journal › Article › Scientific › peer-review

Picosecond MOPA with ytterbium doped tapered double clad fiber

The powerful picosecond master oscillator - power amplifier (MOPA) with double clad ytterbium doped tapered fiber as a buster amplifier has been demonstrated in the presented paper. The developed MOPA has 60ps pulses with 0.3mJ pulse energy and 5MW peak power.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Research group: Ultrafast and intense lasers, Photonics, Research group: Nanophotonics, Ampliconyx Ltd , Institute of Radio Engineering and Electronics of the Russian Academy of Sciences
Contributors: Filippov, V., Vorotynskii, A., Noronen, T., Gumenyuk, R., Chamorovskii, Y., Golant, K.
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ISBN (Electronic): 9781510606074

Publication series

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Publisher: SPIE
No.: 10083
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: Fiber laser, Picosecond laser, Ultrafast laser
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10.1117/12.2252006
Source: Scopus
Source ID: 85019465842
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Time-Dependent Energy and Resource Management in Mobility-Aware D2D-Empowered 5G Systems

The 5G mobile networks are expected to offer higher degrees of radio access heterogeneity across a wide range of technologies (LTE, WiFi, mmWave, etc.), which operate in both licensed and unlicensed spectrum providing dissimilar data rates and coverage. In light of the stringent requirements in terms of resource and energy efficiency, the performance optimization of such heterogeneous 5G systems becomes an involved task that demands abundant information on the states of users to solve a complex, large-scale optimization problem. However, the unpredictable mobility of communicating entities, including dual mobility of D2D partners, may lead to a rapid deviation from the initial, optimized system state and thus requires frequent re-optimizations of the entire network. In this article, we aim to deliver a comprehensive tutorial on the implications of system-wide energy and resource management with the emphasis on its time-dependent behavior. Proposing a novel network-centric 5G optimization framework, we employ insights from the random walk and Markov chain theories, and also confirm our findings with an extensive system-level simulation campaign. These results reveal an exponential performance degradation rate that primarily depends on the average user speeds. Together with reporting the divergence exponents for different 5G system configurations, we also provide practical insights into how to exploit them in order to non-incrementally improve the throughput and energy performance of the network.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Electronics and Communications Engineering, University of Russia, University Mediterranea of Reggio, RUDN University
Contributors: Orsino, A., Samuylov, A., Moltchanov, D., Andreev, S., Militano, L., Araniti, G., Koucheryavy, Y.
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ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
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Source: Scopus
Source ID: 85028851100
Research output: Contribution to journal › Article › Scientific › peer-review

Urban 3D segmentation and modelling from street view images and LiDAR point clouds
3D urban maps with semantic labels and metric information are not only essential for the next generation robots such autonomous vehicles and city drones, but also help to visualize and augment local environment in mobile user applications. The machine vision challenge is to generate accurate urban maps from existing data with minimal manual annotation. In this work, we propose a novel methodology that takes GPS registered LiDAR (Light Detection And Ranging) point clouds and street view images as inputs and creates semantic labels for the 3D points clouds using a hybrid of rule-based parsing and learning-based labelling that combine point cloud and photometric features. The rule-based parsing boosts segmentation of simple and large structures such as street surfaces and building facades that span almost 75% of the point cloud data. For more complex structures, such as cars, trees and pedestrians, we adopt boosted decision trees that exploit both structure (LiDAR) and photometric (street view) features. We provide qualitative examples of our methodology in 3D visualization where we construct parametric graphical models from labelled data and in 2D image segmentation where 3D labels are back projected to the street view images. In quantitative evaluation we report classification accuracy and computing times and compare results to competing methods with three popular databases: NAVTEQ True, Paris-Rue-Madame and TLS (terrestrial laser scanned) Velodyne.

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Contributors: Babahajiani, P., Fan, L., Kämäräinen, J., Gabbouj, M.
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Bibliographical note
EXT="Babahajiani, Pouria"
Source: Scopus
Source ID: 85019692066
Research output: Contribution to journal › Article › Scientific › peer-review

Using enterprise architecture artefacts in an organisation
As a tool for management and planning, Enterprise Architecture (EA) can potentially align organisations' business processes, information, information systems and technology towards a common goal, and supply the information required within this journey. However, an explicit view on why, how, when and by whom EA artefacts are used in order to realise its full potential is not defined. Utilising the features of information systems use studies and data from a case study with 14 EA stakeholder interviews, we identify and describe 15 EA artefact use situations that are then reflected in the related literature. Their analysis enriches understanding of what are EA artefacts, how and why they are used and when are they used, and results in a theoretical framework for understanding their use in general.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT)
Contributors: Niemi, E., Pekkola, S.
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Peer-reviewed: Yes

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Bibliographical note
EXT="Niemi, Eetu"
Source: Scopus
Source ID: 84929593903
Research output: Contribution to journal › Article › Scientific › peer-review

Describing mobile devices as RESTful services for the end-users
This paper presents an end-user oriented approach of describing mobile devices as RESTful services. The mobile services are provided to the end-users through a centralized server. To enable plugging of devices, they provide a machine-processable device description with detailed specification of their RESTful API. The device description is used to generate required user interface as well as generating the RESTful invocations. We provide general guidelines on how to design a REST API for a mobile device and a device description for machine-to-machine interactions. The approach is demonstrated by building a centralized marketplace to promote and use available mobile services. The central marketplace acts as a broker for the dynamic mobile services. In addition, we use two case study applications to demonstrate the service registration, provisioning, and usage.

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MoE publication type: A4 Article in a conference publication
Organisations: Pervasive Computing, City University of Hong Kong
Contributors: Ruokonen, A., Wu, Z., Lu, R.

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Source: Scopus
Source ID: 85010420468
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Dynamic social trust associations over d2d communications: An implementation perspective

Network-assisted device-to-device (D2D) connectivity is a next-generation wireless technology that facilitates direct user contacts in physical proximity while taking advantage of the flexible and ubiquitous control coming from the cellular infrastructure. This novel type of user interactions creates challenges in constructing meaningful proximity-based applications and services that would enjoy high levels of user adoption. Accordingly, to enable such adoption a comprehensive understanding of user sociality and trust factors is required together with respective technology enablers for secure D2D communications, especially when cellular control is not available at all times. In this paper, we study an important aspect of secure communications over proximity-based direct links, with a primary emphasis on developing the corresponding proof-of-concept implementation. Our developed prototype offers rich functionality for dynamic management of security functions in proximate devices, whenever a new device joins the secure group of users or an existing one leaves it. To evaluate the behavior of our implemented application, we characterize its performance in terms of computation and transmission delays from the user perspective.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Electronics and Communications Engineering, Pervasive Computing, Research area: User experience, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Research area: Software engineering, Brno University of Technology, Intel Corporation
Contributors: Urama, J., Olshannikova, E., Ometov, A., Masek, P., Andreev, S., Olsson, T., Hosek, J., Niutanen, J., Koucheryavy, Y., Mikkonen, T.
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ISBN (Electronic): 9781509026258
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications
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10.1109/MobServ.2016.41

Bibliographical note

EXT="Niutanen, Jussi"
Source: Scopus
Source ID: 85010280710
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Visual decision support for business ecosystem analysis

This study comparatively evaluates the effectiveness of three visualization methods (list, matrix, network) and the influence of data complexity, task type, and user characteristics on decision performance in the context of business ecosystem analysis. We pursue this objective using an exploratory study with 14 prototypical users (e.g. executives, analysts, investors, and policy makers). The results show that in low complexity contexts, decision performance between visual representations differ but not substantially. In high complexity contexts, however, decision performance suffers significantly if visual representations are not appropriately matched to task types. Our study makes several theoretical and practical contributions. Theoretically, we extend cognitive fit theory by investigating the impact of business ecosystem task type and complexity. Managerially, our study contributes to the relatively underexplored, but emerging area of the design of business ecosystem intelligence tools and presentation of business ecosystem data for the purpose of decision making.

We conclude with future research opportunities.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Tennenbaum Institute & School of Interactive Computing Georgia Institute of Technology 85 Fifth Street NW Atlanta, VTT Technical Research Centre of Finland, mediaX and H*STAR Stanford University Stanford
Contributors: Basole, R. C., Huhtamäki, J., Still, K., Russell, M. G.
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ASJC Scopus subject areas: Engineering(all), Computer Science Applications, Artificial Intelligence
Keywords: Business ecosystem, Cognitive fit theory, Data complexity, Decision support, Information visualization
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Source: Scopus
Source ID: 84984633268
Research output: Contribution to journal › Article › Scientific › peer-review

Improving the delivery cycle: A multiple-case study of the toolchains in Finnish software intensive enterprises
Context: Software companies seek to gain benefit from agile development approaches in order to meet evolving market needs without losing their innovative edge. Agile practices emphasize frequent releases with the help of an automated toolchain from code to delivery. Objective: We investigate, which tools are used in software delivery, what are the reasons omitting certain parts of the toolchain and what implications toolchains have on how rapidly software gets delivered to customers. Method: We present a multiple-case study of the toolchains currently in use in Finnish software-intensive organizations interested in improving their delivery frequency. We conducted qualitative semi-structured interviews in 18 case organizations from various software domains. The interviewees were key representatives of their organization, considering delivery activities. Results: Commodity tools, such as version control and continuous integration, were used in almost every organization. Modestly used tools, such as UI testing and performance testing, were more distinctly missing from some organizations. Uncommon tools, such as artifact repository and acceptance testing, were used only in a minority of the organizations. Tool usage is affected by the state of current workflows, manual work and relevancy of tools. Organizations whose toolchains were more automated and contained fewer manual steps were able to deploy software more rapidly. Conclusions: There is variety in the need for tool support in different development steps as there are domain-specific differences in the goals of the case organizations. Still, a well-founded toolchain supports speedy delivery of new software.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Software engineering, University of Helsinki, Aalto University
Contributors: Mäkinen, S., Leppänen, M., Kilamo, T., Mattila, A., Laukkanen, E., Pagels, M., Männistö, T.
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Original language: English
ASJC Scopus subject areas: Software, Information Systems, Computer Science Applications

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DOIs:
10.1016/j.infsof.2016.09.001
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Research output: Contribution to journal › Article › Scientific › peer-review

Development of an England-wide indoor overheating and air pollution model using artificial neural networks

With the UK climate projected to warm in future decades, there is an increased research focus on the risks of indoor overheating. Energy-efficient building adaptations may modify a buildings risk of overheating and the infiltration of air pollution from outdoor sources. This paper presents the development of a national model of indoor overheating and air pollution, capable of modelling the existing and future building stocks, along with changes to the climate, outdoor air pollution levels, and occupant behaviour. The model presented is based on a large number of EnergyPlus simulations run in parallel. A metamodelling approach is used to create a model that estimates the indoor overheating and air pollution risks for the English housing stock. The performance of neural networks (NNs) is compared to a support vector regression (SVR) algorithm when forming the metamodel. NNs are shown to give almost a 50% better overall performance than SVR.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: University College London, London School of Hygiene and Tropical Medicine, Public Health England
Contributors: Symonds, P., Taylor, J., Chalabi, Z., Mavrogianni, A., Davies, M., Hamilton, I., Vardoulakis, S., Heaviside, C. , Macintyre, H.
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Volume: 9
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ASJC Scopus subject areas: Architecture , Building and Construction, Modelling and Simulation, Computer Science Applications
Keywords: indoor air pollution, machine learning, metamodelling, neural networks, overheating, stock modelling
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10.1080/19401493.2016.1166265
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http://www.scopus.com/inward/record.url?scp=84963632445&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84963632445
Research output: Contribution to journal › Article › Scientific › peer-review

SamExploreR: Exploring reproducibility and robustness of RNA-seq results based on SAM files

Motivation: Data from RNA-seq experiments provide us with many new possibilities to gain insights into biological and disease mechanisms of cellular functioning. However, the reproducibility and robustness of RNA-seq data analysis results is often unclear. This is in part attributed to the two counter acting goals of (i) a cost efficient and (ii) an optimal experimental design leading to a compromise, e.g. in the sequencing depth of experiments. Results: We introduce an R package called samExploreR that allows the subsampling (m out of n bootstraping) of short-reads based on SAM files facilitating the investigation of sequencing depth related questions for the experimental design. Overall, this provides a systematic way for exploring the reproducibility and robustness of general RNA-seq studies. We exemplify the usage of samExploreR by studying the influence of the sequencing depth and the annotation on the identification of differentially expressed genes.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, BioMediTech, Queen's University, Belfast, Northern Ireland, University of Arkansas for Medical Sciences, Nankai University

Contributors: Stupnikov, A., Tripathi, S., De Matos Simoes, R., McArt, D., Salto-Tellez, M., Glazko, G., Dehmer, M., Emmert-Streib, F.
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ASJC Scopus subject areas: Statistics and Probability, Medicine(all), Biochemistry, Molecular Biology, Computer Science Applications, Computational Theory and Mathematics, Computational Mathematics
DOIs:

10.1093/bioinformatics/btw475
Source: Scopus
Source ID: 84994666672
Research output: Contribution to journal › Article › Scientific › peer-review

Casual immersive viewing with smartphones
In this paper, we explore how to better integrate virtual reality viewing to a smartphone. We present novel designs for casual (short-term) immersive viewing of spatial and 3D content, such as augmented and virtual reality, with smartphones. Our goal is to create a simple and low-cost casual-viewing design which could be retrofitted and eventually be embedded into smartphones, instead of using larger spatial viewing accessories. We explore different designs and implemented several prototypes. One prototype uses thin and light near-to-eye optics with a smartphone display, thus providing the user with the functionality of a large, high-resolution virtual display. Our designs also enable 3D user interfaces. Easy interaction through various gestures and other modalities is possible by using the inertial and other sensors and camera of the smartphone. Our preliminary concepts are a starting point for exploring useful constructions and designs for such usage.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group , University of California, Santa Barbara
Contributors: Rakkolainen, I., Raisamo, R., Turk, M., Höllerer, T., Palovuori, K.
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ASJC Scopus subject areas: Human-Computer Interaction, Software, Computer Science Applications
Keywords: 3D interaction, Augmented reality, Mobile computing, Near-to-eye display, Virtual reality
DOIs:

10.1145/2994310.2994314

Bibliographical note
EXT="Rakkolainen, Ismo"
Source: Scopus
Source ID: 84994852921
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Focusing on user experience and business models in startups: Investigation of two-dimensional value creation
While good user experience (UX) can be seen to provide competitive advantage for the company and added value to users, resources for achieving UX may often be lacking in software startups. Furthermore, in different phases of business and product development process, concentrating on the focal things can be challenging. In this study, we investigated the factors affecting UX work in startups as well as UX goals startups set for their products. Furthermore, we reviewed the goals in terms of the Minimum Viable UX framework as well as value creation aspects. We present qualitative results of a

survey study with 20 software startups as well as findings of a literature review. Our study suggests that while startups aim to provide products with good usability, the lack of a more comprehensive approach to UX can hinder their value creation; affecting both user satisfaction and business success. As a result, this may affect the successful implementation of startup's business model.

General information
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Organisations: Research area: User experience, Department of Pervasive Computing, University of Oulu
Contributors: Hokkanen, L., Xu, Y., Väänänen, K.
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Publication date: 17 Oct 2016

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Keywords: Business model, Software, Startup, User experience, Value
DOIs:

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Source: Scopus
Source ID: 84994831715
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Participatory development of user experience design guidelines for a B2B company
As business success is increasingly dependent on an organization's ability to provide a pleasant user experiences (UX) for its products, companies need to find ways to harness every employee to think about UX in their daily work. To support this goal, we present a participatory development process to create user experience design guidelines for a company developing materials-handling equipment for warehouses. The guidelines were developed to steer the work of all R&D designers and developers towards experience-driven design of the products in business-to-business context. The participatory process includes six steps: Spreading awareness of UX within the company, providing information on UX, supporting understanding of UX, co-creation of guidelines, reviewing the outcome, and implementing the guidelines. This paper concentrates on describing the first five phases. The participatory approach is applicable by other organizations to support the change towards experience-driven design. The process and outcome aims to support employees' everyday work aiming for products with pleasant UX.

General information
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Organisations: Department of Pervasive Computing, Research area: User experience, Rocla Oy, Aalto University
Contributors: Hildén, E., Väätäjä, H., Roto, V., Uusitalo, K.
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Bibliographical note
EXT="Roto, Virpi"
Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Software visualization today - Systematic literature review
Software visualization means visualizing various aspects and artifacts related to software. By this definition a wide range of different software engineering aspects from program comprehension to understanding software process and usage are covered. This paper presents the results of systematic literature review spanning six years of software visualization

literature. The main result shows that the most studied topics in the past six years are related to software structure, behavior and evolution. Software process and usage are addressed only in few studies. In the future studying the adoption of software visualization tools in industry context would be beneficial.

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Organisations: Department of Pervasive Computing, Research area: Software engineering, Research area: User experience
Contributors: Mattila, A., Ihantola, P., Kilamo, T., Luoto, A., Nurminen, M., Väätäjä, H.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Temporal dimensions of affect in user experience of digital news in the field
This paper examines temporal dimensions of affective experiences as part of user experience of digital news reading in field conditions in two case studies. The first study focused on user experience of novel browser optimized versions of news for tablet computers. The second study examined the experience of digital replicas. The participants were active readers of newspapers studied. The daily reporting of affect was done over the usage period of one week. The results of both studies showed that there are differences between positive and negative affect, in their dynamism over time and individual differences they captured. The amount of negative emotions was very low with small individual differences and it reduced over time. In contrast, positive affect indicated slightly positive user experience with larger amount of individual differences. Its main dynamism was expressed at the beginning of study.

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Organisations: Department of Pervasive Computing, Research area: User experience, Eindhoven University of Technology
Contributors: Jumisko-Pyykkö, S., Pesonen, E., Väätäjä, H.
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A coordination-based brokerage architecture for multi-cloud resource markets
With an increasing number of service providers in the cloud market, the competition between these is also increasing. Each provider attempts to attract customers by providing a high quality service with lowest possible cost and at the same time trying to make profit. Often, cloud resources are advertised and brokered in a spot market style, i.e., traded for immediate delivery. This paper proposes an architecture for a brokerage model specifically for multi-cloud resource spot markets that integrates the resource brokerage function across several cloud providers. We use a tuple space architecture to facilitate coordination. This architecture supports specifically multiple cloud providers selling unused resources in the spot market. To support the matching process by finding the best match between customer requirements and providers,

offers are matched with regard the lowest possible cost available for the customer in the market at the time of the request. The key role of this architecture is to provide the coordination techniques built on a tuple space, adapted to the cloud spot market.

General information

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Organisations: Dublin City University, Free University of Bolzano-Bozen, School of Computing Edinburgh Napier University Edinburgh
Contributors: Aldawood, S., Fowley, F., Pahl, C., Taibi, D., Liu, X.
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Information Systems
Keywords: Cloud Brokerage Architecture, Cloud Resources Market, Resource Brokerage, Spot Market, Tuple Space
DOIs:
10.1109/W-FiCloud.2016.19
Source: Scopus
Source ID: 85009829349
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

MVP Explained: A Systematic Mapping Study on the Definitions of Minimal Viable Product

Context: One of the most important steps of the Lean Startupmethodology is the definition of Minimum Viable Product (MVP), needed to start the learning process by integrating the early adopters' feedbacks as soon as possible. Objective: This study aims at identifying the common definitions of MVP proposed and the key factors identified to help entrepreneurs efficiently define their MVP, reducing errors due to unconsidered unknown factors. Method: We identified the MVP definitions and key factors by means of a systematic mapping study, defining the research questions and the protocol to be used. We selected the bibliographic sources, the keywords, and the selection criteria for searching the relevant papers. Results: We found 97 articles and, through inclusion and exclusion criteria, removed 75 articles, which reduced the total to 22 at the end of the process. The results are a classification schema for characterizing the definition of Minimum Viable Product in Lean Startups and a set of common key factors identified in the MVP definitions. Conclusion: The identified key factors are related to technical characteristics of the product as well as market and customer aspects. We found a positive improvement of the state of the art of MVP and the definition of Minimum.

General information

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Contributors: Lenarduzzi, V., Taibi, D.
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EXT="Lenarduzzi, Valentina"
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Challenges and capabilities of conductive polymeric materials for electromechanical stimulation of stem cells: A case study

Cell cultivation devices that mimic the complex microenvironment of cells in the human body are of high importance for the future of stem cell research. This paper introduces a prototype of an electromechanical stimulation platform as a modular expansion of an earlier developed mechanical stimulation device for stem cell research. A solution processable ink from PEDOT:PSS and graphene is studied as a suitable material for fabrication of transparent stretchable electrodes. Challenges of electrode integration on a flexible membrane using this material are critically discussed.

General information

Publication status: Published
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Organisations: Department of Automation Science and Engineering
Contributors: Viehrig, M., Tuukkanen, S., Kallio, P.
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ASJC Scopus subject areas: Artificial Intelligence, Human-Computer Interaction, Computer Science Applications
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Bibliographical note

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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Full-duplex mobile device: Pushing the limits

In this article, we address the challenges of transmitter-receiver isolation in mobile full-duplex devices, building on shared-antenna-based transceiver architecture. First, self-adaptive analog RF cancellation circuitry is required, since the ability to track time-varying self-interference coupling characteristics is of utmost importance in mobile devices. In addition, novel adaptive nonlinear DSP methods are also required for final self-interference suppression at digital baseband, since mobile-scale devices typically operate under highly nonlinear low-cost RF components. In addition to describing the above kind of advanced circuit and signal processing solutions, comprehensive RF measurement results from a complete demonstrator implementation are also provided, evidencing beyond 40 dB of active RF cancellation over an 80 MHz waveform bandwidth with a highly nonlinear transmitter power amplifier. Measured examples also demonstrate the good self-healing characteristics of the developed control loop against fast changes in the coupling channel. Furthermore, when complemented by nonlinear digital cancellation processing, the residual self-interference level is pushed down to the noise floor of the demonstration system, despite the harsh nonlinear nature of the self-interference. These findings indicate that deploying the full-duplex principle can indeed also be feasible in mobile devices, and thus be one potential technology in, for example, 5G and beyond radio systems.

General information

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Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Intel Corporation
Contributors: Korpi, D., Tamminen, J., Turunen, M., Huusari, T., Choi, Y. S., Anttila, L., Talwar, S., Valkama, M.
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Image interpolation based on non-local geometric similarities and directional gradients

Image interpolation offers an efficient way to compose a high-resolution (HR) image from the observed low-resolution (LR) image. Advanced interpolation techniques design the interpolation weighting coefficients by solving a minimum mean-square-error (MMSE) problem in which the local geometric similarity is often considered. However, using local geometric similarities cannot usually make the MMSE-based interpolation as reliable as expected. To solve this problem, we propose a robust interpolation scheme by using the nonlocal geometric similarities to construct the HR image. In our proposed method, the MMSE-based interpolation weighting coefficients are generated by solving a regularized least squares problem that is built upon a number of dual-reference patches drawn from the given LR image and regularized by the directional gradients of these patches. Experimental results demonstrate that our proposed method offers a remarkable quality improvement as compared to some state-of-the-art methods, both objectively and subjectively.

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Organisations: Department of Signal Processing, Research group: Video, University of Electronic Science and Technology of China
Contributors: Zhu, S., Zeng, B., Zeng, L., Gabbouj, M.
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ASJC Scopus subject areas: Signal Processing, Media Technology, Computer Science Applications, Electrical and Electronic Engineering
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Source: Scopus
Source ID: 84983409176
Research output: Contribution to journal › Article › Scientific › peer-review

Trading exploits online: A preliminary case study

A software defect that exposes a software system to a cyber security attack is known as a software vulnerability. A software security exploit is an engineered software solution that successfully exploits the vulnerability. Exploits are used to break into computer systems, but exploits are currently used also for security testing, security analytics, intrusion detection, consultation, and other legitimate and legal purposes. A well-established market emerged in the 2000s for software vulnerabilities. The current market segments populated by small and medium-sized companies exhibit signals that may eventually lead to a similar industrialization of software exploits. To these ends and against these industry trends, this paper observes the first online market place for trading exploits between buyers and sellers. The paper adopts three different perspectives to study the case. The paper (a) portrays the studied exploit market place against the historical background in the software security industry. A qualitative assessment is made to (b) evaluate the case against the common characteristics of traditional online market places. The qualitative observations are used in the quantitative part

(c) for predicting the price of exploits with partial least squares regression. The results show that (i) the case is unique from a historical perspective, although (ii) the online market place characteristics are familiar. The regression estimates also indicate that (iii) the pricing of exploits is only partially dependent on such factors as the targeted platform, the date of disclosure of the exploited vulnerability, and the quality assurance service provided by the market place provider. The results allow to contemplate (iv) practical means for enhancing the market place.

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Organisations: University of Turku, Department of Information Technology
Contributors: Ruohonen, J., Hyrynsalmi, S., Leppänen, V.
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Source: Scopus
Source ID: 84987653537
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Asymmetric full-duplex with contiguous downlink carrier aggregation
In this paper, a contiguous carrier aggregation scheme for the downlink transmissions in an inband full-duplex cellular network is analyzed. In particular, we consider a scenario where the base station transmits over a wider bandwidth than the mobiles, while both parties are still using the same center frequency. As a result, the mobiles must cancel their own self-interference over a wider bandwidth, when compared to a situation where the uplink and downlink frequency bands are symmetric. Furthermore, due to the inherent RF impairments in the mobile devices, nonlinear modeling of the self-interference is required in the digital domain to fully cancel it over the whole reception bandwidth. The feasibility of the proposed scheme is demonstrated with real-life RF measurements, using two different bandwidths. In both of these cases, it is shown that the SI can be attenuated below the receiver noise floor over the whole reception bandwidth.

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Contributors: Korpi, D., Anttila, L., Valkama, M.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Exploring synergy between communications, caching, and computing in 5G-grade deployments
Decisive progress in 5G mobile technology, fueled by a rapid proliferation of computation- hungry and delay-sensitive services, puts economic pressure on the research community to rethink the fundamentals of underlying networking architectures. Along these lines, the first half of this article offers a first-hand tutorial on the most recent advances in content-centric networking, emerging user applications, as well as enabling system architectures. We establish that while significant progress has been made along the individual vectors of communications, caching, and computing, together with some promising steps in proposing hybrid functionalities, the ultimate synergy behind a fully integrated solution is not nearly well understood. Against this background, the second half of this work carefully brings into perspective additional important factors, such as user mobility patterns, aggressive application requirements, and associated operator

deployment capabilities, to conduct comprehensive system-level analysis. Furthermore, supported by a full-fledged practical trial on a live cellular network, our systematic findings reveal the most dominant factors in converged 5G-grade communications, caching, and computing layouts, as well as indicate the natural optimization points for system operators to leverage the maximum available benefits.

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Contributors: Andreev, S., Galinina, O., Pyattaev, A., Hosek, J., Masek, P., Yanikomeroglu, H., Koucheryavy, Y.
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Source: Scopus
Source ID: 84982290651
Research output: Contribution to journal › Article › Scientific › peer-review

Toward trusted, social-aware D2D connectivity: Bridging across the technology and sociality realms
Driven by the unprecedented increase of mobile data traffic, D2D communications technology is rapidly moving into the mainstream of the 5G networking landscape. While D2D connectivity originally emerged as a technology enabler for public safety services, it is likely to remain at the heart of the 5G ecosystem by spawning a wide diversity of proximate applications and services. In this work, we argue that the widespread adoption of the direct communications paradigm is unlikely without embracing the concepts of trust and social-aware cooperation between end users and network operators. However, such adoption remains conditional on identifying adequate incentives that engage humans and their connected devices in a plethora of collective activities. To this end, the mission of our research is to advance the vision of social-aware and trusted D2D connectivity, as well as to facilitate its further adoption. We begin by reviewing the various types of underlying incentives with the emphasis on sociality and trust, discuss these factors specifically for humans and for networked devices (machines), and also propose a novel framework allowing construction of much needed incentive-aware D2D applications. Our supportive system-level performance evaluations suggest that trusted and social-aware direct connectivity has the potential to decisively augment network performance. We conclude by outlining the future perspectives of its development across the research and standardization sectors.

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Organisations: Department of Electronics and Communications Engineering, Department of Pervasive Computing, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Universita degli Studi di Reggio Calabria, Ericsson Research and Wireless
Contributors: Ometov, A., Orsino, A., Militano, L., Moltchanov, D., Araniti, G., Olshannikova, E., Fodor, G., Andreev, S., Olsson, T., Iera, A., Torsner, J., Koucheryavy, Y., Mikkonen, T.
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Portable sensor system for reliable condition measurement

Regarding sustainable development, there is a growing need to gather more and more various kinds of measurement, space, and consumption information about property. The necessity for property condition measurement is apparent and the appropriate circumstances, such as indoor air quality and suitable temperature, have an essential influence on comfort and welfare at work and, at the same time, have significance in terms of energy efficiency. This paper presents a portable prototype system for property condition measurement. The objective was to generate a reliable system that improves the quality and also the visual presentation of the collected data. The paper presents the components of the system and the technology utilized to implement the system. The results of piloting in a real-life environment, where particular focus was placed on both controlling energy efficiency and well-being at work, are also presented.

General information

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Organisations: Pori Department, Research group: Software Engineering and Intelligent Systems, Riffid Oy
Contributors: Soini, J., Sillberg, P., Rantanen, P., Nummela, J.
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Source ID: 84983609917
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Utilizing MOOCs in the development of education and training programs

Open education and distance learning are not new pedagogical innovations. However, through the introduction of Massive Open Online Courses (MOOC), they have recently attracted a great deal of attention among educational establishments. MOOCs can be considered a threat to small universities, but, on the other hand, they can also be a means of providing opportunities to develop their core activities. The challenge is how universities will perceive this phenomenon and take advantage of the new chances it brings. This paper examines the utilization of MOOCs from several points of view. The focus is on degree courses and continuing education offered by universities, but in-house personnel training in companies is also discussed. The issue is how to find proper ways to utilize third-party MOOCs in these three domains. Based on our investigations, the paper introduces a preliminary model for exploiting MOOCs in the development of education and training programs.

General information

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Contributors: Linna, P., Mäkinen, T., Keto, H.
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Source ID: 84983684751
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Robust data reconciliation of combustion variables in multi-fuel fired industrial boilers

This paper introduces an application of simultaneous nonlinear data reconciliation and gross error detection for power plants utilizing a complex but computationally light first principle combustion model. Element and energy balances and robust techniques introduce nonlinearity and the consequent optimization problem is solved using nonlinear optimization. Data reconciliation improves estimation of process variables and enables improved sensor quality control and identification of process anomalies. The approach was applied to an industrial 200 MW_{th} fluidized bed boiler combusting wood, peat, bark, and slurry. The results indicate that the approach is valid and is able to perform in various process conditions. As the combustion model is generic, the method is applicable in any boiler environment.

General information

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Organisations: Department of Automation Science and Engineering, Research area: Dynamic Systems, Research area: Measurement Technology and Process Control, Indmeas Ltd.
Contributors: Korpela, T., Suominen, O., Majanne, Y., Laukkanen, V., Lautala, P.
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Keywords: Data reconciliation, Diagnostics, Estimation, Gross error detection, Monitoring, Power plant
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10.1016/j.conengprac.2016.07.002
Source: Scopus
Source ID: 84978710819
Research output: Contribution to journal › Article › Scientific › peer-review

A novel stochastic channel modeling approach for mmWave systems with beamforming

The stochastic channel models typically abstract away the details of the paths that carry energy in the radio channel. While these have been universally acceptable for decades due to their ease of use and reasonable accuracy in most practical cases, the appearance of steerable, narrow-beam antennas in mmWave bands makes the exact path information very valuable, primarily for beam tracking algorithms. Currently, only deterministic channel modeling (e.g. ray tracing) provides the required level of details, but at prohibitive computing cost. This limits the study and design environments for such algorithms to the confines of existing ray tracing data, which is bulky and rarely available for free. In this paper, we consider an approach to stochastic channel modeling that allows to achieve the level of details equivalent to ray tracing, but at a fraction of the computing costs. The proposed approach may be immediately applied to any system operating at 20-100 GHz. It allows the researchers and engineers to perform quick testing of elaborate mmWave MAC and PHY algorithms with a system-level simulation, without having to obtain exhaustive measurement or ray tracing data.

General information

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Contributors: Pyattaev, A., Johnsson, K., Andreev, S., Koucheryavy, Y.
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Applied Mathematics
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Source ID: 84979729800
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Multi-carrier CDMA for network assisted device-to-device communications for an integrated OFDMA cellular system

Device-to-Device communication (D2D) has been a hot research topic in recent years, especially concerning the integration of D2D and conventional cellular networks. In general, the integration improves the efficiency and flexibility of the overall system. Furthermore, D2D can provide partial solutions for some inherent problems of cellular systems, such as cell edge related problems. Currently, most of the D2D integration studies assume that D2D UEs and cellular UEs use identical multiple access (MA) technology for the convenience of integration and backward compatibility. In this paper, besides the conventional OFDMA based D2D, we investigate the use of multicarrier code division multiple access (MC-CDMA) as the MA scheme for D2D UEs. The idea is to use processing gains obtained by spreading against critical interference, especially from cellular UEs. The study is emphasized on interference related issues, including interference analysis of the integrated system, and overall performance enhancement, mainly for D2D UEs, by utilizing frequency domain spreading. Network simulations show the gain against critical interference from cellular UEs. Meanwhile, it is shown that intra-cell cross mode interference control/elimination is the key scheme to guarantee performance of the integrated system. Furthermore, we discuss the potential benefits and procedures of MC-CDMA D2D based cluster integration.

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Source ID: 84979740932
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Novel frequency domain cyclic prefix autocorrelation based compressive spectrum sensing for cognitive radio

Cognitive radio (CR) has received increasing attention and is considered an important solution to the spectral crowding problem. The main idea behind CR technology is to utilize the unused spectral resources which are determined to be available for secondary user by effective spectrum sensing techniques. However, CR technology significantly depends on the spectrum sensing techniques which are applied to detect the presence of primary user (PU) signals. This paper focuses on detecting OFDM primaries using novel frequency-domain cyclic prefix (CP) autocorrelation based compressive spectrum sensing algorithms. To counteract the practical wireless channel effects, frequency domain approaches for PU signal detection are developed. The proposed spectrum sensing method eliminates the effects of both noise uncertainty and frequency selective channels. Using the frequency domain autocorrelation approach results in highly increased flexibility, facilitating robust wideband multi-mode, multi-channel sensing with low complexity. It also allows to sense weak PU signals which are partly overlapped by other strong PU or CR transmissions.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning
Contributors: Dikmese, S., Ilyas, Z., Sofotasios, P., Renfors, M., Valkama, M.

Publication date: 5 Jul 2016

Host publication information
Title of host publication: 2016 IEEE 83rd Vehicular Technology Conference (VTC Spring)
Publisher: IEEE
ISBN (Electronic): 9781509016983
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Applied Mathematics
Keywords: Cognitive radio, Energy detector, Frequency selective channel and noise uncertainty, OFDMVCP, Time and/or frequency domain CP autocorrelation based compressive spectrum sensing
DOIs:
10.1109/VTCSpring.2016.7504368

Bibliographical note
INT=elt,"Ilyas, Zobia"
Source: Scopus
Source ID: 84979752384
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Framework for optimization and scheduling of a copper production plant

This work presents a nonlinear optimization and scheduling approach applied to a copper production plant. The solution maximizes smelting furnace production and provides valid converting schedules by simulating the evolution of the process over the optimization horizon. The production process is briefly described and the main models used to predict and calculate furnace and converter parameters are detailed. Though the solution is concentrated on the main elements, copper and iron, the optimization framework enables easy future augmentation with more complex models. A schedule optimization case is presented.

General information
Publication status: Published
MoE publication type: A3 Part of a book or another research book
Organisations: Department of Automation Science and Engineering, Research area: Dynamic Systems, Research area: Measurement Technology and Process Control
Contributors: Suominen, O., Mörsky, V., Ritala, R., Vilkko, M.
Number of pages: 6
Pages: 1243-1248
Publication date: 25 Jun 2016

Host publication information
Title of host publication: 26th European Symposium on Computer Aided Process Engineering, 2016
Volume: 38
Publisher: Elsevier Science B.V.
ISBN (Print): 9780444634283

Publication series
Name: Computer Aided Chemical Engineering
ISSN (Print): 1570-7946
ASJC Scopus subject areas: Chemical Engineering(all), Computer Science Applications
Keywords: copper smelting, modelling, nonlinear optimization, Scheduling
DOIs:
10.1016/B978-0-444-63428-3.50212-5
URLs:
http://www.scopus.com/inward/record.url?scp=84994385954&partnerID=8YFLogxK (Link to publication in Scopus)

Bibliographical note
JUFOID=70254
Source: Scopus
Source ID: 84994385954
Research output: Chapter in Book/Report/Conference proceeding › Chapter › Scientific › peer-review

Investigating mid-air gestures and handhelds in motion tracked environments

Smart spaces with multiple interactive devices and motion tracking capabilities are becoming more common. However, there is little research on how interaction with one device affects the usage of other devices in the space. We investigate the effects of mobile devices and physical interactive devices on gestural interaction in motion-tracked environments. For our user study, we built a smart space consisting of a gesture-controlled large display, an NFC reader and a mobile device, to simulate a system in which users can transfer information between the space and personal devices. The study with 13 participants revealed that (1) the mobile device affects gesturing as well as passive stance; (2) users may stop

moving completely when they intend to stop interacting with a display; (3) interactive devices with overlapping interaction space make unintentional interaction significantly more frequent. Our findings give implications for gestural interaction design as well as design of motion-tracked smart spaces.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience
Contributors: Mäkelä, V., Korhonen, H., Ojala, J., Järvi, A., Väänänen, K., Raisamo, R., Turunen, M.
Number of pages: 7
Pages: 45-51
Publication date: 20 Jun 2016

Host publication information
Title of host publication: PerDis 2016 - Proceedings of the 5th ACM International Symposium on Pervasive Displays
Publisher: ACM
ISBN (Electronic): 9781450343664
ASJC Scopus subject areas: Computer Networks and Communications, Hardware and Architecture, Computer Graphics and Computer-Aided Design, Computer Science Applications
Keywords: Handhelds, Large displays, Mid-air gestures, Mobile devices, Motion-tracked environments, Smart spaces, Ubiquitous computing
Electronic versions:

Investigating_Mid_Air_Gestures_M_kel_EtAl_PerDis16
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10.1145/2914920.2915015
URLs:

http://urn.fi/URN:NBN:fi:tty-201903291363

Bibliographical note
INT=tie,"Järvi, Antti"
Source: Scopus
Source ID: 84979742748
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Fifty years of graph matching, network alignment and network comparison
In this paper we survey methods for performing a comparative graph analysis and explain the history, foundations and differences of such techniques of the last 50 years. While surveying these methods, we introduce a novel classification scheme by distinguishing between methods for deterministic and random graphs. We believe that this scheme is useful for a better understanding of the methods, their challenges and, finally, for applying the methods efficiently in an interdisciplinary setting of data science to solve a particular problem involving comparative network analysis.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing
Contributors: Emmert-Streib, F., Dehmer, M., Shi, Y.
Number of pages: 18
Pages: 180-197
Publication date: 10 Jun 2016
Peer-reviewed: Yes

Publication information
Journal: Information Sciences
Volume: 346-347
ISSN (Print): 0020-0255
Ratings:

Scopus rating (2016): CiteScore 8.6 SJR 1.781 SNIP 2.515
Original language: English
ASJC Scopus subject areas: Artificial Intelligence, Software, Control and Systems Engineering, Theoretical Computer Science, Computer Science Applications, Information Systems and Management
Keywords: Biological networks, Computational graph theory, Graph matching, Network comparison, Network similarity, Quantitative graph theory
DOIs:

10.1016/j.ins.2016.01.074

Source: Scopus
Source ID: 84964349574
Research output: Contribution to journal › Article › Scientific › peer-review

Linear accelerometers and rate gyros for rotary joint angle estimation of heavy-duty mobile manipulators using forward kinematic modeling

A gravity-referenced joint angle estimation approach is proposed for multiple-degree-of-freedom hydraulic manipulators. The approach is built solely upon easy-to-install linear accelerometers and angular rate gyroscopes to avoid physical contact to rotary joint mechanisms and the use of in-axis sensors. As a significant novelty, a comprehensive kinematics model for linear accelerations acting on the accelerometers during motion is associated with the well-known principles of complementary sensor fusion for the first time, which provides a practical solution for using the force of gravity as an angular reference while in fast motion. In experiments with a serial-link manipulator of a multiton off-road forestry vehicle, gyro-aided sensor fusion employing the kinematics model achieved a joint angle sensing error of less than ±1°, which translated to a centimeter end-effector positioning accuracy. This can be considered a significant result in view of the vibrations oscillating through the manipulator structure, coupled linear accelerations of linkage motion, and nonstatic interaction between the vehicle base and the terrain.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: MMDM, Department of Intelligent Hydraulics and Automation, Research group: Mobile manipulation, Research area: Information Technology for Biology and Health, Research area: Intelligence in Machines, Research area: Signal and Information Processing
Contributors: Vihonen, J., Honkakorpi, J., Tuominen, J., Mattila, J., Visa, A.
Number of pages: 10
Pages: 1765-1774
Publication date: 1 Jun 2016
Peer-reviewed: Yes

Publication information

Journal: IEEE - ASME Transactions on Mechatronics
Volume: 21
Issue number: 3
ISSN (Print): 1083-4435
Ratings:

Scopus rating (2016): CiteScore 8.6 SJR 1.511 SNIP 2.548
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Control and Systems Engineering, Computer Science Applications
Keywords: Kinematics, Manipulators, Microelectromechanical devices
DOIs:

10.1109/TMECH.2016.2544352
Source: Scopus
Source ID: 84970024956
Research output: Contribution to journal › Article › Scientific › peer-review

Visual Voice Activity Detection in the Wild

The visual voice activity detection (V-VAD) problem in unconstrained environments is investigated in this paper. A novel method for V-VAD in the wild, exploiting local shape and motion information appearing at spatiotemporal locations of interest for facial video segment description and the bag of words model for facial video segment representation, is proposed. Facial video segment classification is subsequently performed using the state-of-The-Art classification algorithms. Experimental results on one publicly available V-VAD dataset denote the effectiveness of the proposed method, since it achieves better generalization performance in unseen users, when compared to the recently proposed state-of-The-Art methods. Additional results on a new unconstrained dataset provide evidence that the proposed method can be effective even in such cases in which any other existing method fails.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Aristotle University of Thessaloniki
Contributors: Patrona, F., Iosifidis, A., Tefas, A., Nikolaidis, N., Pitas, I.
Number of pages: 11
Pages: 967-977
Publication date: 1 Jun 2016

Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Multimedia
Volume: 18
Issue number: 6
ISSN (Print): 1520-9210
Ratings:
Scopus rating (2016): CiteScore 8.1 SJR 1.298 SNIP 2.536
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Signal Processing, Media Technology, Computer Science Applications
Keywords: Action Recognition, Bag of Words model, Voice Activity Detection in the wild
DOIs:
10.1109/TMM.2016.2535357
Source: Scopus
Source ID: 84971281783
Research output: Contribution to journal › Article › Scientific › peer-review

Towards semantic self-description of industrial devices and control system interfaces
Information systems in production environments control and gather data in operations integrating multiple devices and systems with various communication interfaces. With the development of smart industrial environments, needing to connect heterogeneous components into systems communicating over the Internet, integration and interoperability challenges emerge. Self-description is regarded as the capability of devices and systems to include descriptions expressing the offered services and information exchange. Further by semantic descriptions they can provide interpretable, meaningful information how to use the service interface but also how to interpret the capabilities and data. The paper presents a Semantic Web technology based approach to harmonize access and utilization of devices and control systems in distributed and dynamic environments. For this two standards based ontologies are developed: an industrial plant model for hierarchical structure and a state model for operational information of system components. To demonstrate the architecture and developed models the approach is applied to the components of a small-scale example industrial process.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Research area: Information Systems in Automation, Fortiss GmbH
Contributors: Hästbacka, D., Zoitl, A.
Number of pages: 6
Pages: 879-884
Publication date: 19 May 2016

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Title of host publication: 2016 IEEE International Conference on Industrial Technology (ICIT)
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 9781467380751
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications
DOIs:
10.1109/ICIT.2016.7474867
Source: Scopus
Source ID: 84974588366
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Coordinating proactive social devices in a mobile cloud: Lessons learned and a way forward
Recent device shipment trends strongly indicate that the number of Web-enabled devices other than PCs and smart phones are growing rapidly. Marking the end of the dominant era of these two traditional device categories, people will soon commonly use various types of Internet-connected devices in their daily lives, where no single device will dominate. Since today's devices are mostly standalone and only stay in sync in limited ways, new approaches are needed for mastering the complexity arising from the world of many types of devices, created by different manufacturers and implementing competing standards. Today, the most common denominator for dealing with the differences is using clouds. Unfortunately, however, while the cloud is well suited for numerous activities, there are also serious limitations, especially when considering systems that consist of numerous, battery-powered computing devices that have limited connectivity. In this paper, we provide an insight to our research where totally cloud-based orchestration of cooperating devices is partitioned into more local actions, where constant communication with the cloud backend can be at least partially omitted.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering
Contributors: Mäkitalo, N., Aaltonen, T., Mikkonen, T.
Number of pages: 10
Pages: 179-188
Publication date: 14 May 2016

Host publication information
Title of host publication: MOBILESoft '16 Proceedings of the International Conference on Mobile Software Engineering and Systems
Publisher: ACM
ISBN (Electronic): 9781450341783
ASJC Scopus subject areas: Control and Systems Engineering, Software, Computer Science Applications, Signal Processing
Keywords: Cloud computing, Cyber-physical systems, Internet of things, Mobile cloud, Multi-device ownership, Multi-device programming
DOIs:
10.1145/2897073.2897079
Source: Scopus
Source ID: 84983554842
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Characterizing rate limiting steps in transcription from RNA production times in live cells
Motivation: Single-molecule measurements of live Escherichia coli transcription dynamics suggest that this process ranges from sub- to super-Poissonian, depending on the conditions and on the promoter. For its accurate quantification, we propose a model that accommodates all these settings, and statistical methods to estimate the model parameters and to select the relevant components. Results: The new methodology has improved accuracy and avoids overestimating the transcription rate due to finite measurement time, by exploiting unobserved data and by accounting for the effects of discrete sampling. First, we use Monte Carlo simulations of models based on measurements to show that the methods are reliable and offer substantial improvements over previous methods. Next, we apply the methods on measurements of transcription intervals of different promoters in live E. coli, and show that they produce significantly different results, both in low- and high-noise settings, and that, in the latter case, they even lead to qualitatively different results. Finally, we demonstrate that the methods can be generalized for other similar purposes, such as for estimating gene activation kinetics. In this case, the new methods allow quantifying the inducer uptake dynamics as opposed to just comparing them between cases, which was not previously possible. We expect this new methodology to be a valuable tool for functional analysis of cellular processes using single-molecule or single-event microscopy measurements in live cells.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research group: Laboratory of Biosystem Dynamics-LBD, Department of Signal Processing
Contributors: Häkkinen, A., Ribeiro, A. S.
Number of pages: 7
Pages: 1346-1352
Publication date: 1 May 2016
Peer-reviewed: Yes

Publication information
Journal: Bioinformatics
Volume: 32
Issue number: 9
ISSN (Print): 1367-4803
Ratings:
Scopus rating (2016): CiteScore 10.8 SJR 5.21 SNIP 2.336
Original language: English
ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computational Theory and Mathematics, Computer Science Applications, Computational Mathematics, Statistics and Probability
DOIs:
10.1093/bioinformatics/btv744
Source: Scopus
Source ID: 84966359423
Research output: Contribution to journal › Article › Scientific › peer-review

Feasibility characterization of cryptographic primitives for constrained (wearable) IoT devices

The Internet of Things (IoT) employs smart devices as its building blocks for developing a ubiquitous communication framework. It thus supports a wide variety of application domains, including public safety, healthcare, education, and public transportation. While offering a novel communication paradigm, IoT finds its requirements closely connected to the security issues. The role of security following the fact that a new type of devices known as wearables constitute an emerging area. This paper delivers an applicability study of the state-of-the-art cryptographic primitives for wearable IoT devices, including the pairing-based cryptography. Pairing-based schemes are well-recognized as fundamental enablers for many advanced cryptographic applications, such as privacy protection and identity-based encryption. To deliver a comprehensive view on the computational power of modern wearable devices (smart phones, watches, and embedded devices), we perform an evaluation of a variety of them utilizing bilinear pairing for real-time communication. In order to deliver a complete picture, the obtained bilinear pairing results are complemented with performance figures for classical cryptography (such as block ciphers, digital signatures, and hash functions). Our findings show that wearable devices of today have the needed potential to efficiently operate with cryptographic primitives in real time. Therefore, we believe that the data provided during this research would shed light on what devices are more suitable for certain cryptographic operations.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno
Contributors: Ometov, A., Masek, P., Malina, L., Florea, R., Hosek, J., Andreev, S., Hajny, J., Niutanen, J., Koucheryavy, Y.
Publication date: 19 Apr 2016

Host publication information

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ISBN (Print): 9781509019410
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Human-Computer Interaction
Keywords: Bilinear Pairing, Cryptography, Group Signatures, IoT, Performance evaluation, Wearables
Electronic versions:

Feasibility characterization of cryptographic primitives 2016
DOIs:

10.1109/PERCOMW.2016.7457161
URLs:

http://urn.fi/URN:NBN:fi:tuni-202003092613

Bibliographical note

INT=elt,"Florea, Roman"
EXT="Niutanen, Jussi"
Source: Scopus
Source ID: 84966546696
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

A unifying perspective on proximity-based cellular-assisted mobile social networking

Today, the rapid adoption of mobile social networking is changing how and where humans communicate. As a result, in recent years we have been increasingly moving from physical (e.g., face-to-face) to virtual interaction. However, there is also a new emerging category of social applications that take advantage of both worlds, that is, using virtual interaction to enhance physical interaction. This novel form of networking is enabled by D2D communication between/among the laptops, smartphones, and wearables of persons in proximity of each other. Unfortunately, it has remained limited by the fact that most people are simply not aware of the many potential virtual opportunities in their proximity at any given time. This is a result of the very real digital privacy and security concerns surrounding direct communication between stranger devices. Fortunately, these concerns can be mitigated with the help of a centralized trusted entity, such as a cellular service provider, which can not only authenticate and protect the privacy of devices involved into D2D communication, but also facilitate the discovery of device capabilities and their available content. This article offers an extensive research summary behind this type of cellular-assisted D2D communication, detailing the enabling technology and its implementation, relevant usage scenarios, security challenges, and user experience observations from large-scale deployments.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Department of Pervasive Computing, Research area: Software engineering
Contributors: Andreev, S., Hosek, J., Olsson, T., Johnsson, K., Pyattaev, A., Ometov, A., Olshannikova, E., Gerasimenko, M., Masek, P., Koucheryavy, Y., Mikkonen, T.
Number of pages: 9
Pages: 108-116
Publication date: 1 Apr 2016
Peer-reviewed: Yes

Publication information
Journal: IEEE Communications Magazine
Volume: 54
Issue number: 4
ISSN (Print): 0163-6804
Ratings:

Scopus rating (2016): CiteScore 17.7 SJR 2.298 SNIP 5.041
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computer Networks and Communications
DOIs:

10.1109/MCOM.2016.7452274
Source: Scopus
Source ID: 84964277259
Research output: Contribution to journal › Article › Scientific › peer-review

On feasibility of 5G-grade dedicated RF charging technology for wireless-powered wearables
For decades, wireless energy transfer and harvesting received focused attention in the research community, but with limited practical applications. Recently, with the development of fifth-generation (5G) mobile technology, the concept of dedicated radio-frequency (RF) charging promises to support the growing market of wearable devices. In this work we shed light on the potential of wireless RF power transfer by elaborating upon feasible system parameters and architecture, emphasizing the basic tradeoffs behind omni-directional and directional out-of-band energy transmission, providing system- level performance evaluation, and discussing open challenges on the way to sustainable wireless- powered wearables. The key aspects highlighted in this article include system operation choices, user mobility effects, impact of network and user densities, and regulatory issues. Ultimately, our research aims to facilitate the integration of wireless RF charging technology into the emerging 5G ecosystem.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, University of Manitoba, Univ of Oulu
Contributors: Galinina, O., Tabassum, H., Mikhaylov, K., Andreev, S., Hossain, E., Koucheryavy, Y.
Number of pages: 10
Pages: 28-37
Publication date: 1 Apr 2016
Peer-reviewed: Yes

Publication information
Journal: IEEE Wireless Communications
Volume: 23
Issue number: 2
ISSN (Print): 1536-1284
Ratings:

Scopus rating (2016): CiteScore 14.2 SJR 2.082 SNIP 3.875
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering
DOIs:

10.1109/MWC.2016.7462482
Source: Scopus
Source ID: 84968750633
Research output: Contribution to journal › Article › Scientific › peer-review

Detection of bubbles as concentric circular arrangements

The paper proposes a method for the detection of bubble-like transparent objects in a liquid. The detection problem is non-trivial since bubble appearance varies considerably due to different lighting conditions causing contrast reversal and multiple interreflections. We formulate the problem as the detection of concentric circular arrangements (CCA). The CCAs are recovered in a hypothesize-optimize-verify framework. The hypothesis generation is based on sampling from the partially linked components of the non-maximum suppressed responses of oriented ridge filters, and is followed by the CCA parameter estimation. Parameter optimization is carried out by minimizing a novel cost-function. The performance was tested on gas dispersion images of pulp suspension and oil dispersion images. The mean error of gas/oil volume estimation was used as a performance criterion due to the fact that the main goal of the applications driving the research was the bubble volume estimation. The method achieved 28 and 13 % of gas and oil volume estimation errors correspondingly outperforming the OpenCV Circular Hough Transform in both cases and the WaldBoost detector in gas volume estimation.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Vision, Research Community on Data-to-Decision (D2D), Machine Vision and Pattern Recognition Laboratory, Lappeenranta University of Technology, Computer Vision Group, Czech Technical University in Prague, Monash University Malaysia
Contributors: Strokina, N., Matas, J., Eerola, T., Lensu, L., Kälviäinen, H.
Number of pages: 10
Pages: 387-396
Publication date: Apr 2016
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Early online date: 10 Feb 2016

Publication information

Journal: Machine Vision and Applications
Volume: 27
Issue number: 3
ISSN (Print): 0932-8092
Ratings:

Scopus rating (2016): CiteScore 4.7 SJR 0.741 SNIP 1.433
Original language: English
ASJC Scopus subject areas: Hardware and Architecture, Computer Vision and Pattern Recognition, Software, Computer Science Applications
Keywords: Bubble detection, Circular arrangements, Image processing, Machine vision, Object segmentation
DOIs:

10.1007/s00138-016-0749-7
Source: Scopus
Source ID: 84957656160
Research output: Contribution to journal › Article › Scientific › peer-review

Digital predistortion for mitigating spurious emissions in spectrally agile radios

Spectrally non-contiguous transmissions pose serious transceiver design challenges due to the nonlinear PA. When two or more non-contiguous carriers with close proximity are amplified by the same PA, spurious emissions inside or in the vicinity of the transmitter RF band are created. These spurious emissions may violate emission limits or otherwise compromise network coverage and reliability. Lowering the transmit power is a straightforward remedy, but it will reduce throughput, coverage, and power efficiency of the device. To improve linearity without sacrificing performance, several DPD techniques have recently been proposed to target the spurious emissions explicitly. These techniques are designed to minimize the computational and hardware complexity of DPD, thus making them better suited for mobile terminals and other lowcost devices. In this article, these recent advances in DPD for non-contiguous transmission scenarios are discussed, with a focus on mitigating the spurious emissions in the concrete example case of non-contiguous dual-carrier transmission. The techniques are compared to more traditional DPD approaches in terms of their computational and hardware complexities, as well as linearization performance.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Qualcomm Inc., Wireless Innovation Laboratory at Worcester Polytechnic Institute
Contributors: Abdelaziz, M., Fu, Z., Anttila, L., Wyglinski, A. M., Valkama, M.
Number of pages: 10

Pages: 60-69
Publication date: 1 Mar 2016
Peer-reviewed: Yes

Publication information
Journal: IEEE Communications Magazine
Volume: 54
Issue number: 3
ISSN (Print): 0163-6804
Ratings:
Scopus rating (2016): CiteScore 17.7 SJR 2.298 SNIP 5.041
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computer Networks and Communications
DOIs:
10.1109/MCOM.2016.7432149
Source: Scopus
Source ID: 84963776001
Research output: Contribution to journal › Article › Scientific › peer-review

Highly dynamic spectrum management within licensed shared access regulatory framework

Historical fragmentation in spectrum access models accentuates the need for novel concepts that allow for efficient sharing of already available but underutilized spectrum. The emerging LSA regulatory framework is expected to enable more advanced spectrum sharing between a limited number of users while guaranteeing their much needed interference protection. However, the ultimate benefits of LSA may in practice be constrained by space-time availability of the LSA bands. Hence, more dynamic LSA spectrum management is required to leverage such realtime variability and sustain reliability when, for example, the original spectrum user suddenly revokes the previously granted frequency bands as they are required again. In this article, we maintain the vision of highly dynamic LSA architecture and rigorously study its future potential, from reviewing market opportunities and discussing available technology implementations to conducting performance evaluation of LSA dynamics and outlining the standardization landscape. Our investigations are based on a comprehensive system-level evaluation framework, which has been specifically designed to assess highly dynamic LSA deployments.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno
Contributors: Ponomarenko-Timofeev, A., Pyattaev, A., Andreev, S., Koucheryavy, Y., Mueck, M., Karls, I.
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Pages: 100-109
Publication date: 1 Mar 2016
Peer-reviewed: Yes

Publication information
Journal: IEEE Communications Magazine
Volume: 54
Issue number: 3
ISSN (Print): 0163-6804
Ratings:
Scopus rating (2016): CiteScore 17.7 SJR 2.298 SNIP 5.041
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computer Networks and Communications
DOIs:
10.1109/MCOM.2016.7432155

Bibliographical note
INT=elt,"Ponomarenko-Timofeev, Aleksei"
Source: Scopus
Source ID: 84963721319
Research output: Contribution to journal › Article › Scientific › peer-review

Random Value Impulse Noise Removal Based on Most Similar Neighbors

A novel filter based on four most similar neighbors (MSN) is proposed in this paper which considers all the pixels of the sliding window except the central pixel after taking the first order absolute differences from the central pixel. The proposed filter is composed of two steps: noise detection followed by filtering. In noise detection, first order absolute differences are calculated and sorted in ascending order. Clusters of equal sizes are formed based on most similar pixels and then fuzzy rules are applied to detect the noise present in the current pixel. Threshold parameters are set adaptively. In filtering phase, median based fuzzy filter is used to restore the corrupted pixels. Experimental results show that the proposed filter outperforms several state-of-the-art filers for random value impulse noise removal in an image.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, International Islamic University Islamabad
Contributors: Habib, M., Rasheed, S., Hussain, A., Ali, M.
Number of pages: 5
Pages: 329-333
Publication date: 26 Feb 2016

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Publisher: IEEE
ISBN (Print): 9781467396660
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Keywords: fuzzy logic, Image processing, impulse noise, noise removal
DOIs:
10.1109/FIT.2015.64

Bibliographical note

INT=elt,"Ali, Mubashir"
Source: Scopus
Source ID: 84964689604
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Quantitative + qualitative information for heritage conservation: An open science research for paving 'collaboratively' the way to historical-BIM

Insofar as our cultural heritage (CH) has become not only an economic resource but a key element in defining our identity, its accurate and flexible documentation has emerged as an essential task. The generation of 3D information with physical and functional characteristics is now possible through the connection of survey data with Historical Building Information Modeling (HBIM). However, few studies have focused on the semantic enrichment process of models based on point clouds, especially on the field of cultural heritage. These singularities make the conversion of point cloud to 'as-built' HBIM an expensive process from the mathematical and computational viewpoint. At present, there is no software that guarantees automatic and efficient data conversion in architectural or urban contexts. The ongoing research 'Documenting and Visualizing Industrial Heritage' is conducted by the School of Architecture, Tampere University of Technology, Finland based on an Open Notebook Reserarch Model. It is focused on advance the knowledge of digital operating environments for the representation and management of historical buildings and sites. On the one hand, the research is advancing in three-dimensional 'as-built' modeling based on remote sensing data, while on the other hand is aiming to incorporate more qualitative information based on concepts of production and management in the lifecycle of the built environment. The purpose of this presentation is to discuss the different approaches to date on the HBIM generation chain: from 3D point cloud data collection to semantically enriched parametric models.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: School of Architecture, Research group: EDGE, Michigan Technological University, University of Valladolid
Contributors: Garcia-Fernandez, J., Joutsiniemi, A., Ahn, Y., Fernandez, J. J.
Number of pages: 2
Pages: 207-208
Publication date: 24 Feb 2016

Host publication information

Title of host publication: 2015 Digital Heritage International Congress, Digital Heritage 2015
Publisher: IEEE
ISBN (Print): 9781509000487
ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Science Applications, Information Systems, Archaeology, Cultural Studies
Keywords: BIM, Conservation, HBIM, Heritage, Open Science, Remote Sensing

DOIs:
10.1109/DigitalHeritage.2015.7419495
Source: Scopus
Source ID: 84965156312
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

First-principles data set of 45,892 isolated and cation-coordinated conformers of 20 proteinogenic amino acids
We present a structural data set of the 20 proteinogenic amino acids and their amino-methylated and acetylated (capped) dipeptides. Different protonation states of the backbone (uncharged and zwitterionic) were considered for the amino acids as well as varied side chain protonation states. Furthermore, we studied amino acids and dipeptides in complex with divalent cations (Ca^{2+}, Ba^{2+}, Sr^{2+}, Cd^{2+}, Pb^{2+}, and Hg^{2+}). The database covers the conformational hierarchies of 280 systems in a wide relative energy range of up to 4 eV (390 kJ/mol), summing up to a total of 45,892 stationary points on the respective potential-energy surfaces. All systems were calculated on equal first-principles footing, applying density-functional theory in the generalized gradient approximation corrected for long-range van der Waals interactions. We show good agreement to available experimental data for gas-phase ion affinities. Our curated data can be utilized, for example, for a wide comparison across chemical space of the building blocks of life, for the parametrization of protein force fields, and for the calculation of reference spectra for biophysical applications.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Physics, Fritz Haber Institute of the Max Planck Society, COMP Centre of Excellence, Department of Applied Physics, Aalto University, Aalto University, Duke University
Contributors: Ropo, M., Schneider, M., Baldauf, C., Blum, V.
Publication date: 16 Feb 2016
Peer-reviewed: Yes

Publication information
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Volume: 3
Article number: 160009
ISSN (Print): 2052-4463
Ratings:
Scopus rating (2016): CiteScore 4.7 SJR 3.261 SNIP 2.208
Original language: English
ASJC Scopus subject areas: Education, Library and Information Sciences, Computer Science Applications, Information Systems, Statistics, Probability and Uncertainty, Statistics and Probability
Electronic versions:
ropo et al - First-principles data set
DOIs:
10.1038/sdata.2016.9
URLs:
http://urn.fi/URN:NBN:fi:tty-201607294339
Source: Scopus
Source ID: 84961184519
Research output: Contribution to journal › Article › Scientific › peer-review

Lean manufacturing methods in simulation literature: Review and association analysis
The lean manufacturing philosophy includes several methods that aim to remove waste from production. This paper studies lean manufacturing methods and how simulation is used to consider them. In order to do this, it reviews papers that study simulation together with lean methods. The papers that are reviewed are categorized according to the lean methods used and result types obtained. Analysis is performed in order to gain knowledge about the volumes of occurrence of different methods and result types. Typical methods in the papers are different types of value stream mapping and work-in-process models. An exploratory analysis is performed to reveal the relationships between the methods and result types. This is done using association analysis. It reveals the methods that are commonly studied together in the literature. The paper also lists research areas that are not considered in the literature. These areas are often related to the analysis of variation.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Mechanical Engineering and Industrial Systems, Research area: Manufacturing and Automation, Aalto University, Department of Engineering Design and Production
Contributors: Tokola, H., Niemi, E., Väistö, V.

Number of pages: 10
Pages: 2239-2248
Publication date: 16 Feb 2016

Host publication information

Title of host publication: 2015 Winter Simulation Conference (WSC)
ISBN (Print): 978-1-4673-9743-8
ASJC Scopus subject areas: Software, Modelling and Simulation, Computer Science Applications
DOIs:
10.1109/WSC.2015.7408336

Bibliographical note

EXT="Niemi, Esko"
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Guest editorial special issue on the internet of nano things

The six papers in this special section focus on the Internet of nanotechnology things. While researchers are currently investigating these challenges to develop fully functional nano communication systems, a question remains as to whether they can represent an extended communication network that is part of the broader Internet. These papers address new solutions for the Internet of Nano Things. The Internet of Things paradigm has transformed the way we operate our personal and professional lives, it is driving our economy and will continue to enable many new opportunities in broad research areas. As this pervasive and ubiquitous interconnection of our everyday life appliances continues into the future, new types of devices enabled by nano and biotechnology promise to push engineering to previously unexplored application domains, where the exchange of information and access from/to the broader Internet for their monitoring and control are even more essential. The research on nanoscale communication and networks aims to develop systems for interconnecting these novel devices at the nanoscale, i.e., the Internet of Nano Things.

General information

Publication status: Published
MoE publication type: B1 Article in a scientific magazine
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Nano Communication Centre, State University of New York, University of Nebraska - Lincoln
Contributors: Balasubramaniam, S., Jornet, J. M., Pierobon, M., Koucheryavy, Y.
Number of pages: 3
Pages: 1-3
Publication date: 1 Feb 2016
Peer-reviewed: No

Publication information

Journal: IEEE Internet of Things Journal
Volume: 3
Issue number: 1
ISSN (Print): 2327-4662
Ratings:
Scopus rating (2016): CiteScore 8 SJR 1.447 SNIP 6.181
Original language: English
ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Hardware and Architecture, Information Systems, Signal Processing, Information Systems and Management
DOIs:
10.1109/JIOT.2016.2516838
Source: Scopus
Source ID: 84959329564
Research output: Contribution to journal › Article › Scientific

An image generator platform to improve cell tracking algorithms simulation of objects of various morphologies, kinetics and clustering

Several major advances in Cell and Molecular Biology have been made possible by recent advances in livecell microscopy imaging. To support these efforts, automated image analysis methods such as cell segmentation and tracking during a time-series analysis are needed. To this aim, one important step is the validation of such image processing methods. Ideally, the "ground truth" should be known, which is possible only by manually labelling images or in artificially produced images. To simulate artificial images, we have developed a platform for simulating biologically inspired objects, which generates bodies with various morphologies and kinetics and, that can aggregate to form clusters. Using this platform, we tested and compared four tracking algorithms: Simple Nearest-Neighbour (NN), NN with Morphology and two DBSCAN-based methods. We show that Simple NN works well for small object velocities, while the others perform better on higher velocities and when clustering occurs. Our new platform for generating new benchmark images to test image

analysis algorithms is openly available at (http://griduni.uninova.pt/Clustergen/ClusterGen-v1.0.zip).

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Laboratory of Biosystem Dynamics-LBD, Campus FCT-UNL
Contributors: Canelas, P., Martins, L., Mora, A., S. Ribeiro, A., Fonseca, J.
Number of pages: 12
Pages: 44-55
Publication date: 2016

Host publication information
Title of host publication: SIMULTECH 2016 - Proceedings of the 6th International Conference on Simulation and Modeling Methodologies, Technologies and Applications
Publisher: SCITEPRESS
ISBN (Electronic): 9789897581991
ASJC Scopus subject areas: Modelling and Simulation, Computational Theory and Mathematics, Computer Science Applications, Information Systems
Keywords: Cell Tracking, Cluster Tracking, Microscopy, Synthetic Time-lapse Image Simulation
Source: Scopus
Source ID: 84991211006
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Brownfield Process: A method for modular product family development aiming for product configuration
Modularisation, product platforms, product families and product configuration are efficient product structuring tactics in mass customisation. Industry needs descriptions of how the engineering should be done in this context. We suggest that key engineering concepts in this field are partitioning logic, set of modules, interfaces, architecture and configuration knowledge. A literature review reveals that methods consider these concepts partly or with different combinations, but considering all of them is rare. Therefore, a design method known as the Brownfield Process is presented. The method is applied to an industrial case in which the aim was rationalisation of existing product variety towards a modular product family that enables product configuration. We suggest that the method is valuable in cases with similar goals.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research area: Design, Development and LCM, Department of Mechanical Engineering and Industrial Systems
Contributors: Pakkanen, J., Juuti, T., Lehtonen, T.
Number of pages: 32
Pages: 210-241
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: DESIGN STUDIES
Volume: 45B
ISSN (Print): 0142-694X
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Scopus rating (2016): CiteScore 5.1 SJR 1.32 SNIP 2.622
Original language: English
ASJC Scopus subject areas: Engineering(all), Architecture , Computer Science Applications, Artificial Intelligence, Social Sciences(all), Arts and Humanities (miscellaneous)
Keywords: Design method, Design process, Engineering design, Product design, Product development
Electronic versions:

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URLs:

http://urn.fi/URN:NBN:fi:tty-201608194419
Source: Scopus
Source ID: 84967235654
Research output: Contribution to journal › Article › Scientific › peer-review

Digital storytelling promoting twenty-first century skills and student engagement

This article presents results on how students became engaged and motivated when using digital storytelling in knowledge creation in Finland, Greece and California. The theoretical framework is based on sociocultural theories. Learning is seen as a result of dialogical interactions between people, substances and artefacts. This approach has been used in the creation of the Global Sharing Pedagogy (GSP) model for the empirical study of student levels of engagement in learning twenty-first century skills. This model presents a set of conceptual mediators for student-driven knowledge creation, collaboration, networking and digital literacy. Data from 319 students were collected using follow-up questionnaires after the digital storytelling project. Descriptive statistical methods, correlations, analysis of variance and regression analysis were used. The mediators of the GSP model strongly predicted student motivation and enthusiasm as well as their learning outcomes. The digital storytelling project, using the technological platform Mobile Video Experience (MoViE), was very successful in teaching twenty-first century skills.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Pori Department, University of Helsinki
Contributors: Niemi, H., Multisilta, J.
Pages: 451-468
Publication date: 2016
Peer-reviewed: Yes

Publication information

Journal: Technology, Pedagogy and Education
Volume: 25
Issue number: 4
ISSN (Print): 1475-939X
Ratings:

Scopus rating (2016): CiteScore 2.4 SJR 0.906 SNIP 1.557
Original language: English
ASJC Scopus subject areas: Education, Communication, Computer Science Applications, Information Systems
Keywords: engagement, learning, motivation, twenty-first century skills
DOIs:

10.1080/1475939X.2015.1074610
URLs:

http://www.scopus.com/inward/record.url?scp=84939476760&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84939476760
Research output: Contribution to journal › Article › Scientific › peer-review

Dots-on-the-fly electron beam lithography

We demonstrate a novel approach for electron-beam lithography (EBL) of periodic nanostructures. This technique can rapidly produce arrays of various metallic and etched nanostructures with line and pitch dimensions approaching the beam spot size. Our approach is based on often neglected functionality which is inherent in most modern EBL systems. The raster/vector beam exposure system of the EBL software is exploited to produce arrays of pixel-like spots without the need to define coordinates for each spot in the array. Producing large arrays with traditional EBL techniques is cumbersome during pattern design, usually leads to large data files and easily results in system memory overload during patterning. In Dots-on-The-fly (DOTF) patterning, instead of specifying the locations of individual spots, a boundary for the array is given and the spacing between spots within the boundary is specified by the beam step size. A designed pattern element thus becomes a container object, with beam spacing acting as a parameterized location list for an array of spots confined by that container. With the DOTF method, a single pattern element, such as a square, rectangle or circle, can be used to produce a large array containing thousands of spots. In addition to simple arrays of nano-dots, we expand the technique to produce more complex, highly tunable arrays and structures on substrates of silicon, ITO/ FTO coated glass, as well as uncoated fused silica, quartz and sapphire.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Optoelectronics Research Centre, Research group: Nanophotonics
Contributors: Isotalo, T. J., Niemi, T.
Number of pages: 7
Publication date: 2016

Host publication information

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Article number: 97771E
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ISSN (Print): 0277-786X
ISSN (Electronic): 1996-756X
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics
Keywords: electron beam lithography, nano-fabrication, nano-particle arrays, optoelectronics, periodic nano-structures, plasmonics
DOIs:
10.1117/12.2219136
Source: Scopus
Source ID: 84981516864
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Fabrication and characterization of broadband superluminescent diodes for 2 μm wavelength
Single-mode superluminescent diodes operating at 2 μm wavelength are reported. The structures are based on GaSb material systems and were fabricated by molecular beam epitaxy. Several waveguide designs have been implemented. A continuous-wave output power higher than 35 mW is demonstrated for a spectrum centered at around 1.92 μm. We show that the maximum output power of the devices is strongly linked to spectrum width. Device having low output power exhibit a wide spectrum with a full-width half-maximum (FWHM) as large as 209 nm, while devices with highest output power exhibit a narrower spectrum with about 61 nm FWHM.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Contributors: Zia, N., Viheriälä, J., Koskinen, R., Koskinen, M., Suomalainen, S., Guina, M.
Publication date: 2016

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Publisher: SPIE
Article number: 97680Q
ISBN (Electronic): 9781510600034

Publication series
Name: Proceedings of SPIE
Volume: 9768
ISSN (Print): 0277-786X
ISSN (Electronic): 1996-756X
ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Gallium antimonide, SLD design, Superluminescent diodes, Tilt waveguide
Electronic versions:
Proc_SPIE_9768_97680Q_N._Zia_et_al_author_prepared_version
DOIs:
10.1117/12.2209720
URLs:
http://urn.fi/URN:NBN:fi:tty-201706201608

Bibliographical note
INT=orc,"Koskinen, Mervi"
Source: Scopus
Source ID: 84978727362
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Graph Embedded Extreme Learning Machine

In this paper, we propose a novel extension of the extreme learning machine (ELM) algorithm for single-hidden layer feedforward neural network training that is able to incorporate subspace learning (SL) criteria on the optimization process followed for the calculation of the network's output weights. The proposed graph embedded ELM (GEELM) algorithm is able to naturally exploit both intrinsic and penalty SL criteria that have been (or will be) designed under the graph embedding framework. In addition, we extend the proposed GEELM algorithm in order to be able to exploit SL criteria in arbitrary (even infinite) dimensional ELM spaces. We evaluate the proposed approach on eight standard classification problems and nine publicly available datasets designed for three problems related to human behavior analysis, i.e., the recognition of human face, facial expression, and activity. Experimental results denote the effectiveness of the proposed approach, since it outperforms other ELM-based classification schemes in all the cases.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
Pages: 311 - 324
Publication date: 2016
Peer-reviewed: Yes

Publication information

Journal: IEEE Transactions on Cybernetics
Volume: 46
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ISSN (Print): 2168-2267
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Human-Computer Interaction, Information Systems, Software, Control and Systems Engineering, Electrical and Electronic Engineering
DOIs:

10.1109/TCYB.2015.2401973
Research output: Contribution to journal › Article › Scientific › peer-review

High-power 1550 nm tapered DBR lasers fabricated using soft UV-nanoimprint lithography

Paper reports the DBR-RWG surface grating design, the fabrication process, and the output characteristics of tapered DBR laser diodes for the applications, like for example LIDAR and range finding, that require eye-safe high-power single-mode coherent light sources. The fabricated regrowth-free DBR AlGaInAs/InP lasers exhibited a CW output power as high as 560 mW in single-mode operation at room temperature. At maximum output power the SMSR was 38 dB, proving the excellent behavior of the surface gratings. The tapered section enabled scaling the maximum CW power at room temperature from 125 mW to 560 mW, by increasing its length from 0.5 mm to 4.0 mm. The paper discusses the limitations and performance variation associated to the power scaling by using the tapered section length as a scaling parameter.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Nanophotonics, Research group: Semiconductor Technology and Applications, Materials Research Laboratory, Turun Yliopisto/Turun Biomateriaalikeskus
Contributors: Viheriälä, J., Aho, A. T., Mäkelä, J., Salmi, J., Virtanen, H., Leinonen, T., Dumitrescu, M., Guina, M.
Number of pages: 7
Publication date: 2016

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Article number: 97330Q
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Publication series

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Publisher: SPIE
Volume: 9733
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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: 1550 nm laser diode, DBR, Power scaling, Tapered laser diode
DOIs:
10.1117/12.2207423

Bibliographical note
INT=orc,"Aho, Antti T."
JUFOID=71479
Source: Scopus
Source ID: 84978785955
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Hot pen and laser writable photonic polymer films
An orange-reflecting photonic polymer film has been fabricated based on a hydrogen-bonded cholesteric liquid crystalline (CLC) polymer consisting of non-reactive (R)-(+)-3-methyladipic acid as the chiral dopant. This polymer film can be patterned easily by evaporating the chiral dopant at specific locations with a hot pen or a laser beam. Removal of chiral dopant leads to a decrease in the helical pitch at the heat treated areas leading to a change in color from orange to green revealing a high contrast pattern. The photonic patterns are irreversible and stable at ambient conditions. This makes such a CLC polymer film interesting as writable photonic paper.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Eindhoven University of Technology
Contributors: Moirangthem, M., Stumpel, J. E., Alp, B., Teunissen, P., Bastiaansen, C. W. M., Schenning, A. P. H. J.
Publication date: 2016

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Publisher: SPIE
Article number: 97690Y
ISBN (Electronic): 9781510600041
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics
Keywords: Cholesteric liquid crystals, laser writing, patterned surface, photonic paper, thermal writing
DOIs:
10.1117/12.2209065
URLs:
http://www.scopus.com/inward/record.url?scp=84982292427&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84982292427
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

HTML5-based mobile agents for Web-of-Things
Systems and services utilizing Internet-of-Things can benefit from dynamically updated software in a significant way. In this paper we show how the most advanced variant of moving code, mobile agents, can be used for operating and managing Internet-connected systems composed of gadgets, sensors and actuators. We believe that the use of mobile agents brings several benefits, for example, mobile agents help to reduce the network load, overcome network latency, and encapsulate protocols. In addition, they can perform autonomous tasks that would otherwise require extensive configuration. The need for moving agents is even more significant if the applications and other factors of the over experience should follow the user to new contexts. When multiple agents are used to provide the user with services, some mechanisms to manage the agents are needed. In the context of Internet-of-Things such management should reflect the physical spaces and other relevant contexts. In this paper we describe the technical solutions used in implementation of the mobile agents, describe two proof concepts and we also compare our solution to related work. We also describe our visions of the future work.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Software engineering
Contributors: Voutilainen, J. P., Mattila, A. L., Systä, K., Mikkonen, T.
Number of pages: 9
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Publication date: 2016

Peer-reviewed: Yes

Publication information
Journal: Informatica
Volume: 40
Issue number: 1
ISSN (Print): 0350-5596
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Scopus rating (2016): CiteScore 1.2 SJR 0.136 SNIP 0.461
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Software, Artificial Intelligence, Theoretical Computer Science
Keywords: Html5, Internet-of-things, Javascript, Mobile agents, Web applications, Web-of-things
Electronic versions:

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URLs:

http://urn.fi/URN:NBN:fi:tty-201605033936
Source: Scopus
Source ID: 84963719558
Research output: Contribution to journal › Article › Scientific › peer-review

Integrating III-V, Si, and polymer waveguides for optical interconnects: RAPIDO
We present a vision for the hybrid integration of advanced transceivers at 1.3 μm wavelength, and the progress done towards this vision in the EU-funded RAPIDO project. The final goal of the project is to make five demonstrators that show the feasibility of the proposed concepts to make optical interconnects and packet-switched optical networks that are scalable to Pb/s systems in data centers and high performance computing. Simplest transceivers are to be made by combining directly modulated InP VCSELs with 12 μm SOI multiplexers to launch, for example, 200 Gbps data into a single polymer waveguide with 4 channels to connect processors on a single line card. For more advanced transceivers we develop novel dilute nitride amplifiers and modulators that are expected to be more power-efficient and temperatureinsensitive than InP devices. These edge-emitting III-V chips are flip-chip bonded on 3 μm SOI chips that also have polarization and temperature independent multiplexers and low-loss coupling to the 12 μm SOI interposers, enabling to launch up to 640 Gbps data into a standard single mode (SM) fiber. In this paper we present a number of experimental results, including low-loss multiplexers on SOI, zero-birefringence Si waveguides, micron-scale mirrors and bends with 0.1 dB loss, direct modulation of VCSELs up to 40 Gbps, ±0.25μm length control for dilute nitride SOA, strong band edge shifts in dilute nitride EAMs and SM polymer waveguides with 0.4 dB/cm loss.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, VTT Technical Research Centre of Finland, IBM Research, Vertilas GmbH, Scuola Superiore sant'Anna, Tyndall National Institute at National University of Ireland, Cork, Modulight Inc.
Contributors: Aalto, T., Harjanne, M., Offrein, B. J., Caër, C., Neumeyr, C., Malacarne, A., Guina, M., Sheehan, R. N., Peters, F. H., Melanen, P.
Publication date: 2016

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Name: Proceedings of SPIE
Volume: 9753
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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: electro absorption modulator, hybrid integration, optical interconnect, optical interposer, optoelectronics, polymer photonics, semiconductor optical amplifier, Silicon photonics, VCSEL, wavelength multiplexers
DOIs:

10.1117/12.2214786

Bibliographical note

EXT="Melanen, Petri"
Source: Scopus
Source ID: 84975114015
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Methodology to obtain the security controls in multi-cloud applications

What controls should be used to ensure adequate security level during operation is a non-trivial subject in complex software systems and applications. The problem becomes even more challenging when the application uses multiple cloud services which security measures are beyond the control of the application provider. In this paper, a methodology that enables the identification of the best security controls for multicloud applications whose components are deployed in heterogeneous clouds is presented. The methodology is based on application decomposition and modelling of threats over the components, followed by the analysis of the risks together with the capture of cloud business and security requirements. The methodology has been applied in the MUSA EU H2020 project use cases as the first step for building up the multi-cloud applications' security-aware Service Level Agreements (SLA). The identified security controls will be included in the applications' SLAs for their monitoring and fulfilment assurance at operation.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Research group: Factory automation systems technology, Faculty of Engineering Sciences, Factory Automation Systems and Technologies Lab (FAST-Lab), Second University of Naples, ENEA/CREATE/Università Degli Studi Napoli Federico II, TECNALIA. ICT-European Software Institute. Parque Tecnológico de Bizkaia
Contributors: Afolaranmi, S. O., Gonzalez Moctezuma, L. E., Rak, M., Casola, V., Rios, E., Martinez Lastra, J. L.
Number of pages: 6
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Publication date: 2016

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ASJC Scopus subject areas: Computer Science (miscellaneous), Computer Science Applications, Software
Keywords: Cyber-security Methodologies, Multi-cloud, Security-by-design, Threat Modelling
DOIs:

10.5220/0005912603270332
URLs:

http://www.scopus.com/inward/record.url?scp=84979747685&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84979747685
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Metrics for polyphonic sound event detection

This paper presents and discusses various metrics proposed for evaluation of polyphonic sound event detection systems used in realistic situations where there are typically multiple sound sources active simultaneously. The system output in this case contains overlapping events, marked as multiple sounds detected as being active at the same time. The polyphonic system output requires a suitable procedure for evaluation against a reference. Metrics from neighboring fields such as speech recognition and speaker diarization can be used, but they need to be partially redefined to deal with the overlapping events. We present a review of the most common metrics in the field and the way they are adapted and interpreted in the polyphonic case. We discuss segment-based and event-based definitions of each metric and explain the consequences of instance-based and class-based averaging using a case study. In parallel, we provide a toolbox containing implementations of presented metrics.

General information

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Organisations: Department of Signal Processing, Research group: Audio research group
Contributors: Mesaros, A., Heittola, T., Virtanen, T.
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Publication information

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ASJC Scopus subject areas: Fluid Flow and Transfer Processes, Process Chemistry and Technology, Computer Science Applications, Engineering(all), Materials Science(all), Instrumentation
Keywords: Audio content analysis, Audio signal processing, Computational auditory scene analysis, Evaluation of sound event detection, Everyday sounds, Pattern recognition, Polyphonic sound event detection, Sound events
Electronic versions:
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URLs:
http://urn.fi/URN:NBN:fi:tty-201607294341
Source: Scopus
Source ID: 84973574836
Research output: Contribution to journal › Article › Scientific › peer-review

Optical fiber amplifier with spectral compression elements for high-power laser pulse generation

We report main features of spectral compression of parabolic pulses in nonlinear optical fibers. It is shown that the variational analysis correctly describes evolution of pulse parameters during spectral compression. The model of cascade amplifier system employing spectral compression is developed to achieve superior spectral densities. The proposed configuration is promising as optical pulse preamplifier for operation in the high-energy pulse laser systems.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, University de Mons, Ulyanovsk State University, Optoelectronic Research Center
Contributors: Fotiadi, A. A., Korobko, D. A., Okhotnikov, O. G., Zolotovskii, I. O.
Publication date: 2016

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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Electrical and Electronic Engineering, Applied Mathematics
Keywords: Fiber optics amplifiers, high-power laser pulses, nonlinear spectral compression, phase self-modulation
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Source: Scopus
Source ID: 84985911601
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Simultenious binary hash and features learning for image retrieval

Content-based image retrieval systems have plenty of applications in modern world. The most important one is the image search by query image or by semantic description. Approaches to this problem are employed in personal photo-collection management systems, web-scale image search engines, medical systems, etc. Automatic analysis of large unlabeled image datasets is virtually impossible without satisfactory image-retrieval technique. It's the main reason why this kind of automatic image processing has attracted so much attention during recent years. Despite rather huge progress in the field, semantically meaningful image retrieval still remains a challenging task. The main issue here is the demand to provide reliable results in short amount of time. This paper addresses the problem by novel technique for simultaneous learning of global image features and binary hash codes. Our approach provide mapping of pixel-based image representation to

hash-value space simultaneously trying to save as much of semantic image content as possible. We use deep learning methodology to generate image description with properties of similarity preservation and statistical independence. The main advantage of our approach in contrast to existing is ability to fine-tune retrieval procedure for very specific application which allow us to provide better results in comparison to general techniques. Presented in the paper framework for data-dependent image hashing is based on use two different kinds of neural networks: convolutional neural networks for image description and autoencoder for feature to hash space mapping. Experimental results confirmed that our approach has shown promising results in compare to other state-of-the-art methods.

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MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Don State Technical University, Univ of Texas at San Antonio
Contributors: Frantc, V. A., Makov, S. V., Voronin, V. V., Marchuk, V. I., Semenishchev, E. A., Egiazarian, K. O., Agaian, S.
Publication date: 2016

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ISBN (Electronic): 9781510601109

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Name: SPIE Conference Proceedings
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Computer Science Applications, Applied Mathematics, Electrical and Electronic Engineering
Keywords: autoencoder, content{based image retrieval, deep convolutional neural network, semantic hashing
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10.1117/12.2223605
Source: Scopus
Source ID: 84991480411
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Still image/video frame lossy compression providing a desired visual quality
The problem of how to automatically provide a desired (required) visual quality in lossy compression of still images and video frames is considered in this paper. The quality can be measured based on different conventional and visual quality metrics. In this paper, we mainly employ human visual system (HVS) based metrics PSNR-HVS-M and MSSIM since both of them take into account several important peculiarities of HVS. To provide a desired visual quality with high accuracy, iterative image compression procedures are proposed and analyzed. An experimental study is performed for a large number of grayscale test images. We demonstrate that there exist several coders for which the number of iterations can be essentially decreased using a reasonable selection of the starting value and the variation interval for the parameter controlling compression (PCC). PCC values attained at the end of the iterative procedure may heavily depend upon the coder used and the complexity of the image. Similarly, the compression ratio also considerably depends on the above factors. We show that for some modern coders that take HVS into consideration it is possible to give practical recommendations on setting a fixed PCC to provide a desired visual quality in a non-iterative manner. The case when original images are corrupted by visible noise is also briefly studied.

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Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, National Aerospace University
Contributors: Zemliachenko, A., Lukin, V., Ponomarenko, N., Egiazarian, K., Astola, J.
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Issue number: 3
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ASJC Scopus subject areas: Computer Science Applications, Information Systems, Signal Processing, Software, Artificial Intelligence, Hardware and Architecture, Applied Mathematics
Keywords: Compression ratio, Lossy compression, Required quality, Visual quality metrics
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Source: Scopus
Source ID: 84930357751
Research output: Contribution to journal › Article › Scientific › peer-review

Technoeconomical Analysis of Macrocell and Femtocell Based HetNet under Different Deployment Constraints
Ultradense deployment of small cells is being considered as one of the key flavors of the emerging 5G cellular networks to address the future data capacity challenges. A large share of these deployments will be indoor, as this is the arena where the majority of the data traffic is believed to originate from in the future. Indoor small cell solutions (e.g., femtocell or WiFi) are well positioned for delivering superior indoor coverage and capacity. However, due to relatively smaller coverage footprint compared to traditional macrocells, a very dense deployment of small cells will be needed in order to have a ubiquitous indoor coverage. Such dense deployment triggers cost and energy efficiency concerns for mobile operators. In this paper, we analyze and compare the technoeconomic performance of two deployment strategies: homogeneous macrocellular densification and heterogeneous macro-femto deployment strategy, from an indoor service provisioning perspective. Particularly, we analyze and contrast the performance of macro-femto based deployment, with varying femtocell market penetration rate and under different femtocell backhaul connectivity constraints, with that of homogeneous macrocellular densification. The results indicate superior performance of indoor femtocell based deployment as compared to macrocellular-only densification, due to better indoor coverage, radio channel conditions, and high degree of spatial reuse.

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning
Contributors: Yunas, S. F., Ansari, W. H., Valkama, M.
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Volume: 2016
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ISSN (Print): 1574-017X
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Bibliographical note
INT=elt,"Ansari, Waqas H."
Source: Scopus
Source ID: 84985945396
Research output: Contribution to journal › Article › Scientific › peer-review

Two models for hydraulic cylinders in flexible multibody simulations
In modelling hydraulic cylinders interaction between the structural response and the hydraulic system needs to be taken into account. In this chapter two approaches for modelling flexible multibody systems coupled with hydraulic actuators i.e. cylinders are presented and compared. These models are the truss-elementlike cylinder and bending flexible cylinder models. The bending flexible cylinder element is a super-element combining the geometrically exact Reissner-beam

element, the C^1-continuous slide-spring element needed for the telescopc movement and the hydraulic fluid field. Both models are embeded with a friction model based on a bristle approach. The models are implemented in a finite element enviroment. In time the coupled stiff differential equation system is integrated using the L-stable Rosenbrock method.

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MoE publication type: A3 Part of a book or another research book
Organisations: Department of Civil Engineering, Research group: Structural Mechanics, Department of Mechanical Engineering and Industrial Systems, Research area: Applied Mechanics, FS Dynamics Finland Oy Ab
Contributors: Ylinen, A., Mäkinen, J., Kouhia, R.
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DOIs:
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JUFOID=79940
EXT="Ylinen, Antti"
Source: Scopus
Source ID: 84964233721
Research output: Chapter in Book/Report/Conference proceeding › Chapter › Scientific › peer-review

Energy cooperation for throughput optimization based on save-then-transmit protocol in wireless communication system
Green communication and energy saving have been a critical issue in modern wireless communication systems. The concepts of energy harvesting and energy transfer are recently receiving much attention in academic research field. In this paper, we study energy cooperation problems based on save-then-transmit protocol and propose two energy cooperation schemes for different system models: two-node communication model and three-node relay communication model. In both models, all of the nodes transmitting information have no fixed energy supplies and gain energy only via wireless energy harvesting from nature. Besides, these nodes also follow a save-then-transmit protocol. Namely, for each timeslot, a fraction (referred to as save-ratio) of time is devoted exclusively to energy harvesting while the remaining fraction is used for data transmission. In order to maximize the system throughput, energy transfer mechanism is introduced in our schemes, i.e., some nodes are permitted to share their harvested energy with other nodes by means of wireless energy transfer. Simulation results demonstrate that our proposed schemes can outperform both the schemes with half-allocate save-ratio and the schemes without energy transfer in terms of throughput performance, and also characterize the dependencies of system throughput, transferred energy, and save-ratio on energy harvesting rate.

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Wireless Communications and Positioning (WICO), Chongqing Key Lab of Mobile Communication Technology, Chongqing University of Posts and Telecommunications
Contributors: Dai, C., Li, F., Renfors, M.
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Peer-reviewed: Yes

Publication information
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Article number: 119
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ASJC Scopus subject areas: Computer Networks and Communications, Signal Processing, Computer Science Applications
Keywords: Energy harvesting, Energy transfer, Save-then-transmit protocol, Throughput optimization
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http://www.scopus.com/inward/record.url?scp=84930207810&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84930207810
Research output: Contribution to journal › Article › Scientific › peer-review

Bispectrum-based demodulation technique using triple-channel heterodyning of triplet-signal

Paper is dedicated to novel bispectrum-based demodulation technique by using triple-channel heterodyning of triplet-signals. Test statistics used for triplet-signals detection and discrimination are evaluated in the form of the bimagnitude peak values. Experimental study of noise immunity in bispectrum-based digital communication system is performed for suggested triple-channel heterodyning technique. Bit error rate (BER) values are computed under additive Gaussian noise influence in radio communication link for wide variations of input signal-to-noise ratio (SNR).

General information

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Organisations: Department of Signal Processing, Research group: Algebraic and Algorithmic Methods in Signal Processing AAMSP, Signal Processing Research Community (SPRC), National Aerospace University
Contributors: Naumenko, V., Solodovnik, V., Totsky, A., Zelensky, A., Astola, J.
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ASJC Scopus subject areas: Computer Science (miscellaneous), Computer Science Applications
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DOIs:
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Source: Scopus
Source ID: 84962840376
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

HVS-based local analysis of denoising efficiency for DCT-based filters

Images acquired and processed in communication and multimedia systems are often noisy. Thus, pre-filtering is a typical stage to remove noise. At this stage, a special attention has to be paid to image visual quality. This paper analyzes denoising efficiency from the viewpoint of visual quality improvement using metrics that take into account human vision system (HVS). Specific features of the paper consist in, first, considering filters based on discrete cosine transform (DCT) and, second, analyzing the filter performance locally. Such an analysis is possible due to the structure and peculiarities of the metric PSNR-HVS-M. It is shown that a more advanced DCT-based filter BM3D outperforms a simpler (and faster) conventional DCT-based filter in locally active regions, i.e., neighborhoods of edges and small-sized objects. This conclusions allows accelerating BM3D filter and can be used in further improvement of the analyzed denoising techniques.

General information

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Organisations: Department of Signal Processing, Research group: Algebraic and Algorithmic Methods in Signal Processing AAMSP, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC)
Contributors: Rubel, O., Ponomarenko, N., Lukin, V., Astola, J., Egiazarian, K.
Number of pages: 4
Pages: 189-192

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ASJC Scopus subject areas: Computer Science (miscellaneous), Computer Science Applications
Keywords: DCT-based filters, HVS-metrics, image denoising, local analysis
DOIs:
10.1109/INFOCOMMST.2015.7357309
Source: Scopus
Source ID: 84962840358
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Method of data compression for traffic monitoring
In this paper a problem of compressing data containing information on basic parameters of network traffic is considered. Six test sets with different types of network traffic for known monitoring tool Wireshark are formed. Analysis of compression efficiency for these datasets by widely used archivers is carried out. It is shown that the main part of memory in compressed data relates to timestamps. A method for compressing timestamps that consists in delta calculation, Burrows-Wheeler transform (BWT), distance coding (DC) and recursive group coding (RGC) at the final stage is proposed. It is demonstrated that the use of RGC at the final stage provides more efficient coding compared to known methods. It is also shown that the proposed method of timestamps coding produces about twice larger compression ratio than WinRar.

General information
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Contributors: Kozhemiakina, N., Lukin, V., Ponomarenko, N., Akulynichev, A., Astola, J., Egiazarian, K.
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ISBN (Print): 9789669751928
ASJC Scopus subject areas: Computer Science (miscellaneous), Computer Science Applications
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DOIs:
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Source: Scopus
Source ID: 84962870220
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Texture detection in noisy images by combining several local parameters
A problem of detecting textural areas in images corrupted by noise is considered. Detection is based on joint use of several local parameters calculated in scanning windows (blocks) of different size. Trained support vector machine (SVM) classifier is used for combining local parameters. Factors that influence detector performance are analyzed. It is shown that detector performance can be improved by taking into account information from classifier output for neighbor pixels.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing Research Community (SPRC), Kharkiv National Aerospace University, Department of Transmitters
Contributors: Naumenko, A., Krivenko, S., Ponomarenko, N., Zelensky, A., Lukin, V.
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Publication date: 14 Dec 2015

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Publisher: Institute of Electrical and Electronics Engineers Inc.
Article number: 7357321
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ASJC Scopus subject areas: Computer Science (miscellaneous), Computer Science Applications
Keywords: image, local parameters, noise, SVM, texture detection
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http://www.scopus.com/inward/record.url?scp=84962836336&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84962836336
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Urban sensing and smart home energy optimisations: A machine learning approach

Energy effciency for smart home applications is proposed using urban sensing data with machine learning techniques. We exploit Internet of Things (IoTs) enabled environmental and energy panel sensor data, smart home sensing data and opportunistic crowd-sourced data for energy effcient applications in a smart urban home. We present some applications where data from the IoT enabled sensors can be utilised using machine learning techniques. Prediction of small scale renewable energy using solar photovoltaic panels and environmental sensor data is used in energy management such as water heating system. Smart meter data and motion sensor data are used in household appliance monitoring applications with machine learning techniques towards energy savings. Further event detection from environmental and traffc sensor data is proposed in planning and optimising energy usage of smart electric vehicles for a smart urban home. Initial experimental results show the applicability of developing energy effcient applications using machine learning techniques with IoT enabled sensor data.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, CSIRO Digital Productivity Flagship
Contributors: Shahriar, M. S., Rahman, M. S.
Number of pages: 4
Pages: 19-22
Publication date: 1 Nov 2015

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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
Keywords: Energy efficiency, Machine learning, Urban sensing
DOIs:
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Bibliographical note

INT=elt,"Rahman, M. Sabbir"
Source: Scopus
Source ID: 84961161222
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Polynomial Input-Output Stability for Linear Systems

We introduce the concept of polynomial input-output stability for infinite-dimensional linear systems. We show that this stability type corresponds exactly to the recent notion of P-stability in the frequency domain. In addition, we show that on a Hilbert space a regular linear system whose system operator generates a polynomially stable semigroup is always polynomially input-output stable, and present additional conditions under which the system is input-output stable. The results are illustrated with an example of a polynomially input-output stable one-dimensional wave system.

General information

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Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling
Contributors: Paunonen, L., Laakkonen, P.
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Volume: 60
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Control and Systems Engineering, Computer Science Applications
Keywords: Distributed parameter system, Stability
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http://www.scopus.com/inward/record.url?scp=84942853446&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84942853446
Research output: Contribution to journal › Article › Scientific › peer-review

Antroposeeni - A mixed reality game
In this paper, we describe Antroposeeni, a mixed reality game designed and developed for mobile devices. Antroposeeni utilizes location-based services, GPS for tracking users and augmented reality techniques for displaying captivating audiovisual content and creating rich experiences. Our demonstration will introduce a pilot version of the game, which encompasses narrative elements of the game mediated through developed media technologies. The goal for the demonstration is to give the conference visitors a chance to test the game in a specifically tailored route close to the conference site. After conducting the pilot we plan to organize a short review regarding the user experience.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Augmented Human Activities (AHA), Metaria Ry
Contributors: Luhtala, M., Karvonen, T., Pylväs, J., Ala-Kokko, A., Magica, R., Takeda, Y., Turunen, M.
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ASJC Scopus subject areas: Human-Computer Interaction, Software, Computer Science Applications
Keywords: Aesthetics, Art, Augmented reality, Design, Games, Mixed reality, Software design, Theatre, User experience
DOIs:
10.1145/2818187.2818287
URLs:
http://www.scopus.com/inward/record.url?scp=84962875980&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84962875980
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

OASIS deck of cards - House of colleagues: A playful
A research experiment to facilitate playful interaction and community learning within an academic organization of about 170 employees was conducted. A 2-player card game including 61 'staff character cards' and 39 question cards was implemented to be played by the relatively new community. The game period, including supporting events, ran for 5 weeks. After the experiment 59 staff members responded to an online survey on play experiences. The results showed that ways of participation and means of play are more diverse in a work community context than as they are specified in the game rules. More emphasis should be set on framing the game and supporting it as a continuous activity to become a playful practice in the work community. An academic community has inherent contextual prerequisites that need to be addressed in order for a playful practice to gain traction as a means for community building.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Mathematical modelling with wide societal impact (MathImpact)
Contributors: Nummenmaa, T., Kultima, A., Kankainen, V., Savolainen, S., Syvänen, A., Alha, K., Mäyrä, F.
Number of pages: 8
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ISBN (Electronic): 9781450339483
ASJC Scopus subject areas: Human-Computer Interaction, Software, Computer Science Applications
Keywords: Academia, Adult play, Attitudes towards play, Card game, Community, Design, Play at work, Playfulness, University
DOIs:
10.1145/2818187.2818296
URLs:
http://www.scopus.com/inward/record.url?scp=84962803762&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84962803762
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Analytical model for magnetic anisotropy of non-oriented steel sheets
Purpose - Recent investigations on magnetic properties of non-oriented (NO) steel sheets enhance the comprehension of the magnetic anisotropy behaviour of widely employed electrical sheets. The concept of energy/coenergy density can be employed to model these magnetic properties. However, it usually presents an implicit form which requires an iterative process. The purpose of this paper is to develop an analytical model to consider these magnetic properties with an explicit formulation in order to ease the computations. Design/methodology/approach - From rotational measurements, the anhysteretic curves are interpolated in order to extract the magnetic energy density for different directions and amplitudes of the magnetic flux density. Furthermore, the analytical representation of this energy is suggested based on statistical distribution which aims to minimize the intrinsic energy of the material. The model is finally validated by comparing measured and computed values of the magnetic field strength. Findings - The proposed model is based on an analytical formulation of the energy depending on the components of the magnetic flux density. This formulation is composed of three Gumbel distributions. Every functional parameters of energy density is formulated with only four parameters which are calculated by fitting the energy extracted from measurements. Finally, the proposed model is validated by comparing the computation and the measurements of 9 H loci for NO steel sheets at 10 Hz. The proposed analytical model shows good agreements with an average relative error of 27 per cent. Originality/value - The paper presents an original analytical method to model magnetic anisotropy for NO electrical sheets. With this analytical formulation, the determination of H does not require any iterative process as it is usually the case with this energy method coupled with implicit function. This method can be easily incorporated in finite element method since it does not require any extra iterative process.

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Organisations: Smart Energy Systems (SES), Aalto University
Contributors: Martin, F., Singh, D., Belahcen, A., Rasilo, P., Haavisto, A., Arkkio, A.
Number of pages: 14
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Peer-reviewed: Yes

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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computational Theory and Mathematics, Applied Mathematics
Keywords: FEM, Ferromagnetic materials, Magnetic anisotropy, Soft magnetic materials

DOIs:
10.1108/COMPEL-02-2015-0076
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http://www.scopus.com/inward/record.url?scp=84941117731&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84941117731
Research output: Contribution to journal › Article › Scientific › peer-review

Estimation of additional losses due to random contacts at the edges of stator of an electrical machine
Purpose - Punching of the electrical sheets impair the insulation and make random galvanic contacts between the edges of the sheets. The purpose of this paper is to model the random galvanic contacts at the stator edges of 37 kW induction machine and estimate the additional losses due to these contacts. Design/methodology/approach - The presence of the surface current at the edges of sheets causes the discontinuity in the tangential component of the magnetic field. The surface boundary layer model which is based on this concept is implemented to model the galvanic contacts at the edges of the sheets. Finite element analysis based on magnetic vector potential was done and theoretical statistical study of the random conductivity at the stator edge was performed using brute force method. Findings - Finite element analysis validates the interlaminar current when galvanic contacts are present at the edges of electrical sheets. The case studies show that the rotor and stator losses increases with the thickness of the contacts. Statistical studies show that the mean value of total electromagnetic loss was increased by 7.7 percent due to random contacts at the edges of sheets. Originality/value - The novel approach for modeling the galvanic contacts at the stator edges of induction machine is discussed in this paper. The hypothesis of interlaminar current due to galvanic contacts is also validated using finite element simulation.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Smart Energy Systems (SES), Aalto University
Contributors: Shah, S. B., Rasilo, P., Belahcen, A., Arkkio, A.
Number of pages: 10
Pages: 1501-1510
Publication date: 7 Sep 2015
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Issue number: 5
ISSN (Print): 0332-1649
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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computational Theory and Mathematics, Applied Mathematics
Keywords: Boundary conditions, Eddy current, Electrical conductivity, FEM, Magnetic vector potential
DOIs:
10.1108/COMPEL-02-2015-0083
URLs:
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Source: Scopus
Source ID: 84941111680
Research output: Contribution to journal › Article › Scientific › peer-review

DropELM: Fast neural network regularization with Dropout and DropConnect
In this paper, we propose an extension of the Extreme Learning Machine algorithm for Single-hidden Layer Feedforward Neural network training that incorporates Dropout and DropConnect regularization in its optimization process. We show that both types of regularization lead to the same solution for the network output weights calculation, which is adopted by the proposed DropELM network. The proposed algorithm is able to exploit Dropout and DropConnect regularization, without computationally intensive iterative weight tuning. We show that the adoption of such a regularization approach can lead to better solutions for the network output weights. We incorporate the proposed regularization approach in several recently proposed ELM algorithms and show that their performance can be enhanced without requiring much additional computational cost.

General information
Publication status: Published

MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
Number of pages: 10
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Peer-reviewed: Yes

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Scopus rating (2015): CiteScore 4.2 SJR 0.981 SNIP 1.698
Original language: English
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Cognitive Neuroscience
Keywords: DropConnect, Dropout, Extreme Learning Machine, Regularization, Single Hidden Layer Feedforward Networks
DOIs:

10.1016/j.neucom.2015.04.006
URLs:

http://www.scopus.com/inward/record.url?scp=84929271496&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84929271496
Research output: Contribution to journal › Article › Scientific › peer-review

Evaluating a Future Remote Control Environment with an Experience-Driven Science Fiction Prototype
The case study presented in this paper aimed at discovering opportunities for ambient intelligence and new interaction methods for a future remote crane-operating environment. The theoretical objective was to carry out an experience-driven research project in an industrial work context, and the practical objective was to create and evaluate a future oriented science fiction prototype. The work was carried out in close co-operation with an industrial partner who was a domain expert in the field of crane industry. The aim was to focus on clearly defined user experience goals to which the industrial partner committed. The consequent immediate objective was to focus on two explicit experiences relating to 'Feeling of being motivated' and to 'Sense of community' that were placed at the core of the design investigations. These experiences were deliberated into a science fiction prototype entitled 'Remote operator's day in a future control centre'. The science fiction prototype was further introduced to users by twofold means: as a plain, simple short story and through an interactive experience path. The main contribution of the paper is to demonstrate how an emerging technology research of a new domain may employ science fiction prototyping method as a primary means of experience design investigations.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Augmented Human Activities (AHA), VTT Technical Research Centre of Finland, Jyväskylän yliopisto, Konecranes Ltd
Contributors: Kymalainen, T., Perala, P., Hakulinen, J., Heimonen, T., James, J., Pera, J.
Number of pages: 8
Pages: 81-88
Publication date: 12 Aug 2015

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Title of host publication: Proceedings - 2015 International Conference on Intelligent Environments, IE 2015
Publisher: Institute of Electrical and Electronics Engineers Inc.
Article number: 7194274
ISBN (Electronic): 9781467366540
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Engineering (miscellaneous), Social Sciences (miscellaneous)
Keywords: human-computer interaction (HCI), Intelligent environment (IE), remote crane operation, science fiction prototyping (SFP), user experience (UX)
DOIs:

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http://www.scopus.com/inward/record.url?scp=84955492937&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84955492937

Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Distance-based human action recognition using optimized class representations

We study distance-based classification of human actions and introduce a new metric learning approach based on logistic discrimination for the determination of a low-dimensional feature space of increased discrimination power. We argue that for effective distance-based classification, both the optimal projection space and the optimal class representation should be determined. We qualitatively and quantitatively illustrate the superiority of the proposed approach to metric learning approaches employing the class mean for class representation. We also introduce extensions of the proposed metric learning approach to allow for richer class representations and to operate in arbitrary-dimensional Hilbert spaces for non-linear feature extraction and classification. Experimental results denote that the performance of the proposed distance-based classification schemes is comparable (or even better) to that of Support Vector Machine classifier (in both the linear and kernel cases) which is currently the standard choice for human action recognition.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
Number of pages: 9
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Peer-reviewed: Yes

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Volume: 161
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Original language: English
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Cognitive Neuroscience
Keywords: Distance-based classification, Optimized class representations
DOIs:
10.1016/j.neucom.2014.10.088
URLs:
http://www.scopus.com/inward/record.url?scp=84929045315&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84929045315

Research output: Contribution to journal › Article › Scientific › peer-review

Image interpolation based on non-local geometric similarities

Image interpolation refers to constructing a high-resolution (HR) image from a low-resolution (LR) image. Traditionally, an HR image can be produced from an observed LR image via the polynomial-based interpolation (bi-linear or bi-cubic interpolations, involving a small number of neighbors around each interpolated position). The advanced interpolation makes use of the so-called 'geometric similarity' to design a set of optimal interpolation weighting coefficients. However, better geometric similarities can perhaps be found from a non-local area within the LR source image or even from other but similar images (possibly with higher resolutions). Based on this fact, we propose in this paper a non-local geometric similarity based interpolation scheme to construct HR images. In our proposed method, optimal weighting coefficients are determined by solving a regularized least squares problem which is built upon a number of dual reference patches drawn from the observed LR image and regularized by the variation of directional gradients of the image patch. Experimental results demonstrate that our proposed method offers a remarkable quality improvement, both objectively and subjectively.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), University of Electronic Science and Technology of China, University of Science and Technology of China
Contributors: Zhu, S., Zeng, B., Liu, G., Zeng, L., Fang, L., Gabbouj, M.
Publication date: 4 Aug 2015

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Title of host publication: 2015 IEEE International Conference on Multimedia and Expo (ICME)
Publisher: IEEE COMPUTER SOCIETY PRESS

ISBN (Print): 9781479970827
ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
Keywords: geometric similarity, Image interpolation, regularization, weighting coefficients
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10.1109/ICME.2015.7177417
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http://www.scopus.com/inward/record.url?scp=84946043968&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84946043968
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Stability-Guaranteed Force-Sensorless Contact Force/Motion Control of Heavy-Duty Hydraulic Manipulators

In this paper, a force-sensorless high-performance contact force/motion control approach is proposed for multiple-degree-of-freedom hydraulic manipulators. A rigorous stability proof for an entire hydraulic manipulator performing contact tasks is provided for the first time. The controller design for the manipulator is based on the recently introduced virtual decomposition control approach. As a significant novelty, the end-effector contact force is directly estimated from the manipulator's cylinder pressure data, which provides a practical solution for heavy-duty contact force control without engaging fragile force/torque sensors. In the experiments, the proposed controller achieved a force control accuracy of 4.1% at a desired contact force of 8000 N while in motion. This can be considered a significant result due to the hydraulic actuators' highly nonlinear behaviors, the coupled mechanical linkage dynamics, and the complex interaction dynamics between the manipulator and the environment.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Intelligent Hydraulics and Automation, Research group: Mobile manipulation, Field robotics for efficient work sites (FIRE)
Contributors: Koivumäki, J., Mattila, J.
Number of pages: 18
Pages: 918-935
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Peer-reviewed: Yes

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Journal: IEEE Transactions on Robotics
Volume: 31
Issue number: 4
ISSN (Print): 1552-3098
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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Control and Systems Engineering, Computer Science Applications
Keywords: Contact force estimation, contact force/motion control, hydraulic manipulators, nonlinear model-based control, stability analysis, virtual decomposition control (VDC)
DOIs:
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Research output: Contribution to journal › Article › Scientific › peer-review

Gathering useful programming data; Analysis and insights from real-time collaborative editing

Traditionally, collaborative coding has been practiced in open source communities where cooperation has mostly taken place on a coordination level. Nowadays, web technology is sufficiently advanced to enable collaborative coding in real-time as group work, which eases communication in software development. In this paper this phenomenon has been studied from a knowledge transfer and learning perspective. With the aid of two different example cases (code camps), we have examined the possibilities and challenges in learning during real-time group work. Additionally, we have evaluated the effect of the structure of log data created during software development. The research frame for this study is the utilization of log data visualization in evaluating group work and further improvement of the visualization in order to support software development.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication

Organisations: Pori Department, Research group: Software Engineering and Intelligent Systems, Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Contributors: Rantala, M., Soini, J., Kilamo, T.
Number of pages: 6
Pages: 229-234
Publication date: 15 Jul 2015

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Article number: 7160270
ISBN (Print): 9789532330854
ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Hardware and Architecture, Electrical and Electronic Engineering
DOIs:
10.1109/MIPRO.2015.7160270
URLs:
http://www.scopus.com/inward/record.url?scp=84946129499&partnerID=8YFLogxK (Link to publication in Scopus)

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ORG=pla,0.7
ORG=tie,0.3
Source: Scopus
Source ID: 84946129499
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Effective variable switching point predictive current control for ac low-voltage drives
This paper presents an effective model predictive current control scheme for induction machines driven by a three-level neutral point clamped inverter, called variable switching point predictive current control. Despite the fact that direct, enumeration-based model predictive control (MPC) strategies are very popular in the field of power electronics due to their numerous advantages such as design simplicity and straightforward implementation procedure, they carry two major drawbacks. These are the increased computational effort and the high ripples on the controlled variables, resulting in a limited applicability of such methods. The high ripples occur because in direct MPC algorithms the actuating variable can only be changed at the beginning of a sampling interval. A possible remedy for this would be to change the applied control input within the sampling interval, and thus to apply it for a shorter time than one sample. However, since such a solution would lead to an additional overhead which is crucial especially for multilevel inverters, a heuristic preselection of the optimal control action is adopted to keep the computational complexity at bay. Experimental results are provided to verify the potential advantages of the proposed strategy.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Smart Energy Systems (SES), Technische Universitat Munchen, National Technical University of Athens, Technische Hochschule Ingolstadt
Contributors: Stolze, P., Karamanakos, P., Kennel, R., Manias, S., Endisch, C.
Number of pages: 13
Pages: 1366-1378
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Peer-reviewed: Yes

Publication information
Journal: International Journal of Control
Volume: 88
Issue number: 7
ISSN (Print): 0020-7179
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Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Computer Science Applications
Keywords: ac low-voltage drives, model predictive control (MPC), optimal control, three-level inverter, variable switching point
DOIs:
10.1080/00207179.2014.942699

Source: Scopus
Source ID: 84930755978
Research output: Contribution to journal › Article › Scientific › peer-review

A robust AMMI model for the analysis of genotype-by-environment data

Motivation: One of the most widely used models to analyse genotype-by-environment data is the additive main effects and multiplicative interaction (AMMI) model. Genotype-by-environment data resulting from multi-location trials are usually organized in two-way tables with genotypes in the rows and environments (location-year combinations) in the columns. The AMMI model applies singular value decomposition (SVD) to the residuals of a specific linear model, to decompose the genotype-by-environment interaction (GEI) into a sum of multiplicative terms. However, SVD, being a least squares method, is highly sensitive to contamination and the presence of even a single outlier, if extreme, may draw the leading principal component towards itself resulting in possible misinterpretations and in turn lead to bad practical decisions. Since, as in many other real-life studies the distribution of these data is usually not normal due to the presence of outlying observations, either resulting from measurement errors or sometimes from individual intrinsic characteristics, robust SVD methods have been suggested to help overcome this handicap. Results: We propose a robust generalization of the AMMI model (the R-AMMI model) that overcomes the fragility of its classical version when the data are contaminated. Here, robust statistical methods replace the classic ones to model, structure and analyse GEI. The performance of the robust extensions of the AMMI model is assessed through a Monte Carlo simulation study where several contamination schemes are considered. Applications to two real plant datasets are also presented to illustrate the benefits of the proposed methodology, which can be broadened to both animal and human genetics studies. Availability and implementation: Source code implemented in R is available in the supplementary material under the function r-AMMI.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Centro de Matemática e Aplicações (CMA, NOVA University of Lisbon
Contributors: Rodrigues, P. C., Monteiro, A., Lourenço, V. M.
Number of pages: 9
Pages: 58-66
Publication date: 1 Jul 2015
Peer-reviewed: Yes

Publication information

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Issue number: 1
ISSN (Print): 1367-4803
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Original language: English
ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computational Theory and Mathematics, Computer Science Applications, Computational Mathematics, Statistics and Probability, Medicine(all)
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Source: Scopus
Source ID: 84959872026
Research output: Contribution to journal › Article › Scientific › peer-review

Prioritized centrally-controlled resource allocation in integrated multi-RAT HetNets

Given the importance of multi-radio heterogeneous networks (HetNets) in delivering more throughput and better connectivity experience to today's wireless users, we investigate the prioritized centrally-controlled resource allocation mechanisms in such systems. First, we theoretically formulate the problem of assisted rate allocation across multiple radio access technologies (RATs) as a special case of relative max-min fairness problem with bifurcated (splittable) traffic flows, which can then be solved by employing the standard linear optimization techniques. Our proposed solution delivers certain minimum guarantees to all the network users, while the rest of system resources are divided proportionally to the preset priority of the users. The priorities in our system may correspond to different subscription/pricing plans of a network operator. Finally, we demonstrate the practical benefits of the proposed resource allocation scheme with system-level simulations, as well as discuss its implementation within a testbed prototype based on the OpenFlow architecture.

General information

Publication status: Published

MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Tampere University of Technology, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Wireless Communications and Positioning (WICO), Intel Corporation
Contributors: Gerasimenko, M., Moltchanov, D., Florea, R., Himayat, N., Andreev, S., Koucheryavy, Y.
Number of pages: 7
Publication date: 1 Jul 2015

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Publisher: The Institute of Electrical and Electronics Engineers, Inc.
ISBN (Print): 9781479980888
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Applied Mathematics
DOIs:

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Bibliographical note
AUX=elt,"Florea, Roman"
Source: Scopus
Source ID: 84940398708
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Railway fastener inspection by real-time machine vision
In this paper, a real-time railway fastener detection system using a high-speed laser range finder camera is presented. First, an extensive analysis of various methods based on pixel-wise and histogram similarities are conducted on a specific railway route. Then, a fusing stage is introduced which combines least correlated approaches also considering the performance upgrade after fusing. Then, the resulting method is tested on a larger database collected from a different railway route. After observing repeated successes, the method is implemented on NI LabVIEW and run real-time with a high-speed 3-D camera placed under a railway carriage designed for railway quality inspection.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Video, Middle East Technical University, Electrical and Electronics Engineering Department
Contributors: Aytekin, C., Rezaeitabar, Y., Dogru, S., Ulusoy, I.
Number of pages: 7
Pages: 1101-1107
Publication date: 1 Jul 2015
Peer-reviewed: Yes

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Volume: 45
Issue number: 7
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Scopus rating (2015): CiteScore 6.1 SJR 1.273 SNIP 2.189
Original language: English
ASJC Scopus subject areas: Computer Science Applications, Human-Computer Interaction, Software, Control and Systems Engineering, Electrical and Electronic Engineering
Keywords: High-speed laser range finder, railway fastener detection, railway inspection
DOIs:

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URLs:

http://www.scopus.com/inward/record.url?scp=84932638036&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84932638036
Research output: Contribution to journal › Article › Scientific › peer-review

Wideband self-adaptive RF cancellation circuit for full-duplex radio: Operating principle and measurements
This paper presents a novel RF circuit architecture for self-interference cancellation in inband full-duplex radio transceivers. The developed canceller is able to provide wideband cancellation with waveform bandwidths in the order of 100 MHz or beyond and contains also self-adaptive or self-healing features enabling automatic tracking of time-varying

self-interference channel characteristics. In addition to architecture and operating principle descriptions, we also provide actual RF measurements at 2.4 GHz ISM band demonstrating the achievable cancellation levels with different bandwidths and when operating in different antenna configurations and under low-cost highly nonlinear power amplifier. In a very challenging example with a 100 MHz waveform bandwidth, around 41 dB total cancellation is obtained while the corresponding cancellation figure is close to 60 dB with the more conventional 20 MHz carrier bandwidth. Also, efficient tracking in time-varying reflection scenarios is demonstrated.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Tampere University of Technology, Research group: Wireless Communications and Positioning, Wireless Communications and Positioning (WICO), Intel Corporation
Contributors: Huusari, T., Choi, Y. S., Liikkanen, P., Korpi, D., Talwar, S., Valkama, M.
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Publisher: The Institute of Electrical and Electronics Engineers, Inc.
ISBN (Print): 9781479980888
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Applied Mathematics
Keywords: Full-duplex, RF cancellation, Self adaptive, Self interference, Tracking
DOIs:
10.1109/VTCSpring.2015.7146163

Bibliographical note
AUX=elt,"Huusari, Timo"
AUX=elt,"Liikkanen, Petteri"
Source: Scopus
Source ID: 84940421784
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

AvanTomography: A compact module for positron emission mammography
In AvanTomography project, a compact, high performance module was developed for axial positron emission mammography, which can be integrated with X-ray mammography. With its axial crystal orientation, AvanTomography can achieve a uniform spatial resolution and eliminate the parallax error by unambiguously detecting the location of the positron annihilation. Compact design of the module enables a cost and space efficient system for breast screening. Various configurations, plate or full ring, can be obtained by using multiple modules, allowing the screening of axillary and mammary regions with a single scanner position. In this project, a 6-module system was constructed and tested with a 22Na point source. Energy calibration was performed and initial measurements for energy resolution were conducted.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Augmented Human Activities (AHA), Department of Signal Processing, Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Research group: M2oBSI, Ghent University, Zwijnaarde, Belgium
Contributors: Us, D., Moreno-Galera, A., Nazari-Farsani, S., Palovuori, K., Kosola, H., Zedda, T., Ruotsalainen, U.
Number of pages: 6
Pages: 52-57
Publication date: 30 Jun 2015

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Publisher: IEEE
ISBN (Print): 9781479964765
ASJC Scopus subject areas: Biomedical Engineering, Computer Science Applications
Keywords: Axial geometry, breast cancer, LYSO, Positron Emission Mammography (PEM), Positron Emission Tomography (PET), pulse width conversion
DOIs:
10.1109/MeMeA.2015.7145171

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ORG=sgn,0.5
ORG=elt,0.5
INT=sgn,"Zedda, T."

Source: Scopus
Source ID: 84939483539
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Collaborative cloud-based management of home networks

Future home networks are expected to become extremely sophisticated, yet only the most technically adept persons are equipped with skills to manage them. In this paper, we provide a novel solution as to how complex smart home networks can be collaboratively managed with the assistance of operators and third party experts. Our solution rests in separating the management and control functionalities of the home access points and routers, away from the actual connectivity, traffic forwarding and routing operations within the home network. By so doing, we present a novel REST-based architecture in which the management of the home network can be hosted in an entirely separate, external cloud-based infrastructure, which models the network within the home as a resource graph.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Information security, Tampere University of Technology
Contributors: Silverajan, B., Luoma, J., Vajaranta, M., Itäpuro, R.
Number of pages: 4
Pages: 786-789
Publication date: 29 Jun 2015

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Publisher: IEEE
ISBN (Print): 9783901882760
ASJC Scopus subject areas: Software, Computer Science Applications, Computer Networks and Communications
Keywords: Cloud, Homenet, IoT, Network Management
DOIs:

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Source: Scopus
Source ID: 84942601939
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Blind estimation of speckle variance in synthetic aperture radar images

A task of blind estimation of multiplicative noise (speckle) variance in multi-look images acquired by radars with synthesized aperture array is considered. It is shown that there are several factors affecting accuracy of such estimation. The main of them are spatial correlation of the speckle, complexity of an analyzed image and peculiarities of a method used. Spatial and spectral domain approaches are analyzed. It is shown that for both approaches spatial correlation of the speckle is to be estimated and taken into account. Results for real life TerraSAR-X data are presented as illustrations and for analyzing methods' accuracy.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Tampere University of Technology, Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), National Aerospace University
Contributors: Abramova, V. V., Kozhemiakin, R., Abramov, S. K., Lukin, V. V., Zelensky, A. A., Egiazarian, K.
Publication date: 25 Jun 2015

Host publication information

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Publisher: The Institute of Electrical and Electronics Engineers, Inc.
ISBN (Print): 9781479985579
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications
Keywords: blind estimation, multi-look, SAR, speckle variance
DOIs:

10.1109/ICATT.2015.7136846

Bibliographical note

EXT="Lukin, V. V."
Source: Scopus

Source ID: 84939434768
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Experimental study of bispectrum-based encoding in radio communication system

This paper is devoted to a novel multi-frequency and bispectrum-based encoding technique designed for radio communication systems. An experimental study of an interference resistance in digital communication is performed using a novel bispectrum-based strategy. Test statistics evaluated in the form of peak values of magnitude bispectrum estimates are proposed for triplet-signals discrimination. Bit error rates assessed experimentally in a radio communication link contaminated by additive Gaussian noise and fading are studied within a wide range of input signal-to-noise ratio (SNR). Advantages of the proposed bispectral-based signal processing as compared with common phase and frequency shift keying are demonstrated and discussed.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Algebraic and Algorithmic Methods in Signal Processing AAMSP, Signal Processing Research Community (SPRC), National Aerospace University
Contributors: Naumenko, V. V., Solodovnik, V. F., Totsky, A. V., Zelensky, A. A., Astola, J. T.
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications
Keywords: bispectrum, digital communication system, fading, interference immunity, phase coupling, triplet-signal
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Planar monopole antennas on substrates fabricated through an additive manufacturing process

This paper introduces a new method for creating a flexible antenna using additive manufacturing for the construction of the substrate. Two substrates were created using a 3D multi-material polymer printer. These substrates were composed using different ratios of the two materials supported by the printer. Planar monopole antennas with a bevel were placed on top of these substrates to form flexible antennas. This paper demonstrates a quick way to create antennas that can be used on non-rigid structures.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering, George Woodruff School of Mechanical Engineering, Georgia Institute of Technology
Contributors: Saintsing, C. D., Yu, K., Qi, H. J., Tentzeris, M.
Number of pages: 3
Pages: 159-161
Publication date: 19 Jun 2015
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Electrical and Electronic Engineering, Communication
Keywords: 3D Printing, Additive Manufacturing, Broadband Antennas, Flexible Antennas
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Source: Scopus
Source ID: 84937963448
Research output: Contribution to journal › Article › Scientific › peer-review

Long-term epileptic EEG classification via 2D mapping and textural features

Interpretation of long-term Electroencephalography (EEG) records is a tiresome task for clinicians. This paper presents an efficient, low cost and novel approach for patient-specific classification of long-term epileptic EEG records. We aim to achieve this with the minimum supervision from the neurologist. To accomplish this objective, first a novel feature extraction method is proposed based on the mapping of EEG signals into two dimensional space, resulting into a texture image. The texture image is constructed by mapping and scaling EEG signals and their associated frequency sub-bands into the gray-level image domain. Image texture analysis using gray level co-occurrence matrix (GLCM) is then applied in order to extract multivariate features which are able to differentiate between seizure and seizure-free events. To evaluate the discriminative power of the proposed feature extraction method, a comparative study is performed, against other dedicated feature extraction methods. The comparative performance evaluations show that the proposed feature extraction method can outperform other state-of-art feature extraction methods with a low computational cost. With a training rate of 25%, the overall sensitivity of 70.19% and specificity of 97.74% are achieved in the classification of over 163 h of EEG records using support vector machine (SVM) classifiers with linear kernels and trained by the stochastic gradient descent (SGD) algorithm.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Video, Research group: Filterbanks, Research Community on Data-to-Decision (D2D), Qatar University
Contributors: Samiee, K., Kiranyaz, S., Gabbouj, M., Saramäki, T.
Number of pages: 11
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Original language: English
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Engineering(all)
Keywords: CHB-MIT dataset, Electroencephalography, Epileptic seizure classification, Haralick, Stochastic gradient descent, Textural features
DOIs:

10.1016/j.eswa.2015.05.002
Source: Scopus
Source ID: 84930636361
Research output: Contribution to journal › Article › Scientific › peer-review

Urothelial cancer gene regulatory networks inferred from large-scale RNAseq, Bead and Oligo gene expression data

Background: Urothelial pathogenesis is a complex process driven by an underlying network of interconnected genes. The identification of novel genomic target regions and gene targets that drive urothelial carcinogenesis is crucial in order to improve our current limited understanding of urothelial cancer (UC) on the molecular level. The inference of genome-wide gene regulatory networks (GRN) from large-scale gene expression data provides a promising approach for a detailed investigation of the underlying network structure associated to urothelial carcinogenesis. Methods: In our study we inferred and compared three GRNs by the application of the BC3Net inference algorithm to large-scale transitional cell carcinoma gene expression data sets from Illumina RNAseq (179 samples), Illumina Bead arrays (165 samples) and Affymetrix Oligo microarrays (188 samples). We investigated the structural and functional properties of GRNs for the identification of molecular targets associated to urothelial cancer. Results: We found that the urothelial cancer (UC) GRNs show a significant enrichment of subnetworks that are associated with known cancer hallmarks including cell cycle, immune response, signaling, differentiation and translation. Interestingly, the most prominent subnetworks of co-located genes were found on chromosome regions 5q31.3 (RNAseq), 8q24.3 (Oligo) and 1q23.3 (Bead), which all represent known genomic regions frequently deregulated or aberated in urothelial cancer and other cancer types. Furthermore, the identified hub genes of the individual GRNs, e.g., HID1/DMC1 (tumor development), RNF17/TDRD4 (cancer antigen) and CYP4A11 (angiogenesis/ metastasis) are known cancer associated markers. The GRNs were highly dataset specific on the interaction level between individual genes, but showed large similarities on the biological function level represented by

subnetworks. Remarkably, the RNAseq UC GRN showed twice the proportion of significant functional subnetworks. Based on our analysis of inferential and experimental networks the Bead UC GRN showed the lowest performance compared to the RNAseq and Oligo UC GRNs. Conclusion: To our knowledge, this is the first study investigating genome-scale UC GRNs. RNAseq based gene expression data is the data platform of choice for a GRN inference. Our study offers new avenues for the identification of novel putative diagnostic targets for subsequent studies in bladder tumors.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, BioMediTech, Research Community on Data-to-Decision (D2D), BioMediTech - Institute of Biosciences and Medical Technology, Queen's University, Belfast, Northern Ireland
Contributors: Matos Simoes, R. D., Dalleau, S., Williamson, K. E., Emmert-Streib, F.
Publication date: 14 May 2015
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Publication information
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ISSN (Print): 1752-0509
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Original language: English
ASJC Scopus subject areas: Molecular Biology, Structural Biology, Applied Mathematics, Modelling and Simulation, Computer Science Applications
Keywords: BC3Net, Computational genomics, Gene regulatory network, Urothelial cancer
DOIs:
10.1186/s12918-015-0165-z
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Source ID: 84931068065
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Multistep reactions of water with small Pd_n clusters: A first principles study
Multistep dissociative chemisorption reactions of water with Pd_4 and Pd_7 clusters were studied using density functional theory. The adsorption energies and referred adsorption sites from water molecule (H_2O) to partially dissociative (H_2+O and OH+H), then to fully dissociative (O+H+H) configurations are carefully determined. It is found that the adsorption energies of three dissociative reactions are 5-6 times larger than that of water molecule. Atop sites of Pd_4 and Pd_7 clusters are found to be the most stable sites for the adsorbed H_2O molecule. For the coadsorption cases of partially and fully dissociated products, H_2 and OH molecules preferably tend to bind at the low coordination (atop or bridge) sites, and O and H atoms prefer to adsorb on the high coordination (hollow) sites. It is also found that the most favorable adsorption sites for the molecular adsorbates (H_2O, H_2 and OH) are adjacent to the Pd atoms with the largest site-specific polarizabilities. Therefore, site-specific polarizability is a good predictor of the favorable adsorption sites for the weakly bound molecules. The different directions of charge transfer between the Pd clusters and the adsorbate(s) is observed. Furthermore, the processes of the adsorption, dissociation, and the dissociative products diffusion of H_2O are analyzed.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Computational Science X (CompX), Northwest University China, Nanjing University
Contributors: Liang, Y., Ma, L., Wang, J., Wang, G.
Publication date: 1 May 2015
Peer-reviewed: Yes

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Journal: Journal of Theoretical and Computational Chemistry
Volume: 14
Issue number: 3
Article number: 1550017
ISSN (Print): 0219-6336
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Original language: English
ASJC Scopus subject areas: Physical and Theoretical Chemistry, Computational Theory and Mathematics, Computer Science Applications
Keywords: Chemisorption, cluster, density functional theory, transition state

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Research output: Contribution to journal › Article › Scientific › peer-review

Recent advances in antenna design and interference cancellation algorithms for in-band full duplex relays

In-band full-duplex relays transmit and receive simultaneously at the same center frequency, hence offering enhanced spectral efficiency for relay deployment. In order to deploy such full-duplex relays, it is necessary to efficiently mitigate the inherent self-interference stemming from the strong transmit signal coupling to the sensitive receive chain. In this article, we present novel state-of-the-art antenna solutions as well as digital self-interference cancellation algorithms for compact MIMO fullduplex relays, specifically targeted for reduced-cost deployments in local area networks. The presented antenna design builds on resonant wavetraps and is shown to provide passive isolations on the order of 60-70 dB. We also discuss and present advanced digital cancellation solutions, beyond classical linear processing, specifically tailored against nonlinear distortion of the power amplifier when operating close to saturation. Measured results from a complete demonstrator system, integrating antennas, RF cancellation, and nonlinear digital cancellation, are also presented, evidencing close to 100 dB of overall self-interference suppression. The reported results indicate that building and deploying compact full-duplex MIMO relays is already technologically feasible.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Tampere University of Technology, Wireless Communications and Positioning (WICO), Aalto University
Contributors: Heino, M., Korpi, D., Huusari, T., Antonio-Rodríguez, E., Venkatasubramanian, S., Riihonen, T., Anttila, L., Icheln, C., Haneda, K., Wichman, R., Valkama, M.
Number of pages: 11
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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computer Networks and Communications
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Bibliographical note

AUX=elt,"Huusari, Timo"
Source: Scopus
Source ID: 84929335830
Research output: Contribution to journal › Article › Scientific › peer-review

Variable switching point predictive torque control with extended prediction horizon

This paper introduces the extension of the prediction horizon in the one-step variable switching point predictive torque control (VSP^2TC). Even though in the majority of power electronics applications using model predictive control (MPC) based schemes, a prediction horizon of one suffices, the use of longer prediction horizons offers substantial performance benefits. To highlight this, the proposed algorithm is applied to a low voltage (LV) drive system, which comprises a two-level inverter and an induction machine (IM). As it is shown, by extending the prediction horizon, important drive quality indices, such as the torque ripple, and the total harmonic distortion (THD) of the stator currents are reduced. However, the computational effort required for solving the formulated optimization problem in real time can be overwhelming. The implementation of a branch-and-bound technique is introduced to front this tricky matter. Simulation results verify the performance of the presented control strategy.

General information

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MoE publication type: A4 Article in a conference publication

Organisations: Smart Energy Systems (SES), National Technical University of Athens, Technische Universitat Munchen
Contributors: Alevras, I., Karamanakos, P., Manias, S., Kennel, R.
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Publisher: Institute of Electrical and Electronics Engineers Inc.
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URLs:

http://urn.fi/URN:NBN:fi:tuni-202004153265
Source: Scopus
Source ID: 84937723977
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Designing controllers with reduced order internal models
In this technical note we study robust output tracking for autonomous linear systems. We introduce a new approach to designing robust controllers using a recent observation that a full internal model is not always necessary for robustness. Especially this may be the case if the control law is only required to be robust with respect to a specific predetermined class of uncertainties in the parameters of the plant. The results are illustrated with an example on robust output tracking for coupled harmonic oscillators.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Mathematical and semantic modelling
Contributors: Paunonen, L.
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Volume: 60
Issue number: 3
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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Control and Systems Engineering, Computer Science Applications
DOIs:

10.1109/TAC.2014.2329212
URLs:

http://www.scopus.com/inward/record.url?scp=84923355671&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84923355671
Research output: Contribution to journal › Article › Scientific › peer-review

Task-based information interaction evaluation: The viewpoint of program theory
Evaluation is central in research and development of information retrieval (IR). In addition to designing and implementing new retrieval mechanisms, one must also show through rigorous evaluation that they are effective. A major focus in IR is IR mechanisms' capability of ranking relevant documents optimally for the users, given a query. Searching for information in practice involves searchers, however, and is highly interactive. When human searchers have been incorporated in evaluation studies, the results have of ten suggested that better ranking does not necessarily lead to better search task, or work task, performance. Therefore, it is not clear which system or interface features should be developed to improve the

effectiveness of human task performance. In the present article, we focus on the evaluation of task-based information interaction (TBII). We give special emphasis to learning tasks to discuss TBII in more concrete terms. Information interaction is here understood as behavioral and cognitive activities related to task planning, searching information items, selecting between them, working with them, and synthesizing and reporting. These five generic activities contribute to task performance and outcome and can be supported by information systems. In an attempt toward task-based evaluation, we introduce program theory as the evaluation framework. Such evaluation can investigate whether a program consisting of TBII activities and tools works and how it works and, further, provides a causal description of program (in)effectiveness. Our goal in the present article is to structure TBII on the basis of the five generic activities and consider the evaluation of each activity using the program theory framework. Finally, we combine these activity-based program theories in an overall evaluation framework for TBII. Such an evaluation is complex due to the large number of factors affecting information interaction. Instead of presenting tested program theories, we illustrate how the evaluation of TBII should be accomplished using the program theory framework in the evaluation of systems and behaviors, and their interactions, comprehensively in context.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: University of Tampere
Contributors: Järvelin, K., Vakkari, P., Arvola, P., Baskaya, F., Järvelin, A., Kekäläinen, J., Keskustalo, H., Kumpulainen, S., Saastamoinen, M., Savolainen, R., Sormunen, E.
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Original language: English
ASJC Scopus subject areas: Information Systems, Business, Management and Accounting(all), Computer Science Applications
Keywords: Experimentation, Human factors, Theory
DOIs:

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Source: Scopus
Source ID: 84926320780
Research output: Contribution to journal › Article › Scientific › peer-review

The internet of Bio-Nano things

The Internet of Things (IoT) has become an important research topic in the last decade, where things refer to interconnected machines and objects with embedded computing capabilities employed to extend the Internet to many application domains. While research and development continue for general IoT devices, there are many application domains where very tiny, concealable, and non-intrusive Things are needed. The properties of recently studied nanomaterials, such as graphene, have inspired the concept of Internet of NanoThings (IoNT), based on the interconnection of nanoscale devices. Despite being an enabler for many applications, the artificial nature of IoNT devices can be detrimental where the deployment of NanoThings could result in unwanted effects on health or pollution. The novel paradigm of the Internet of Bio-Nano Things (IoBNT) is introduced in this paper by stemming from synthetic biology and nanotechnology tools that allow the engineering of biological embedded computing devices. Based on biological cells, and their functionalities in the biochemical domain, Bio-NanoThings promise to enable applications such as intra-body sensing and actuation networks, and environmental control of toxic agents and pollution. The IoBNT stands as a paradigm-shifting concept for communication and network engineering, where novel challenges are faced to develop efficient and safe techniques for the exchange of information, interaction, and networking within the biochemical domain, while enabling an interface to the electrical domain of the Internet.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Wireless Communications and Positioning (WICO), University of Nebraska, Georgia Institute of Technology
Contributors: Akyildiz, I. F., Pierobon, M., Balasubramaniam, S., Koucheryavy, Y.
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Original language: English
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Source ID: 84925851587
Research output: Contribution to journal › Article › Scientific › peer-review

Semantic Labeling of Places based on Phone Usage Features using Supervised Learning

Nowadays mobile applications demand higher context awareness. The applications aim to understand the user's context (e.g., home or at work) and provide services tailored to the users. The algorithms responsible for inferring the user's context are the so-called context inference algorithms, the place detection being a particular case. Our hypothesis is that people use mobile phones differently when they are located in different places (e.g. longer calls at home than at work). Therefore, the usage of the mobile phones could be an indicator of the users' current context. The objective of the work is to develop a system that can estimate the user's place label (home, work, etc.), based on phone usage. As training and validation set, we use a database containing phone usage information of 200 users over several months including phone call and SMS logs, multimedia usage, accelerometer, GPS, network information and system information. The data was split into visits, i.e., periods of uninterrupted time that the user has been in a certain place (Home, Work, Leisure, etc.). The data include information about the phone usage during the visits, and the semantic label of the place visited (Home, Work, etc.). We consider two approaches to represent this data: the first approach (so-called visits approach) saves each visit separately; the second approach (so-called places approach) combines all visits of one user to a certain place and creates place-specific information. For place detection, we used five popular classification methods, Naïve Bayes, Decision Tree, Bagged Tree, Neural Network and K-Nearest Neighbors, in both representation approaches. We evaluated their classification rates and found that: 1) Bagged Tree outperforms the other methods; 2) the places data-representation gives better results than the visits data-representation.

General information
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Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Department of Automation Science and Engineering, Research area: Dynamic Systems, Research group: Positioning, Wireless Communications and Positioning (WICO)
Contributors: Rivero Rodriguez, A., Leppäkoski, H., Piché, R.
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Publisher: IEEE
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
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Electronic versions:

Context-Inference
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URLs:
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ORG=ase,0.4

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Source ID: 30
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Communication challenges in high-density deployments of wearable wireless devices
Wearable wireless devices are very likely to soon move into the mainstream of our society, led by the rapidly expanding multibillion dollar health and fitness markets. Should wearable technology sales follow the same pattern as those of smartphones and tablets, these new devices (a.k.a. wearables) will see explosive growth and high adoption rates over the next five years. It also means that wearables will need to become more sophisticated, capturing what the user sees, hears, or even feels. However, with an avalanche of new wearables, we will need to find ways to supply them with low-latency highspeed data connections to enable truly demanding use cases such as augmented reality. This is particularly true for high-density wearable computing scenarios, such as public transportation, where existing wireless technology may have difficulty supporting stringent application requirements. In this article, we summarize our recent progress in this area with a comprehensive review of current and emerging connectivity solutions for high-density wearable deployments, their relative performance, and open communication challenges.

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Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Intelligent dexterity for secure networked infrastructure and applications (IDSNIA), Intel Corporation
Contributors: Pyattaev, A., Johnsson, K., Andreev, S., Koucheryavy, Y.
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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications
DOIs:
10.1109/MWC.2015.7054714
URLs:
http://www.scopus.com/inward/record.url?scp=84924943737&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84924943737
Research output: Contribution to journal › Article › Scientific › peer-review

Fault tolerant control architecture design for mobile manipulation in scientific facilities
This paper describes one of the challenging issues implied by scientific infrastructures on a mobile robot cognition architecture. For a generally applicable cognition architecture, we study the dependencies and logical relations between several tasks and subsystems. The overall view of the software modules is described, including their relationship with a fault management module that monitors the consistency of the data flow among the modules. The fault management module is the solution of the deliberative architecture for the single point failures, and the safety anchor is the reactive solution for the faults by redundant equipment. In addition, a hardware architecture is proposed to ensure safe robot movement as a redundancy for the cognition of the robot. The method is designed for a four-wheel steerable (4WS) mobile manipulator (iMoro) as a case study.

General information
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Organisations: Department of Intelligent Hydraulics and Automation, Research group: Mobile manipulation, Research group: Field robotics and control, Field robotics for efficient work sites (FIRE)
Contributors: M. Aref, M., Oftadeh, R., Ghabcheloo, R., Mattila, J.
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Ratings:

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Original language: English
ASJC Scopus subject areas: Software, Artificial Intelligence, Computer Science Applications
Keywords: Architecture design, Autonomous vehicle drive, Cognition, Mobile robot, Remote handling
DOIs:

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http://www.scopus.com/inward/record.url?scp=84923377541&partnerID=8YFLogxK (Link to publication in Scopus)
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Research output: Contribution to journal › Article › Scientific › peer-review

Video summarization based on Subclass Support Vector Data Description
In this paper, we describe a method for video summarization that operates on a video segment level. We formulate this problem as the one of automatic video segment selection based on a learning process that employs salient video segment paradigms. We design an hierarchical learning scheme that consists of two steps. At the first step, an unsupervised process is performed in order to determine salient video segment types. The second step is a supervised learning process that is performed for each of the salient video segment type independently. For the latter case, since only salient training examples are available, the problem is stated as an one-class classification problem. In order to take into account subclass information that may appear in the video segment types, we introduce a novel formulation of the Support Vector Data Description method that exploits subclass information in its optimization process. We evaluate the proposed approach in three Hollywood movies, where the performance of the proposed Subclass SVDD (SSVDD) algorithm is compared with that of related methods. Experimental results show that the adoption of both hierarchical learning and the proposed SSVDD method contribute to the final classification performance.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Mygdalis, V., Iosifidis, A., Tefas, A., Pitas, I.
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ASJC Scopus subject areas: Computer Science Applications, Artificial Intelligence, Computational Theory and Mathematics
DOIs:

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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Employing a multi-Objective robust optimisation method for healthy and low-energy dwelling design in Delhi, India
Dwelling design needs to consider multiple objectives and uncertainties to achieve effective and robust performance. A multi-objective robust optimisation method is outlined and then applied with the aim to optimise a one-story archetype in Delhi to achieve a healthy low-energy design. EnergyPlus is used to model a sample of selected design and uncertainty inputs. Sensitivity analysis identifies significant parameters and a meta-model is constructed to replicate input-output relationships. The meta-model is employed in a hybrid multi-objective optimisation algorithm that accounts for uncertainty.

Results demonstrate the complexities of achieving a low energy consumption and healthy indoor environmental quality.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: University College London, University of Oxford
Contributors: Nix, E., Das, P., Taylor, J., Davies, M.
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Title of host publication: Proceedings of the 2014 Building Simulation and Optimization Conference
ASJC Scopus subject areas: Computer Science Applications, Architecture , Modelling and Simulation, Building and Construction
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http://www.scopus.com/inward/record.url?scp=84976351471&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84976351471
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Estimation of GFP-tagged RNA numbers from temporal fluorescence intensity data
Motivation: MS2-GFP-tagging of RNA is currently the only method to measure intervals between consecutive transcription events in live cells. For this, new transcripts must be accurately detected from intensity time traces. Results: We present a novel method for automatically estimating RNA numbers and production intervals from temporal data of cell fluorescence intensities that reduces uncertainty by exploiting temporal information. We also derive a robust variant, more resistant to outliers caused e.g. by RNAs moving out of focus. Using Monte Carlo simulations, we show that the quantification of RNA numbers and production intervals is generally improved compared with previous methods. Finally, we analyze data from live Escherichia coli and show statistically significant differences to previous methods. The new methods can be used to quantify numbers and production intervals of any fluorescent probes, which are present in low copy numbers, are brighter than the cell background and degrade slowly. Availability: Source code is available under Mozilla Public License at http://www.cs.tut.fi/%7ehakkin22/jumpdet/. Contact:

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Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Laboratory of Biosystem Dynamics-LBD, Multi-scaled biodata analysis and modelling (MultiBAM)
Contributors: Häkkinen, A., Ribeiro, A. S.
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Original language: English
ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computational Theory and Mathematics, Computer Science Applications, Computational Mathematics, Statistics and Probability, Medicine(all)
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10.1093/bioinformatics/btu592
URLs:

http://www.scopus.com/inward/record.url?scp=84922352843&partnerID=8YFLogxK (Link to publication in Scopus)

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Portfolio EDEND: 2014-09-15
Publisher name: Oxford University Press
Source: researchoutputwizard
Source ID: 396
Research output: Contribution to journal › Article › Scientific › peer-review

Spectral and energy efficiency of ultra-dense networks under different deployment strategies

To tackle the 1000× mobile data challenge, the research towards the 5th generation of mobile cellular networks is currently ongoing. One clear enabler toward substantially improved network area capacities is the increasing level of network densification at different layers of the overall heterogeneous radio access system. Ultra-dense deployments, or DenseNets, seek to take network densification to a whole new level, where extreme spatial reuse is deployed. This article looks into DenseNets from the perspectives of different deployment strategies, covering the densification of the classical macro layer, extremely dense indoor femto layer, as well as outdoor distributed antenna system (DAS), which can be dynamically configured as a single microcell or multiple independent microcells. Also, the potential of a new indoor-to-outdoor service provisioning paradigm is examined. The different deployment solutions are analyzed from the network area spectral and network energy efficiency perspectives, with extreme densification levels, including both indoor and outdoor use scenarios. The obtained results indicate that dedicated indoor solutions with densely deployed femtocells are much more spectrumand energy-efficient approaches to address the enormous indoor capacity demands compared to densifying the outdoor macro layer, when the systems are pushed to their capacity limits. Furthermore, the dynamic outdoor DAS concept offers an efficient and capacity-adaptive solution to provide outdoor capacity, on demand, in urban areas.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Wireless Communications and Positioning (WICO)
Contributors: Yunas, S., Valkama, M., Niemelä, J.
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Publication information

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ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computer Networks and Communications
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Source ID: 84921459532
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The assessment of constructability: BIM cases

The constructability appraisal methods developed so far are based on evaluating and analysing the major design components and systems of an entire building, such as structural systems, materials and production techniques. At first, this paper discusses the current practice of constructability assessment used in Finland and next it introduces an experimental constructability assessment method (ECAM) using building information models (BIM) as a source of constructability information. Interviews of design and construction professionals were used to explore the current practice of constructability assessment. An experimental assessment methodology was developed and tested in case projects. According to the interviews, the main assessment method used was the inspection of drawings, and constructability was assessed occasionally during the design development stage and more systematically at the very end of the detailed design stage with varying professional participants in meetings. Using ECAM in the project level a constructability score of a building and building type can be analysed. When using ECAM on the level of structural elements a constructability score of elements can be measured. These scores incorporate information for the development of constructability. In Finland, the development of a systematic review process of constructability will be needed. The constructability assessment methodology suggested in the article is experimental and is to be developed and tested further before using it reliably in building projects. The assessment combining visual and analytical approach will change present methods for assessing constructability.

General information

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MoE publication type: A1 Journal article-refereed

Organisations: Life Cycle Effectiveness of the Built Environment (LCE@BE), Aalto University
Contributors: Tauriainen, M. K., Puttonen, J. A., Saari, A. J.
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ASJC Scopus subject areas: Civil and Structural Engineering, Building and Construction, Computer Science Applications
Keywords: Analyses, Assessment, BIM, Buildability, Constructability, Modelling, Quantitative
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http://www.scopus.com/inward/record.url?scp=84921652278&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84921652278
Research output: Contribution to journal › Article › Scientific › peer-review

2.4 GHz inkjet-printed RF energy harvester on bulk cardboard substrate
An experimental investigation on the inkjetprinted power harvester for 2.4GHz and review of RF characterization of substrate and printed conductors are presented in this paper. A one stage discrete rectifier based on a voltage doubler structure and a planar monopole antenna are fabricated on cardboard using inkjet printing. The performance of the whole system is examined by measuring the output voltage of the RF power harvester. By the utilization of the proposed idea, the fabrication of low-cost environmentally-friendly battery-less wireless modules is conceivable.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Identification and Sensing Systems Research Group, Sensing Systems for Wireless Medicine (MediSense), Aristotle University of Thessaloniki, School of Electrical and Computer Engineering, Georgia Institute of Technology, School of Electrical and Computer Engineering
Contributors: Khonsari, Z., Björninen, T., Tentzeris, M. M., Sydänheimo, L., Ukkonen, L.
Number of pages: 3
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Electrical and Electronic Engineering, Communication
Keywords: additive manufacturing, cardboard substrate, energy harvester, Inkjet printing, planar monopole
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10.1109/RWS.2015.7129721
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Source ID: 84937875886
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

1180nm VECSEL with 50 W output power
We report on the development of a high-power vertical-external-cavity surface-emitting laser (VECSEL) emitting around 1180 nm. The laser emitted 50 W of output power when the mount of the gain chip was cooled to -15°C. The output power was measured using a 97% reflective cavity end-mirror. The VECSEL was arranged to form an I-shaped cavity with a length of ~100 mm; the gain chip and a curved dielectric mirror (RoC=150) acting as cavity end mirrors. The gain chip was grown by molecular beam epitaxy (MBE) and incorporated 10 GaInAs/GaAs quantum wells. For efficient heat extraction, the chip was capillary bonded to a diamond heat spreader which was attached to a TEC-cooled copper mount. The maximum optical-to-optical conversion efficiency of 28% was achieved for 42 W of output power and -15°C mount temperature.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics
Contributors: Kantola, E., Leinonen, T., Ranta, S., Tavast, M., Penttinen, J., Guina, M.
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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: continuous wave, frequency doubling, heat management, high power, infrared, power scaling, SDL, VECSEL
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

A method for predicting DCT-based denoising efficiency for grayscale images corrupted by AWGN and additive spatially correlated noise
Results of denoising based on discrete cosine transform for a wide class of images corrupted by additive noise are obtained. Three types of noise are analyzed: additive white Gaussian noise and additive spatially correlated Gaussian noise with middle and high correlation levels. TID2013 image database and some additional images are taken as test images. Conventional DCT filter and BM3D are used as denoising techniques. Denoising efficiency is described by PSNR and PSNR-HVS-M metrics. Within hard-thresholding denoising mechanism, DCT-spectrum coefficient statistics are used to characterize images and, subsequently, denoising efficiency for them. Results of denoising efficiency are fitted for such statistics and efficient approximations are obtained. It is shown that the obtained approximations provide high accuracy of prediction of denoising efficiency.

General information
Publication status: Published
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Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), National Aerospace University
Contributors: Rubel, A. S., Lukin, V. V., Egiazarian, K.
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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
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A perceptual quality metric for high-definition stereoscopic 3D video
The use of 3D video is growing in several fields such as entertainment, military simulations, medical applications. However, the process of recording, transmitting, and processing 3D video is prone to errors thus producing artifacts that may affect the perceived quality. Nowadays a challenging task is the definition of a new metric able to predict the perceived quality with low computational complexity in order to be used in real-time applications. The research in this field is very active due to the complexity of the analysis of the influence of stereoscopic cues. In this paper we present a novel stereoscopic metric based on the combination of relevant features able to predict the subjective quality rating in a more accurate way.

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Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC), Universita' degli Studi Roma TRE
Contributors: Battisti, F., Carli, M., Stramacci, A., Boev, A., Gotchev, A.
Publication date: 2015

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Volume: 9399
ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Quality metric, Stereoscopic 3D video, Video transmission
Electronic versions:

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http://urn.fi/URN:NBN:fi:tty-201606134242
Source: Scopus
Source ID: 84928485494
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Busting myths of electronic word of mouth: The relationship between customer ratings and the sales of mobile applications
Business and academic research frequently highlights the power of electronic word of mouth, relying on the knowledge that online customer ratings and reviews influence consumer decision making. Numerous studies in different disciplines have been conducted to examine the effectiveness of electronic word of mouth communication. Previously, typically small sample studies suggest that positive electronic word of mouth increases sales and that the effects depend on the volume and valence of reviews and ratings. This study's contribution lies in testing the relationship between electronic word of mouth and the sales of applications in a mobile application ecosystem (Google Play) with an extensive dataset (over 260 million customer ratings; 18 months). The results show that higher values of valence of customer ratings correlate statistically significantly with higher sales. The volume of ratings correlates positively with sales in the long term but negatively in the short term. Furthermore, the relationship between electronic word of mouth and sales seems to be more important when the price of the application increases. The findings also underline the importance of the choice of a measurement period in studies.

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Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Managing digital industrial transformation (mDIT), Pori Department, Research group: Business Ecosystems, Networks and Innovations, Turun Yliopisto/Turun Biomateriaalikeskus, University of Turku, Turku School of Economics, VTT Technical Research Centre of Finland, University of Turku
Contributors: Hyrynsalmi, S., Seppänen, M., Aarikka-Stenroos, L., Suominen, A., Järveläinen, J., Harkke, V.
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Publication date: 2015
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Journal: Journal of Theoretical and Applied Electronic Commerce Research
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Keywords: App stores, Big data, Consumer ratings, Consumer reviews, Electronic word of mouth, Micro-pricing, Products ratings, Sales

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EXT="Aarikka-Stenroos, Leena"
EXT="Hyrynsalmi, Sami"

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Source: Scopus
Source ID: 84930678533
Research output: Contribution to journal › Article › Scientific › peer-review

Combining full-reference image visual quality metrics by neural network

A task of assessing full-reference visual quality of images is considered. Correlation between the obtained array of mean opinion scores (MOS) and the corresponding array of given metric values allows characterizing correspondence of a considered metric to HVS. For the largest openly available database TID2013 intended for metric verification, a Spearman correlation is about 0.85 for the best existing HVS-metrics. One simple way to improve an efficiency of assessing visual quality of images is to combine several metrics. Our work addresses a possibility of using neural networks for the aforementioned purpose. As leaning data, we have used metric sets for images of the database TID2013 that are employed as the network inputs. Randomly selected half of 3000 images of the database TID2013 has been used at the learning stage whilst other half have been exploited for assessing quality of neural network based HVS-metric. Six metrics "cover" well all types of distortions: FSIMc, PSNR-HMA, PSNR-HVS, SFF, SR-SIM, and VIF, have been selected. As the result of NN learning, the Spearman correlation between the NN output and the MOS for the verification set of database TID2013 reaches 0.93 for the best configuration of NN. This is considerably better than for any particular metric employed as an input (FSIMc is the best among them). Analysis of the designed metric efficiency is carried out, its advantages and drawbacks are demonstrated.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Signal Processing Research Community (SPRC), National Aerospace University
Contributors: Lukin, V. V., Ponomarenko, N. N., Ieremeiev, O., Egiazarian, K., Astola, J.
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ISBN (Print): 9781628414844
ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Full-reference image visual quality assessment, Neural networks
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Source: Scopus
Source ID: 84928473490
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Depth map occlusion filling and scene reconstruction using modified exemplar-based inpainting

RGB-D sensors are relatively inexpensive and are commercially available off-the-shelf. However, owing to their low complexity, there are several artifacts that one encounters in the depth map like holes, mis-alignment between the depth and color image and lack of sharp object boundaries in the depth map. Depth map generated by Kinect cameras also contain a significant amount of missing pixels and strong noise, limiting their usability in many computer vision applications. In this paper, we present an efficient hole filling and damaged region restoration method that improves the quality of the depth maps obtained with the Microsoft Kinect device. The proposed approach is based on a modified exemplar-based inpainting and LPA-ICI filtering by exploiting the correlation between color and depth values in local image neighborhoods. As a result, edges of the objects are sharpened and aligned with the objects in the color image.

Several examples considered in this paper show the effectiveness of the proposed approach for large holes removal as well as recovery of small regions on several test images of depth maps. We perform a comparative study and show that statistically, the proposed algorithm delivers superior quality results compared to existing algorithms.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), Dept. of Radio-Electronics Systems, Don State Technical University
Contributors: Voronin, V. V., Marchuk, V. I., Fisunov, A. V., Tokareva, S. V., Egiazarian, K. O.
Publication date: 2015

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Depth map, Filtering, Image processing, Inpainting, Kinect, Occlusion
DOIs:
10.1117/12.2076506
Source: Scopus
Source ID: 84928473063
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Distant speech separation using predicted time-frequency masks from spatial features
Speech separation algorithms are faced with a difficult task of producing high degree of separation without containing unwanted artifacts. The time-frequency (T-F) masking technique applies a real-valued (or binary) mask on top of the signal's spectrum to filter out unwanted components. The practical difficulty lies in the mask estimation. Often, using efficient masks engineered for separation performance leads to presence of unwanted musical noise artifacts in the separated signal. This lowers the perceptual quality and intelligibility of the output. Microphone arrays have been long studied for processing of distant speech. This work uses a feed-forward neural network for mapping microphone array's spatial features into a T-F mask. Wiener filter is used as a desired mask for training the neural network using speech examples in simulated setting. The T-F masks predicted by the neural network are combined to obtain an enhanced separation mask that exploits the information regarding interference between all sources. The final mask is applied to the delay-and-sum beamformer (DSB) output. The algorithm's objective separation capability in conjunction with the separated speech intelligibility is tested with recorded speech from distant talkers in two rooms from two distances. The results show improvement in instrumental measure for intelligibility and frequency-weighted SNR over complex-valued non-negative matrix factorization (CNMF) source separation approach, spatial sound source separation, and conventional beamforming methods such as the DSB and minimum variance distortionless response (MVDR).

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Contributors: Pertilä, P., Nikunen, J.
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ASJC Scopus subject areas: Modelling and Simulation, Computer Science Applications, Computer Vision and Pattern Recognition, Software, Communication, Linguistics and Language, Language and Linguistics

Keywords: Beamforming, Microphone arrays, Neural networks, Speech separation, Time-frequency masking
DOIs:
10.1016/j.specom.2015.01.006
Source: Scopus
Source ID: 84923277715
Research output: Contribution to journal › Article › Scientific › peer-review

Extreme learning machine based supervised subspace learning

This paper proposes a novel method for supervised subspace learning based on Single-hidden Layer Feedforward Neural networks. The proposed method calculates appropriate network target vectors by formulating a Bayesian model exploiting both the labeling information available for the training data and geometric properties of the training data, when represented in the feature space determined by the network's hidden layer outputs. After the calculation of the network target vectors, Extreme Learning Machine-based neural network training is applied and classification is performed using a Nearest Neighbor classifier. Experimental results on publicly available data sets show that the proposed approach consistently outperforms the standard ELM approach, as well as other standard methods.

General information

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Organisations: Department of Signal Processing, Research Community on Data-to-Decision (D2D)
Contributors: Iosifidis, A.
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ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Cognitive Neuroscience
Keywords: Extreme Learning Machine, Network targets calculation, Supervised subspace learning
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10.1016/j.neucom.2015.04.083
Research output: Contribution to journal › Article › Scientific › peer-review

Green (In,Ga,Al)P-GaP light-emitting diodes grown on high-index GaAs surfaces

We report on green (550-560 nm) electroluminescence (EL) from (Al<inf>0.5</inf>Ga<inf>0.5</inf>)<inf>0.5</inf>In<inf>0.5</inf>P-(Al<inf>0.8</inf>Ga<inf>0.2</inf>)<inf>0.5</inf>In<inf>0.5</inf>P double p-i-n heterostructures with monolayer-scale tensile strained GaP insertions in the cladding layers and light-emitting diodes (LEDs) based thereupon. The structures are grown side-by-side on high-index and (100) GaAs substrates by molecular beam epitaxy. Cross-sectional transmission electron microscopy studies indicate that GaP insertions are flat, thus the GaP-barrier substrate orientation-dependent heights should match the predictions of the flat model. At moderate current densities (~500 A/cm²) the EL intensity of the structures is comparable for all substrate orientations. Opposite to the (100)-grown strictures, the EL spectra of (211) and (311)-grown devices are shifted towards shorter wavelengths (~550 nm at room temperature). At high current densities (>1 kA/cm²) a much higher EL intensity is achieved for the devices grown on high-index substrates. The integrated intensity of (311)-grown structures gradually saturates at current densities above 4 kA/cm², whereas no saturation is revealed for (211)-grown structures up to the current densities above 14 kA/cm². We attribute the effect to the surface orientation-dependent engineering of the GaP band structure which prevents the escape of the nonequilibrium electrons into the indirect conduction band minima of the p- doped (Al<inf>0.8</inf>Ga<inf>0.2</inf>)<inf>0.5</inf>In<inf>0.5</inf>P cladding layers.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Frontier Photonics, Technische Universität Berlin, Fakultät VII-Wirtschaft und Management, 25.6.2012, VI Systems GmbH, CEMES-CNRS, A. F. Ioffe Physical Technical Institute, Institut Für Festkörperphysik
Contributors: Ledentsov, N. N., Shchukin, V. A., Lyytikäinen, J., Okhotnikov, O., Cherkashin, N. A., Shernyakov, Y. M., Payusov, A. S., Gordeev, N. Y., Maximov, M. V., Schlichting, S., Nippert, F., Hoffmann, A.

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ISBN (Print): 9781628414738
ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

>8W GaInNAs VECSEL emitting at 615 nm
We report a high-power VECSEL emitting <8W around 615 nm. The gain chip of the laser was grown by plasmaassisted molecular beam epitaxy and it comprised 10 GaInNAs quantum wells. The VECSEL cavity had a V-shaped geometry and a 10-mm-long non-critically phase-matched LBO crystal for second harmonic generation. The cavity incorporated also an etalon and a birefringent filter for controlling the output wavelength. With the aid of the secondharmonic output and the infrared light leaking out from the laser cavity, the single-pass conversion efficiency of the crystal was estimated to have a value of 0.75%.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics
Contributors: Leinonen, T., Penttinen, J. P., Korpijärvi, V. M., Kantola, E., Guina, M.
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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: frequency doubling, high power visible laser, OPSL, orange-red VECSEL, SDL, SHG
DOIs:
10.1117/12.2079162
Source: Scopus
Source ID: 84925597620
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Idea-space: A use case of collaborative course development in higher education

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Managing digital industrial transformation (mDIT), ESCP Europe Berlin, Ruhr West University of Applied Sciences, Vytautas Magnus University, Duale Hochschule Baden Württemberg, NCSR, Jyväskylän yliopisto
Contributors: AbuJarour, S., Pawlowski, J., Bick, M., Bagucanskyte, M., Frankenberg, A., Hudak, R., Makropoulos, C., Pappa, D., Pitsilis, V., Pirkkalainen, H., Tannhauser, A. C., Trepule, E., Vidalis, A., Volungeviciene, A.
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Publisher: TUDpress Verlag der Wissenschaften GmbH

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ASJC Scopus subject areas: Computer Science Applications, Information Systems
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http://www.scopus.com/inward/record.url?scp=84959421920&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84959421920
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Machine learning for adaptive bilateral filtering

We describe a supervised learning procedure for estimating the relation between a set of local image features and the local optimal parameters of an adaptive bilateral filter. A set of two entropy-based features is used to represent the properties of the image at a local scale. Experimental results show that our entropy-based adaptive bilateral filter outperforms other extensions of the bilateral filter where parameter tuning is based on empirical rules. Beyond bilateral filter, our learning procedure represents a general framework that can be used to develop a wide class of adaptive filters.

General information

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Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), NVIDIA
Contributors: Frosio, I., Egiazarian, K., Pulli, K.
Publication date: 2015

Host publication information

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Publisher: SPIE
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ISBN (Print): 9781628414899

Publication series

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Publisher: The International Society for Optical Engineering
ISSN (Print): 0277-786X
ISSN (Electronic): 1996-756X
ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Adaptive bilateral filter, Denoising, Machine learning, Optimization, Training
DOIs:
10.1117/12.2077733
Source: Scopus
Source ID: 84928485491
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Measuring bend losses in large-mode-area fibers

We investigate the measurement of bend losses in few-mode large-mode-area (LMA) fibers. The influence of the light source spectral characteristics, modal power content and cladding light on the measurement accuracy and precision is studied experimentally. Monte-Carlo simulations are performed to understand the distribution of the variations. This study provides practical guidelines for bend loss measurements.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Frontier Photonics, nLIGHT Corporation
Contributors: Ye, C., Koponen, J., Aallos, V., Kokki, T., Petit, L., Kimmelma, O.
Publication date: 2015

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics

Keywords: Bend loss, Few-mode, Fiber amplifiers, Fiber lasers, Large-mode-area fiber, Silica optical fiber
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10.1117/12.2076813
URLs:
http://www.scopus.com/inward/record.url?scp=84931311791&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84931311791
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Monolithic GaInNAsSb/GaAs VECSEL emitting at 1550 nm

We report the first monolithic GaAs-based vertical external-cavity surface-emitting laser (VECSEL) operating at 1550 nm. The VECSEL is based on a gain mirror which was grown by plasma-assisted molecular beam epitaxy and comprises 8 GaInNAsSb/GaAs quantum wells and an AlAs/GaAs distributed Bragg reflector. When pumped by an 808 nm diode laser, the laser exhibited an output power of 80 mW for a mount temperature of 16 °C.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics
Contributors: Korpijärvi, V., Kantola, E. L., Leinonen, T., Guina, M.
Publication date: 2015

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: dilute nitride, diode-pumped lasers, GaInNAsSb, semiconductor disk lasers, Semiconductor lasers, vertical external cavity surface emitting lasers
DOIs:
10.1117/12.2077517
Source: Scopus
Source ID: 84925652903
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Multi-physics modeling and simulation of a frequency doubling antenna sensor for passive wireless strain sensing

This research studies multi-physics simulation of a frequency doubling antenna sensor for wireless strain measurement. The frequency doubling technology allows easy distinguishing of backscattered passive sensor signal (at the doubled frequency 2) from environmental reflection (at original reader interrogation frequency). Upon bonding to a base structure, because strain/deformation causes resonance frequency change of the antenna sensor, the passive wireless antenna sensor can be used to measure strain in the underlying base structure. To accurately model the mechanical and electromagnetic behaviors of the frequency doubling antenna sensor, a multiphysics coupled simulation approach is proposed. For simulating both the matching network performance and the antenna behavior under strain/deformation, two commercial software packages, COMSOL and ADS, are combined to leverage the strength of each package.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering
Contributors: Cho, C., Yi, X., Wang, Y., Tentzeris, M. M.
Number of pages: 9
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Publication date: 2015

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Publisher: DEStech Publications

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ASJC Scopus subject areas: Computer Science Applications, Health Information Management
URLs:
http://www.scopus.com/inward/record.url?scp=84945541585&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84945541585
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

No-reference visual quality assessment for image inpainting

Inpainting has received a lot of attention in recent years and quality assessment is an important task to evaluate different image reconstruction approaches. In many cases inpainting methods introduce a blur in sharp transitions in image and image contours in the recovery of large areas with missing pixels and often fail to recover curvy boundary edges. Quantitative metrics of inpainting results currently do not exist and researchers use human comparisons to evaluate their methodologies and techniques. Most objective quality assessment methods rely on a reference image, which is often not available in inpainting applications. Usually researchers use subjective quality assessment by human observers. It is difficult and time consuming procedure. This paper focuses on a machine learning approach for no-reference visual quality assessment for image inpainting based on the human visual property. Our method is based on observation that Local Binary Patterns well describe local structural information of the image. We use a support vector regression learned on assessed by human images to predict perceived quality of inpainted images. We demonstrate how our predicted quality value correlates with qualitative opinion in a human observer study. Results are shown on a human-scored dataset for different inpainting methods.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), Dept. of Radio-Electronics Systems, Don State Technical University
Contributors: Voronin, V. V., Frantc, V. A., Marchuk, V. I., Sherstobitov, A. I., Egiazarian, K.
Publication date: 2015

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ISBN (Print): 9781628414899

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Inpainting, Machine learning, Metric, Quality assessment, SVR, Visual salience
DOIs:
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Source: Scopus
Source ID: 84928473922
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Organisational knowledge flows and structural change the case of dispersed education organizations

The paper studies the implications of structural change for organisational knowledge flows. A qualitative case study was carried out in two vocational education and training organisations in Finland in order to recognise how the system-level structural change has been perceived by the education managers. The paper aims to bridge a research gap in knowledge management in situations of changing organisation structures. The results reveal that the externally driven structural change has led to concurrent and somewhat conflicting organisation structures leading to distortion of knowledge flows. Administrative Bureaucracies, team adhocracies and professional autonomies favour different structures and knowledge flows. The results also show that the integration of smaller organisations into large administrative entities further complicates the flow of knowledge and amplifies management challenges relating to concurrent structures. The paper calls for better integration of knowledge management into the strategic management of knowledge-intensive education organisations. The findings provide practical support for the management of previously independent education institutes to confront the structural change towards regional and geographically dispersed actors. More generally, the discussion contributes to the discussion on managing growing knowledge-intensive organisations and knowledge work.

General information

Publication status: Published

MoE publication type: A1 Journal article-refereed
Organisations: Department of Information Management and Logistics, Research group: Novi, School of Management (JKK)
Contributors: Laihonen, H., Syysnummi, P.
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Publication date: 2015
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Volume: 6
Issue number: 3
ISSN (Print): 1743-8268
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ASJC Scopus subject areas: Information Systems and Management, Computer Science Applications, Management Information Systems, Management of Technology and Innovation
Keywords: Education management, Knowledge flows, Knowledge management, VET
DOIs:

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Source: Scopus
Source ID: 84946750279
Research output: Contribution to journal › Article › Scientific › peer-review

Power and wavelength scaling using semiconductor disk laser - bismuth fiber MOPA systems
We present a master oscillator power amplifier (MOPA) system that comprises a mode-locked semiconductor disk laser (SDL) emitting at 1.33 mu m and a bismuth-doped fiber amplifier. The mode-locked SDL was fabricated by wafer bonding an InP-based gain section with a GaAs-based distributed Bragg reflector (DBR) using (3-Mercaptopropyl)trimethoxysilane. The bismuth-doped fiber amplifier was pumped with a continuous wave SDL emitting at 1.18 mu m. The MOPA system produced pulses at a repetition rate of 827 MHz with a pulse energy of 0.62 nJ, which corresponds to an average output power of more than 0.5 W.

General information
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MoE publication type: A4 Article in a conference publication
Organisations: Frontier Photonics, Optoelectronics Research Centre, Research group: Ultrafast and intense lasers, Research group: Semiconductor Technology and Applications, Ulyanovsk State University, Fiber Optics Research Center , Russian Academy of Sciences
Contributors: Heikkinen, J., Gumenyuk, R., Rantamäki, A., Lyytikäinen, J., Leinonen, T., Zolotovskii, I., Melkumov, M., Dianov, E. M., Okhotnikov, O. G.
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ISBN (Print): 9781628414394

Publication series
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Publisher: SPIE-INT SOC OPTICAL ENGINEERING
Volume: 9349
ISSN (Print): 0277-786X
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Keywords: Semiconductor disk laser (SDL), vertical-external-cavity surface-emitting laser (VECSEL), modelocking, wafer bonding, bismuth-doped fiber, master oscillator power amplifier (MOPA), SUPERCONTINUUM GENERATION, OUTPUT POWER, PICOSECOND, VECSEL, PULSES, GHZ

DOIs:
10.1117/12.2076805
Source: WOS
Source ID: 000353134900011
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Preserving natural scene lighting by strobe-lit video

Capturing images in low light intensity, and preserving ambient light in such conditions pose significant problems in terms of achievable image quality. Either the sensitivity of the sensor must be increased, filling the resulting image with noise, or the scene must be lit with artificial light, destroying the aesthetic quality of the image. While the issue has been previously tackled for still imagery using cross-bilateral filtering, the same problem exists in capturing video. We propose a method of illuminating the scene with a strobe light synchronized to every other frame captured by the camera, and merging the information from consecutive frames alternating between high gain and high intensity lighting. The motion between the frames is compensated using motion estimation based on block matching between strobe-illuminated frames. The uniform lighting conditions between every other frame make it possible to utilize conventional motion estimation methods, circumventing the image registration challenges faced in fusing flash/non-flash pairs from non-stationary images. The results of the proposed method are shown to closely resemble those computed using the same filter based on reference images captured at perfect camera alignment. The method can be applied starting from a simple set of three frames to video streams of arbitrary lengths with the only requirements being sufficiently accurate syncing between the imaging device and the lighting unit, and the capability to switch states (sensor gain high/low, illumination on/off) fast enough.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC)
Contributors: Suominen, O., Gotchev, A.
Publication date: 2015

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Ambient light, Bilateral filter, Computational photography, Image denoising, Low-light, Motion compensation
Electronic versions:
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10.1117/12.2185013
URLs:
http://urn.fi/URN:NBN:fi:tty-201606064228
Source: Scopus
Source ID: 84928473920
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Real-time depth image-based rendering with layered dis-occlusion compensation and aliasing-free composition

Depth Image-based Rendering (DIBR) is a popular view synthesis technique which utilizes the RGB+D image format, also referred to as view-plus-depth scene representation. Classical DIBR is prone to dis-occlusion artefacts, caused by the lack of information in areas behind foreground objects, which appear visible in the synthesized images. A number of recently proposed compensation techniques have addressed the problem of hole filling. However, their computational complexity does not allow for real-time view synthesis and may require additional user input. In this work, we propose a hole-compensation technique, which works fully automatically and in a perceptually-correct manner. The proposed technique applies a two-layer model of the given RGB+D imagery, which is specifically tailored for rendering with free viewpoint selection. The main two components of the proposed technique are an adaptive layering of depth into relative 'foreground' and 'background' layers to be rendered separately and an additional blending filtering aimed at creating a blending function for aliasing cancellation during the process of view composition. The proposed real-time implementation turns ordinary view-plus-depth images to true 3D scene representations, which allow visualization in the fly-around manner.

General information
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Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC)
Contributors: Smirnov, S., Gotchev, A.
Publication date: 2015

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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Roadmap for organic and printed electronics

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research group: Laboratory for Future Electronics, Tampere University of Technology, Augmented Human Activities (AHA), OE-A (Organic and Printed Electronics Association), PolyIC GmbH and Co. KG
Contributors: Hecker, K., Clemens, W., Lupo, D., Breitung, S.
Number of pages: 2
Pages: 125-126
Publication date: 2015

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ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Artificial Intelligence
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Source ID: 84976314633
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Smart home gateway system over Bluetooth low energy with wireless energy transfer capability
As billions of sensors and smart meters connect to the Internet of Things (IoT), current wireless technologies are taking decisive steps to ensure their sustainable operation. One popular IoT scenario features a smart home service gateway, which becomes the central point of user's home environment facilitating a multitude of tasks. Given that most IoT devices connected to residential gateway are small-scale and battery-powered, the key challenge is to extend their lifetime without recharging/replacing batteries. To this end, a novel radio technology named Bluetooth low energy (BLE) has recently been completed to enable energy-efficient data transfer. Another inspiring innovation is the capability of sensors to harvest wireless energy in their local environment. In this work, we envision a scenario where many in-home sensors are communicating with a smart gateway over the BLE protocol, while at the same time harvesting RF energy transmitted from the gateway wirelessly via a dedicated radio interface. We thoroughly investigate performance limitations of such wireless energy transfer interface (WETI) with dynamic analytical model and with important practical considerations. Our

methodology delivers the upper bound on WETI operation coupled with BLE-based communication, which characterizes ultimate system performance over the class of practical radio and energy resource management algorithms.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Wireless Communications and Positioning (WICO), International Insitute for Advanced Aerospace Technologies of St. Petersburg State University of Aerospace Instrumentation
Contributors: Galinina, O., Mikhaylov, K., Andreev, S., Turlikov, A., Koucheryavy, Y.
Publication date: 2015
Peer-reviewed: Yes

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Journal: Eurasip Journal on Wireless Communications and Networking
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Issue number: 1
Article number: 178
ISSN (Print): 1687-1472
Ratings:

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ASJC Scopus subject areas: Computer Networks and Communications, Signal Processing, Computer Science Applications
Keywords: Bluetooth low energy, Internet of Things, Sensors, Smart home gateway, Wireless energy transfer
DOIs:

10.1186/s13638-015-0393-3
Source: Scopus
Source ID: 84938840129
Research output: Contribution to journal › Article › Scientific › peer-review

Towards dependable automation
Automation runs the modern society and it’s critical systems. It is anetworked software product depending on the co-operation of old and new technologies.Information security for automation systems should be regarded in light ofthe most important quality required from automation—dependability. This chapterfocuses on process of developing dependable solutions for the entire lifecycle ofautomation systems. The approach includes a guideline for securing automation anda dependability model that is a data flow model extended with security and automationrequirements. Results of this analysis should be used in final requirementspecification for implementation. Dependability model is the key tool in securedevelopment lifecycle. It can be used in new product development, improving anold automation system and also during the active lifecycle of automation to manage inevitable changes occurring during the entire lifespan of automation system.

General information
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MoE publication type: A3 Part of a book or another research book
Organisations: Tampere University of Technology, Department of Automation Science and Engineering, Research area: Information Systems in Automation
Contributors: Seppälä, J., Salmenperä, M.
Number of pages: 21
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ASJC Scopus subject areas: Computer Science Applications, Control and Systems Engineering, Mechanical Engineering, Control and Optimization
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http://www.scopus.com/inward/record.url?scp=84934873164&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84934873164
Research output: Chapter in Book/Report/Conference proceeding › Chapter › Scientific › peer-review

Uncertainty propagation of iron loss from characterization measurements to computation of electrical machines

Purpose - The purpose of this paper is to find out how uncertainties in the characterization of magnetic materials propagate through identification and numerical simulation to the computation of iron losses in electrical machines. Design/methodology/approach - The probabilistic uncertainties in the iron losses are modelled with the spectral approach using chaos polynomials. The Sobol indices are used for the global sensitivity analysis. The machine is modelled with a 2D finite element method and the iron losses are computed with a previously developed accurate method. Findings - The uncertainties propagate in different ways to the different components of losses, i.e. eddy current, hysteresis, and excess losses. The propagation is also different depending on the investigated region of the machine, i.e. Stator or rotor teeth, yokes, tooth tips. Research limitations/implications - The method does not account for uncertainties related to the manufacturing process, which might result in even larger variability. Practical implications - A major implication of the findings is that the identification of iron loss parameters at low frequencies does not affect the loss variability. The identification with high-frequency measurement is very important for the rotor tooth tips. The variability in the excess loss parameters is of low impact. Originality/value - The presented results are of importance for the magnetic material manufacturers and the electrical machine designers. The manufacturers can plan the measurement and identification procedures as to minimize the output variability of the parameters. The designers of the machine can use the result and the presented procedures to estimate the variability of their design.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Smart Energy Systems (SES), Aalto University, L2EP, Université Lille 1, L2EP, Arts et Metiers Paris Tech
Contributors: Belahcen, A., Rasilo, P., Nguyen, T. T., Clénet, S.
Number of pages: 13
Pages: 624-636
Publication date: 2015
Peer-reviewed: Yes

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Journal: COMPEL: The International Journal for Computation and Mathematics in Electrical and Electronic Engineering
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Issue number: 3
ISSN (Print): 0332-1649
Ratings:
Scopus rating (2015): CiteScore 1.2 SJR 0.231 SNIP 0.554
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computational Theory and Mathematics, Applied Mathematics
Keywords: Electrical machine, Finite element methods, Iron losses, Uncertainty estimation
DOIs:
10.1108/COMPEL-10-2014-0271
Source: Scopus
Source ID: 84929258660
Research output: Contribution to journal › Article › Scientific › peer-review

Class-Specific Reference Discriminant Analysis With Application in Human Behavior Analysis

In this paper, a novel nonlinear subspace learning technique for class-specific data representation is proposed. A novel data representation is obtained by applying nonlinear class-specific data projection to a discriminant feature space, where the data belonging to the class under consideration are enforced to be close to their class representation, while the data belonging to the remaining classes are enforced to be as far as possible from it. A class is represented by an optimized class vector, enhancing class discrimination in the resulting feature space. An iterative optimization scheme is proposed to this end, where both the optimal nonlinear data projection and the optimal class representation are determined in each optimization step. The proposed approach is tested on three problems relating to human behavior analysis: Face recognition, facial expression recognition, and human action recognition. Experimental results denote the effectiveness of the proposed approach, since the proposed class-specific reference discriminant analysis outperforms kernel discriminant analysis, kernel spectral regression, and class-specific kernel discriminant analysis, as well as support vector machine-based classification, in most cases.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
Pages: 315-326
Publication date: 25 Dec 2014
Peer-reviewed: Yes

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Volume: 45
Issue number: 3
ISSN (Print): 2168-2291
Ratings:
Scopus rating (2014): CiteScore 7.3 SJR 1.28 SNIP 3.026
Original language: English
ASJC Scopus subject areas: Artificial Intelligence, Signal Processing, Human Factors and Ergonomics, Computer Networks and Communications, Computer Science Applications, Human-Computer Interaction, Control and Systems Engineering
DOIs:
10.1109/THMS.2014.2379274
Research output: Contribution to journal › Article › Scientific › peer-review

Comparative evaluation of gene set analysis approaches for RNA-Seq data
Background: Over the last few years transcriptome sequencing (RNA-Seq) has almost completely taken over microarrays for high-throughput studies of gene expression. Currently, the most popular use of RNA-Seq is to identify genes which are differentially expressed between two or more conditions. Despite the importance of Gene Set Analysis (GSA) in the interpretation of the results from RNA-Seq experiments, the limitations of GSA methods developed for microarrays in the context of RNA-Seq data are not well understood. Results: We provide a thorough evaluation of popular multivariate and gene-level self-contained GSA approaches on simulated and real RNA-Seq data. The multivariate approach employs multivariate non-parametric tests combined with popular normalizations for RNA-Seq data. The gene-level approach utilizes univariate tests designed for the analysis of RNA-Seq data to find gene-specific -values and combines them into a pathway -value using classical statistical techniques. Our results demonstrate that the Type I error rate and the power of multivariate tests depend only on the test statistics and are insensitive to the different normalizations. In general standard multivariate GSA tests detect pathways that do not have any bias in terms of pathways size, percentage of differentially expressed genes, or average gene length in a pathway. In contrast the Type I error rate and the power of gene-level GSA tests are heavily affected by the methods for combining -values, and all aforementioned biases are present in detected pathways. Conclusions: Our result emphasizes the importance of using self-contained non-parametric multivariate tests for detecting differentially expressed pathways for RNA-Seq data and warns against applying gene-level GSA tests, especially because of their high level of Type I error rates for both, simulated and real data.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), University of Arkansas for Medical Sciences, Computational Biology and Machine Learning, Queen's University, Belfast, Northern Ireland
Contributors: Rahmatallah, Y., Emmert-Streib, F., Glazko, G.
Publication date: 5 Dec 2014
Peer-reviewed: Yes

Publication information
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Article number: 397
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Original language: English
ASJC Scopus subject areas: Applied Mathematics, Structural Biology, Biochemistry, Molecular Biology, Computer Science Applications
DOIs:
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Source: Scopus
Source ID: 84923922737
Research output: Contribution to journal › Article › Scientific › peer-review

Regularized extreme learning machine for multi-view semi-supervised action recognition

In this paper, three novel classification algorithms aiming at (semi-)supervised action classification are proposed. Inspired by the effectiveness of discriminant subspace learning techniques and the fast and efficient Extreme Learning Machine (ELM) algorithm for Single-hidden Layer Feedforward Neural networks training, the ELM algorithm is extended by incorporating discrimination criteria in its optimization process, in order to enhance its classification performance. The proposed Discriminant ELM algorithm is extended, by incorporating proper regularization in its optimization process, in order to exploit information appearing in both labeled and unlabeled action instances. An iterative optimization scheme is proposed in order to address multi-view action classification. The proposed classification algorithms are evaluated on three publicly available action recognition databases providing state-of-the-art performance in all the cases.

General information

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Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
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Keywords: Extreme learning machine, Multi-view learning, Semi-supervised learning
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Source: Scopus
Source ID: 84906935799
Research output: Contribution to journal › Article › Scientific › peer-review

Body-touching: An embodied interaction technique for health information systems in developing regions

We present a study of using embodied health information system for developing regions focusing on users not familiar with technology. We designed and developed a health information system with two gesture-based selection techniques: pointing to a screen and touching one's own body part. We evaluated the prototype in user study with 37 semi-literate and literate participants. Our results indicate a clear preference (76%) for touching in the healthcare domain. Based on our observations and user feedback, we present four design guidelines for developing embodied systems for the developing world: designing bodycentric interaction to overcome literacy and technological proficiency barriers, addressing the misconceptions of system behaviors with users not familiar with technology, understanding effects of cultural constraints on interaction, and utilizing interactive virtual avatars to connect with the users.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Augmented Human Activities (AHA), IBM Research, Indian Institute of Technology
Contributors: Sharma, S., Srivastava, S., Sorathia, K., Hakulinen, J., Heimonen, T., Turunen, M., Rajput, N.
Number of pages: 8
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Publication date: 4 Nov 2014

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Publisher: Association for Computing Machinery, Inc
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ASJC Scopus subject areas: Computer Science Applications, Human-Computer Interaction, Software
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10.1145/2676467.2676514
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http://www.scopus.com/inward/record.url?scp=84964053943&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84964053943
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

DYNAMO sound engine - Exploring the aesthetics of dynamic sound interactions

This paper outlines the design and development process of the Dynamic Audio Motion (Dynamo) concept. The Dynamo audio engine was developed for driving dynamic sound interaction states via custom made finite state machine. Further, a generative sound design approach was employed for creating sonic and musical structures. Designed dynamic sound interactions were tested in an embodied information wall application with endusers. During the testing situation, end-users engaged in a reflective creation process providing valuable insight of their experiences of using the system. In this paper we present key questions driving the research, theoretical background, research approach, an audio engine development process, and end-user research activities. The results indicate that dynamic sound interactions supported people's personal, emotional, and creative needs in the design context.

General information

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Organisations: Augmented Human Activities (AHA)
Contributors: Luhtala, M., Heimonen, T., Mäkelä, V., Keskinen, T., Turunen, M., Saarinen, S.
Number of pages: 8
Pages: 159-166
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http://www.scopus.com/inward/record.url?scp=84963995207&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Email intensity, productivity and control in the knowledge worker's performance on the desktop

Experiencing stress, disturbing interruptions, loss of ability to concentrate, hurry and challenges to meet tight deadlines at work are very common in working life. At the same time, while variety of digital communication channels like instant messaging, video calls and social networking sites are getting more popular in working life, email is still intensively utilized work communication media. The goal of the empirical field study analyzing daily desktop computing of knowledge workers was to analyze association between email intensity in work time spending and subjectively experienced quality of work performance. It was found that while intensive email use does not impair subjectively experienced productivity, it may harm ability to concentrate, may increase forgetfulness and inability to solve problems at work effectively. Copyright is held by the owner/author(s). Publication rights licensed to ACM.

General information

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Organisations: Augmented Human Activities (AHA), University of Tampere
Contributors: Franssila, H., Okkonen, J., Savolainen, R.
Number of pages: 4

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Keywords: Email intensity, Knowledge work, Measurement, Productivity, Work performance
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http://www.scopus.com/inward/record.url?scp=84964078815&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84964078815
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Games and energy: Profiling power usage during play

Computer gaming is a globally growing industry, with hundreds of millions of gaming-capable computers consuming an ever increasing amount of energy. Several of the world's most popular computer games tend to make a heavy use of computers' central processing units and/or graphics processing units. When such games execute on typical computers, for much of the time those components are kept in high energy-consuming states, regardless of what is happening in the game. We analyze this pattern of energy usage and we assess the scope for economizing on energy. The results presented also give insight into the energy implications of the hardware platform and operating systems used for hosting such games. We use the results to provide practical suggestions to both the industry and the gamers. Copyright is held by the owner/author(s). Publication rights licensed to ACM.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Mathematical modelling with wide societal impact (MathImpact), European Organization for Nuclear Research
Contributors: Salmela, J. M., Thanisch, P., Sotamaa, O., Niemi, T.
Number of pages: 8
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Publication date: 4 Nov 2014

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ASJC Scopus subject areas: Computer Science Applications, Human-Computer Interaction, Software
Keywords: Computer games, Energy measurement
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Source: Scopus
Source ID: 84963995284
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

MurMur Moderators, the talking playful seats

In this article we present the concept of MurMur Moderators, talking playful seats facilitating playful atmosphere and creativity at office environments. The article describes the design and technological composition of our first prototype, and our experiences exposing the concept to audiences at two science fairs in Italy (2013) and Finland (2014). This research has served as an informative pilot study, consequently directing our focus to the ways the accompanying narrative brings additional design value to the interactive seats. Our goal with the fairs was to investigate what are the preliminary audience reactions for the high level concept and how people interact with the initial prototype. The feedback was used for generating further ideas for ambient play and furniture-as-a-service, some of which carries on to future research and second prototype of the seat.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Mathematical modelling with wide societal impact (MathImpact)
Contributors: Nummenmaa, T., Kultima, A., Tyni, H., Alha, K.
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ASJC Scopus subject areas: Computer Science Applications, Human-Computer Interaction, Software
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http://www.scopus.com/inward/record.url?scp=84964027379&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84964027379
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

On computation of calcium cycling anomalies in cardiomyocytes data

Induced pluripotent stem cell (iPSC) lines derived from skin fibroblasts of patients suffering from cardiac disorders were differentiated to cardiomyocytes and used to generate a data set of Ca^{2+} transients of 136 recordings. The objective was to separate normal signals for later medical research from abnormal signals. We constructed a signal analysis procedure to detect peaks representing calcium cycling in signals and another procedure to classify them into either normal or abnormal peaks. Using machine learning methods we classified signals into normal or abnormal signals on the basis of peak findings in them. We compared classification results obtained to those made visually by an expert biotechnologist who assessed the signals independent of the computer method. Classification accuracies of around 85% indicated high congruence between two modes denoting the high capability and usefulness of computer based processing for the present data.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: BioMediTech, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Contributors: Juhola, M., Joutsijoki, H., Varpa, K., Saarikoski, J., Rasku, J., Iltanen, K., Laurikkala, J., Hyyro, H., Avalos-Salguero, J., Siirtola, H., Penttinen, K., Aalto-Setala, K.
Number of pages: 4
Pages: 1444-1447
Publication date: 2 Nov 2014

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ASJC Scopus subject areas: Health Informatics, Computer Science Applications, Biomedical Engineering
Keywords: Calcium cycling, cardiomyocytes, classification, signal analysis
DOIs:
10.1109/EMBC.2014.6943872
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http://www.scopus.com/inward/record.url?scp=84929461388&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84929461388
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

RF tag front-end design for uncompromised communication and harvesting

Typically, low-cost and low-power backscatter radio communicators utilize a switching mechanism for alternating the antenna load between two values. In this way, they achieve modulation by reflection of the RF waves induced at the communicator's antenna. For tags that employ a rectifier for wireless energy harvesting, a single transistor may switch

between the matched harvester and a reflective load (an open or short). However, optimized backscatter communication occurs when switching between two reflective loads, ideally an open and a short. This prohibits the use of a harvester that requires a good matching (i.e. no reflections) and produces a tradeoff of either compromising communication performance or not employing a harvester. Although this may not pose a problem for commodity RFID tags that operate in short ranges and do not require high computational ability, it is a strong limitation for applications like wireless sensor networks that employ backscatter radio as a low-cost and low-power communication scheme. In this work, an RF front-end is designed, analyzed, and implemented, that overcomes the limitation of compromising communication performance when employing a harvester.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology
Contributors: Kimionis, J., Tentzeris, M. M.
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Publication date: 22 Oct 2014

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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Electrical and Electronic Engineering
Keywords: backscatter radio, communication, harvesting, RFID, tag design
DOIs:
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http://www.scopus.com/inward/record.url?scp=84912130713&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84912130713
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Understanding social OER environments-A quantitative study on factors influencing the motivation to share and collaborate
Social software environments are increasingly used for open education: teachers and learners share and collaborate in these environments. While there are various possibilities for the inclusion of such social functionalities for OER, many organizational, individual and technological challenges can hinder the motivation of teachers to share and collaborate in these environments. Current research cannot explain what barriers teachers face in social OER environments and how those challenges influence their motivation to engage in such environments. An exploratory factor analysis was used in the context of schools and higher education institutions to investigate the possible barriers to engaging in social OER environments; a linear regression analysis was used to predict how the extracted factors influenced the motivation of teachers (N = 754) to share and collaborate. The findings allude to barriers within social OER environments; the main challenges relate to the lack of organizational support, language and culture as well as quality concerns. The key results depict how teachers' motivation to share and collaborate in these environments decreases when they perceive higher language and cultural barriers. These findings can support OER providers as well as educational institutions in their efforts to minimize those barriers.

General information
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Organisations: Managing digital industrial transformation (mDIT), Jyväskylän yliopisto
Contributors: Pirkkalainen, H., Jokinen, J. P. P., Pawlowski, J. M.
Number of pages: 13
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Publication information
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Scopus rating (2014): CiteScore 5.2 SJR 0.768 SNIP 2.286
Original language: English
ASJC Scopus subject areas: Engineering(all), Computer Science Applications, Education
Keywords: knowledge management, knowledge sharing, Social technologies, user generated learning content
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Source: Scopus
Source ID: 84919783368
Research output: Contribution to journal › Article › Scientific › peer-review

Density functional theory study of transition metals doped B_{80} fullerene

Density functional theory calculations have been carried out to investigate 3d, Pd and Pt transition metal (TM) atoms exohedrally and endohedrally doped B_{80} fullerene. We find that the most preferred doping site of the TM atom gradually moves from the outer surface (TM = Sc), to the inner surface (TM = Ti and V) and the center (TM = Cr, Mn, Fe and Zn), then to the outer surface (TM = Co, Ni, Cu, Pd, and Pt) again with the TM atom varying from Sc to Pt. From the formation energy calculations, we find that doping TM atom can further improve the stability of B_{80} fullerene. The magnetic moments of doped V, Cr, Mn, Fe, Co and Ni atoms are reduced from their free-atom values and other TM atoms are completely quenched. Charge transfer and hybridization between 4s and 3d states of TM and 2s and 2p states of B were observed. The energy gaps of TM@B_{80} are usually smaller than that of the pure B_{80}. Endohedrally doped B_{80} fullerene with two Mn and two Fe atoms were also considered, respectively. It is found that the antiferromagnetic (AFM) state is more energetically favorable than the ferromagnetic (FM) state for Mn_2- and Fe_2@B_{80}. The Mn and Fe atoms carry the residual magnetic moments of ~ 3 μ_B and 2 μ_B in the AFM states.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Computational Science X (CompX), National Key Laboratory of Photoelectric Technology and Functional Materials in Shaanxi Province, Northwest University China, Nanjing University
Contributors: Wang, J., Ma, L., Liang, Y., Gao, M., Wang, G.
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ASJC Scopus subject areas: Physical and Theoretical Chemistry, Computational Theory and Mathematics, Computer Science Applications
Keywords: B<inf>80</inf> fullerene, density functional theory, doped, Transition metal
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Research output: Contribution to journal › Article › Scientific › peer-review

Effect of feeder cable's phase tolerance on the first sidelobe level of base station antenna

The sidelobe level of a base station antenna is one of the important parameters to describe the performance of an antenna array. Given a required value of the sidelobe level, we can obtain a set of initial phases, and then further get a set of cable lengths. However, a tolerance (or error range) associated with manufacturing techniques will introduce an error in each cable length, thereby influencing the sidelobe level. This paper uses the knowledge of probability and mathematical statistics to make a statistical analysis for the reliability of the first sidelobe of the antenna array based on Monte Carlo simulations. We also obtain a distribution curve of reliabilities of the first sidelobe versus phase tolerances, which can bring great convenience for practical applications.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Shenzhen University
Contributors: He, Y., Pan, Z., Yang, J., Sun, G., Tentzeris, M. M.
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ASJC Scopus subject areas: Computer Science Applications, Electrical and Electronic Engineering, Computer Networks and Communications
Keywords: first sidelobe, MATLAB, Monte Carlo, phase tolerance
DOIs:
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Source: Scopus
Source ID: 84908637018
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Adaptive sampling for compressed sensing based image compression

The compressed sensing (CS) theory shows that a sparse signal can be recovered at a sampling rate that is (much) lower than the required Nyquist rate. In practice, many image signals are sparse in a certain domain, and because of this, the CS theory has been successfully applied to the image compression in the past few years. The most popular CS-based image compression scheme is the block-based CS (BCS). In this paper, we focus on the design of an adaptive sampling mechanism for the BCS through a deep analysis of the statistical information of each image block. Specifically, this analysis will be carried out at the encoder side (which needs a few overhead bits) and the decoder side (which requires a feedback to the encoder side), respectively. Two corresponding solutions will be compared carefully in our work. We also present experimental results to show that our proposed adaptive method offers a remarkable quality improvement compared with the traditional BCS schemes.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Institute of Image Processing, University of Electronic Science and Technology of China
Contributors: Zhu, S., Zeng, B., Gabbouj, M.
Publication date: 3 Sep 2014

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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
Keywords: adaptive CS sampling, compressed sensing (CS), image compression
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Source: Scopus
Source ID: 84937510540
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Analysis of a city-region from the knowledge perspective: Tampere, Finland

Purpose - The paper aims to evaluate the knowledge-based urban development (KBUD) dynamics of a rapidly emerging knowledge city-region, Tampere region, Finland. Design/methodology/approach - The paper empirically investigates Tampere region's development achievements and progress from the knowledge perspective. Findings - The research, through qualitative and quantitative analyses, reveals the regional development strengths, weaknesses, opportunities and threats of Tampere region. Originality/value - The paper provides useful suggestions based on the lessons learned from the Tampere case investigation that could shed light on the KBUD journey of city-regions.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Department of Information Management and Logistics, Research group: Novi, Queensland University of Technology QUT, School of Management
Contributors: Yigitcanlar, T., Lönnqvist, A., Salonius, H.
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Pages: 445-466
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Issue number: 3
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Library and Information Sciences
Keywords: City-region, Finland, Knowledge-based urban development, Regional development, Tampere
DOIs:

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Bibliographical note
EXT="Lönnqvist, Antti"
Source: Scopus
Source ID: 84908236523
Research output: Contribution to journal › Article › Scientific › peer-review

An enumeration-based model predictive control strategy for the cascaded H-bridge multilevel rectifier

In this paper, a model predictive control strategy is adapted to the cascaded H-bridge (CHB) multilevel rectifier. The proposed control scheme aims to keep the sinusoidal input current in phase with the supply voltage and to achieve independent voltage regulation of the H-bridge cells. To do so, the switches are directly manipulated without the need of a modulator. Furthermore, since all the possible switching combinations are taken into account, the controller exhibits favorable performance not only under nominal conditions but also under asymmetrical voltage potentials and unbalanced loads. Finally, a short horizon is employed in order to ensure robustness; this way, the required computational effort remains reasonable, making it possible to implement the algorithm in a real-time system. Experimental results obtained from a two-cell CHB rectifier are presented in order to demonstrate the performance of the proposed approach.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Smart Energy Systems (SES), Technische Universitat Munchen, ABB Oy, National Technical University of Athens
Contributors: Karamanakos, P., Pavlou, K., Manias, S.
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Control and Systems Engineering, Computer Science Applications
Keywords: Cascaded H-bridge (CHB) multilevel rectifier, model predictive control (MPC), optimal control
Electronic versions:

An enumeration-based model predictive control strategy 2014

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URLs:
http://urn.fi/URN:NBN:fi:tuni-202004163271
Source: Scopus
Source ID: 84894195338
Research output: Contribution to journal › Article › Scientific › peer-review

NetBioV: An R package for visualizing large network data in biology and medicine

NetBioV (Network Biology Visualization) is an R package that allows the visualization of large network data in biology and medicine. The purpose of NetBioV is to enable an organized and reproducible visualization of networks by emphasizing or highlighting specific structural properties that are of biological relevance.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Prostate cancer research center (PCRC), Queen's University, Belfast, Northern Ireland, Universität der Bundeswehr München, Computational Biology and Machine Learning
Contributors: Tripathi, S., Dehmer, M., Emmert-Streib, F.
Number of pages: 3
Pages: 2834-2836
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ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computational Theory and Mathematics, Computer Science Applications, Computational Mathematics, Statistics and Probability, Medicine(all)
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10.1093/bioinformatics/btu384
URLs:
http://www.scopus.com/inward/record.url?scp=84911403383&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84911403383
Research output: Contribution to journal › Article › Scientific › peer-review

The emerging application ecosystems: An introductory analysis of android ecosystem

Emerging mobile application ecosystems have had a clear effect on the software business. Apple App Store and Google Play have gathered both existing large software companies and new start-ups. In creating a healthy ecosystem, the role of the software developer is significant. In practice, the ecosystems' ability to entice developers to create software products to the ecosystem can be argued to be a major factor driving the competitiveness of the ecosystem. This article empirically investigates Google Play, by gathering the data of 350,000 applications from the marketplace. With the dataset, common assumptions linked to the marketplace are studied. The results show that the direct software sale is a practical revenue model only for a few while offering a trial and paid version of the application seems to improve the revenue. The impact of the number of applications in the marketplace is questioned.

General information

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Organisations: Managing digital industrial transformation (mDIT), University of Turku, Turku School of Economics, University of Turku, VTT Technical Research Centre of Finland
Contributors: Hyrynsalmi, S., Suominen, A., Mäkilä, T., Knuutila, T.
Number of pages: 21
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Original language: English
ASJC Scopus subject areas: Management Information Systems, Computer Science Applications
Keywords: App economy, Application marketplace, Freemium, Google play, Mobile ecosystem
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Source: Scopus
Source ID: 84928235907
Research output: Contribution to journal › Article › Scientific › peer-review

System integration for real-time mobile manipulation

Mobile manipulators are one of the most complicated types of mechatronics systems. The performance of these robots in performing complex manipulation tasks is highly correlated with the synchronization and integration of their low-level components. This paper discusses in detail the mechatronics design of a four wheel steered mobile manipulator. It presents the manipulator's mechanical structure and electrical interfaces, designs low-level software architecture based on embedded PC-based controls, and proposes a systematic solution based on code generation products of MATLAB and Simulink. The remote development environment described here is used to develop real-time controller software and modules for the mobile manipulator under a POSIX-compliant, real-time Linux operating system. Our approach enables developers to reliably design controller modules that meet the hard real-time constraints of the entire low-level system architecture. Moreover, it provides a systematic framework for the development and integration of hardware devices with various communication mediums and protocols, which facilitates the development and integration process of the software controller. © 2014 The Author(s). Licensee InTech.

General information

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Contributors: Oftadeh, R., Aref, M. M., Ghabcheloo, R., Mattila, J.
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Radar micro-Doppler feature extraction using the Singular Value Decomposition

The micro-Doppler spectrogram depends on parts of a target moving and rotating in addition to the main body motion (e.g., spinning rotor blades) and is thus characteristic for the type of target. In this study, the micro-Doppler spectrogram is exploited to distinguish between birds and small unmanned aerial vehicles (UAVs). The focus hereby is on micro-Doppler features enabling fast classification of birds and mini-UAVs. In a second classification step, it is desired to exploit micro-

Doppler features to further characterize the type of UAV, e.g., fixed-wing vs. rotary-wing. In this paper, potentially robust features are discussed supporting the first classification step, i.e., separation of birds and UAVs. The Singular Value Decomposition seems a powerful tool to extract such features, since the information content of the micro-Doppler spectrogram is preserved in the singular vectors. In the paper, some examples of micro-Doppler feature extraction via Singular Value Decomposition are given.

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Organisations: Department of Signal Processing, TNO, Thales Nederland B.V.
Contributors: De Wit, J. J. M., Harmanny, R. I. A., Molchanov, P.
Publication date: 12 Mar 2014

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A computational approach to construct a multivariate complete graph invariant
In this paper, we present a computational approach for finding complete graph invariants. Specifically, we generate exhaustive sets of connected, non-isomorphic graphs with 9 and 10 vertices and demonstrate that a 97-dimensional multivariate graph invariant is capable to distinguish each of the non-isomorphic graphs. Furthermore, in order to tame the computational complexity of the problem caused by the vast number of graphs, e.g., involving over 10 million networks with 10 vertices, we suggest a low-dimensional, iterative procedure that is based on highly discriminative individual graph invariants. We show that also this computational approach leads to a perfect discrimination. Overall, our numerical results prove the existence of such graph invariants for networks with 9 and 10 vertices. Furthermore, we show that our iterative approach has a polynomial time complexity.

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Organisations: Research Community on Data-to-Decision (D2D), 6060 Hall in Tyrol, Computational Biology and Machine Learning, Queen's University, Belfast, Northern Ireland
Contributors: Dehmer, M., Emmert-Streib, F., Grabner, M.
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Source ID: 84891738883
Research output: Contribution to journal › Article › Scientific › peer-review

Developing novel multimodal interaction techniques for touchscreen in-vehicle infotainment systems

Haptics has been an integral part of multimodal systems in Human Computer Interaction (HCI). The ability to touch and sense virtual components of any system has long been the holy grail of HCI, which is particularly useful in mission critical environments where other modalities are weakened by environmental noise. Haptics also compliments most modalities of interaction by reinforcing the intimate and personal aspect of interaction. Haptics becomes much more important in environments that prove to be far too noisy for audio feedback.The driving environment is one such area, which the addition of haptics is not just additive, but critical in HCI. However, most of the research on haptic feedback in the car has been conducted using vibro-tactile feedback. In this paper, we present a system in which we have developed a novel haptic feedback environment using pneumatic and vibrotactile technologies, to facilitate in carcommunication, using the In-vehicle Infotainment System. Our aim was to build on the user haptic perception and experience the advance multimodal interaction system by utilizing available feedback techniques in, in-car interaction. The qualitative results of our study show that haptic feedback has great potential for safety and communication use, but the difficulty in interpreting haptic signals requires additional translation means ('semantic linkages'), to support the right interpretation of the haptic information.

General information

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Contributors: Farooq, A., Evreinov, G., Raisamo, R., Mäkinen, E., Nukarinen, T., Majeed, A. A.
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Source: Scopus
Source ID: 84946688361
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Haptic user interface enhancement system for touchscreen based interaction: A novel system for multimodal interaction with touchscreen interfaces

Touchscreens are becoming a more attractive interaction technology in our daily lives and they are quickly replacing most of the conventional user interface controls. The ability to continuously modify and reconfigure screen contacts is a valuable feature in any device, especially in mobile devices like smartphones and tablets, where every inch matters. Perhaps the most inviting aspect of touchscreens is their ability to detect gestures and recognize human activities. Unlike externally static interfaces with a dedicated input device, such as a keypad with discrete well-defined keys; most touch sensitive displays are embodied as a flat, stiff and ridged screen surface. As a result, touch sensitive displays are breaking down and do not follow either ergonomic rules and standards nor physiological and psychological models/concepts of the afferent flow information processing. This, in turn, means that these systems diminish perceptual and intuitive haptic feedback which hinders and sometime limits user interaction.This paper defines a Haptic User Interface Enhancement System (UIES) that transforms the conventionally flat and stiff touchscreen surfaces intoa haptically adaptive interaction hub which is not only able to provide generic vibrotactile stimulation for conformational haptic feedback but is able to guide the user though onscreen User Interface controls via kinetic feedback cues which includes components of forces and torques applied dynamically in the place of contact to the fingertips.

General information

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Organisations: Augmented Human Activities (AHA)
Contributors: Farooq, A., Evreinov, G., Raisamo, R., Majeed, A. A.
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Gene Sets Net Correlations Analysis (GSNCA): A multivariate differential coexpression test for gene sets
Motivation: To date, gene set analysis approaches primarily focus on identifying differentially expressed gene sets (pathways). Methods for identifying differentially coexpressed pathways also exist but are mostly based on aggregated pairwise correlations or other pairwise measures of coexpression. Instead, we propose Gene Sets Net Correlations Analysis (GSNCA), a multivariate differential coexpression test that accounts for the complete correlation structure between genes.Results: In GSNCA, weight factors are assigned to genes in proportion to the genes' cross-correlations (intergene correlations). The problem of finding the weight vectors is formulated as an eigenvector problem with a unique solution. GSNCA tests the null hypothesis that for a gene set there is no difference in the weight vectors of the genes between two conditions. In simulation studies and the analyses of experimental data, we demonstrate that GSNCA captures changes in the structure of genes' cross-correlations rather than differences in the averaged pairwise correlations. Thus, GSNCA infers differences in coexpression networks, however, bypassing method-dependent steps of network inference. As an additional result from GSNCA, we define hub genes as genes with the largest weights and show that these genes correspond frequently to major and specific pathway regulators, as well as to genes that are most affected by the biological difference between two conditions. In summary, GSNCA is a new approach for the analysis of differentially coexpressed pathways that also evaluates the importance of the genes in the pathways, thus providing unique information that may result in the generation of novel biological hypotheses.

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Contributors: Rahmatallah, Y., Emmert-Streib, F., Glazko, G.
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Source ID: 84893275855
Research output: Contribution to journal › Article › Scientific › peer-review

The lord of the sense: A privacy preserving reputation system for participatory sensing applications

Electronic devices we use on a daily basis collect sensitive information without preserving user's privacy. In this paper, we propose the lord of the sense (LotS), a privacy preserving reputation system for participatory sensing applications. Our system maintains the privacy and anonymity of information with the use of cryptographic techniques and combines voting approaches to support users' reputation. Furthermore, LotS maintains accountability by tracing back a misbehaving user while maintaining k-anonymity. A detailed security analysis is presented with the current advantages and disadvantages of our system.

General information

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Organisations: Security Lab, SICS, City University London
Contributors: Michalas, A., Komninos, N.
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Source ID: 84908199099
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Tuberculosis transmission: Modelled impact of air-tightness in dwellings in the UK

High CO_2 emissions from the residential sector have forced UK authorities to promote measures to improve energy efficiency through retrofit. Air-tightening can reduce infiltration rates, thereby decreasing ventilation heat losses, but also reducing indoor air quality. This paper presents an initial investigation of the increase in airborne transmission risk of Tuberculosis (TB) due to air-tightening in two of the most commonly-occurring dwelling types in London (purpose-built flat and terraced). EnergyPlus is used to calculate the ventilation rate of the main bedroom over a year for a range of building permeabilities representing the current and air-tightened stock. The Wells-Riley equation is then used to calculate the risk of infection under three different rates of TB generation. Results indicate the potential for increased airborne TB transmission between building occupants following air-tightening, with occupants of flats more susceptible to infection, particularly at high TB generation rates.

General information

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Organisations: University College London
Contributors: Taylor, J., Altamirano-Medina, H., Shrubsole, C., Das, P., Biddulph, P., Davies, M., Mavrogianni, A., Oikonomou, E.
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Using probabilistic sampling-based sensitivity analyses for indoor air quality modelling

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Organisations: London School of Hygiene and Tropical Medicine, University of Nottingham, University College London
Contributors: Das, P., Chalabi, Z., Davies, M., Hamilton, I., Jones, B., Mavrogianni, A., Shrubsole, C., Taylor, J.
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Research output: Other conference contribution › Paper, poster or abstract › Scientific

A hand-held immaterial volumetric display
We have created an ultralight, movable, "immaterial" fogscreen. It is based on the fogscreen mid-air imaging technology. The hand-held unit is roughly the size and weight of an ordinary toaster. If the screen is tracked, it can be swept in the air to create mid-air slices of volumetric objects, or to show augmented reality (AR) content on top of real objects. Interfacing devices and methodologies, such as hand and gesture trackers, camera-based trackers and object recognition, can make the screen interactive. The user can easily interact with any physical object or virtual information, as the screen is permeable. Any real objects can be seen through the screen, instead of e.g., through a video-based augmented reality screen. It creates a mixed reality setup where both the real world object and the augmented reality content can be viewed and interacted with simultaneously. The hand-held mid-air screen can be used e.g., as a novel collaborating or classroom tool for individual students or small groups.

General information
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Contributors: Sand, A., Rakkolainen, I.
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Source ID: 84901008644
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

An origami inspired reconfigurable spiral antenna
Modern day systems often require reconfigurability in the operating parameters of the transmit and receive antennas, such as the resonant frequency, radiation pattern, impedance, or polarization. In this work a novel approach to antenna reconfigurability is presented by integrating antennas with the ancient art of origami. The proposed antenna consists of an inkjet printed center-fed spiral antenna, which is designed to resonate at 1.0GHz and have a reconfigurable radiation pattern while maintaining the 1.0GHz resonance with little variation in input impedance. When flat, the antenna is a planar spiral exhibiting a bidirectional radiation pattern. By a telescoping action, the antenna can be reconfigured into a conical spiral with a directional pattern and higher gain, which gives the antenna a large front-to-back ratio. Construction of the

antenna in this manner allows for a simple, lightweight, transportable antenna that can expand to specifications in the field.

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Contributors: Saintsing, C. D., Cook, B. S., Tentzeris, M. M.
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Avoiding anomalies when modeling a many-to-many relationship in a multidimensional database
Multidimensional database cubes are easier to design and use when the dimension attributes and fact table measures are in one-to-many relation-ships in the data warehouse. The anomalies that can arise when users browse a cube that incorporates dimensions with many-to-many relationships are widely documented by practitioners. We categorise many-to-many relationships in terms of their associated design problems and we present two techniques for modelling restricted forms of many-to-many relationships. We demonstrate that the techniques can avoid anomalies and we discuss performance implications.

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Contributors: Thanisch, P., Lindell, T., Nummenmaa, J., Nummenmaa, T.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Building energy-efficiency interventions in North-East Europe: Effects on indoor environmental quality and public health
INSULAtE project aims to develop a common protocol for assessment of improving energy efficiency (EE) of dwellings on indoor environmental quality (IEQ) and public health in Europe. So far, measurement data on IEQ parameters (PM, CO, CO_2, VOCs, formaldehyde, NO_2, radon, T and RH) and questionnaire data from occupants were collected from 16 multifamily buildings (94 apartments) in Finland and 20 (96 apartments) in Lithuania before renovation. Most parameters were within recommended limits; however, the data revealed different baselines (before renovation) for each country both in terms of the IEQ parameters and the respondents' satisfaction regarding their residence and indoor air quality. Post renovation data (from one building in each country) showed potential changes in the measured parameters, while further analyses are needed once the data have been collected. The results of this project will be used in developing guidance and support the implementation of the related policies.

General information
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Contributors: Du, L., Prasauskas, T., Leivo, V., Turunen, M., Aaltonen, A., Kiviste, M., Martuzevicius, D., Haverinen-Shaughnessy, U.
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Characterization of charge in airborne fungal spores

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Contributors: Reponen, T., Saari, S., Mensah-Attipoe, J., Ukkonen, A., Veijalainen, A., Pasanen, P., Keskinen, J.
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ASJC Scopus subject areas: Pollution, Building and Construction, Health, Toxicology and Mutagenesis, Computer Science Applications
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Compressive strain measurement using RFID patch antenna sensors
In this research, two radiofrequency identification (RFID) antenna sensor designs are tested for compressive strain measurement. The first design is a passive (battery-free) folded patch antenna sensor with a planar dimension of 61mm × 69mm. The second design is a slotted patch antenna sensor, whose dimension is reduced to 48mm × 44mm by introducing slots on antenna conducting layer to detour surface current path. A three-point bending setup is fabricated to apply compression on a tapered aluminum specimen mounted with an antenna sensor. Mechanics-electromagnetics coupled simulation shows that the antenna resonance frequency shifts when each antenna sensor is under compressive strain. Extensive compression tests are conducted to verify the strain sensing performance of the two sensors. Experimental results confirm that the resonance frequency of each antenna sensor increases in an approximately linear relationship with respect to compressive strain. The compressive strain sensing performance of the two RFID antenna sensors, including strain sensitivity and determination coefficient, is evaluated based on the experimental data.

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Contributors: Cho, C., Yi, X., Wang, Y., Tentzeris, M. M., Leon, R. T.
Publication date: 2014

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Keywords: Folded patch antenna, Passive wireless sensor, RFID, Slotted patch antenna, Strain sensor
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Crack propagation measurement using a battery-free slotted patch antenna sensor

This research studies the performance of a battery-free wireless antenna sensor for measuring crack propagation. In our previous work, a battery-free folded patch antenna was designed for wireless strain and crack sensing. When experiencing deformation, the antenna shape changes, causing shift in electromagnetic resonance frequency of the antenna. The wireless interrogation system utilizes the principle of electromagnetic backscattering and adopts off-the-shelf 900MHz radiofrequency identification (RFID) technology. Following the same sensing mechanism, a slotted patch antenna sensor of smaller size is designed. The antenna detours surface current using slot patterns, so that the effective electrical length is kept similar as previous folded patch antenna. As a result, the sensor footprint is reduced and the antenna resonance frequency is maintained within 900MHz RFID band. To validate the sensor performance for crack sensing, a fatigue crack experiment is conducted on a steel compact-tension specimen. A slotted patch antenna sensor is installed at the center of the A36 steel specimen. For wireless interrogation, a Yagi reader antenna is placed 36 in. away from the antenna sensor to wirelessly measure the resonance frequency shift of the antenna sensor. The measurement is taken after every 10,000 loading cycles, till the specimen fails. Meanwhile, the length and width of the fatigue crack are also recorded. Finally, the resonance frequency shift of the antenna sensor is correlated with crack length and width at each loading stage.

General information

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Contributors: Yi, X., Cho, C., Wang, Y., Cook, B., Tentzeris, M. M., Leon, R. T.
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Keywords: Battery-free sensor, Fatigue crack, RFID, Slotted patch antenna
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Source: Scopus
Source ID: 84939455742
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Functional and genetic analysis of the colon cancer network.

Cancer is a complex disease that has proven to be difficult to understand on the single-gene level. For this reason a functional elucidation needs to take interactions among genes on a systems-level into account. In this study, we infer a colon cancer network from a large-scale gene expression data set by using the method BC3Net. We provide a structural and a functional analysis of this network and also connect its molecular interaction structure with the chromosomal locations of the genes enabling the definition of cis- and trans-interactions. Furthermore, we investigate the interaction of genes that can be found in close neighborhoods on the chromosomes to gain insight into regulatory mechanisms. To our knowledge this is the first study analyzing the genome-scale colon cancer network.

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Queen's University Belfast
Contributors: Emmert-Streib, F., de Matos Simoes, R., Glazko, G., McDade, S., Haibe-Kains, B., Holzinger, A., Dehmer, M., Campbell, F.
Publication date: 2014
Peer-reviewed: Yes

Publication information
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Issue number: Suppl 6
Article number: S6
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Ratings:

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ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computer Science Applications, Applied Mathematics, Structural Biology
URLs:

http://www.scopus.com/inward/record.url?scp=84907412397&partnerID=8YFLogxK (Link to publication in Scopus)
Research output: Contribution to journal › Article › Scientific › peer-review

Graph based representation and analyses for conceptual stages
What is the fundamental similarity between investing in stock of a company, because you like the products of this company, and selecting a design concept, because you have been impressed by the esthetic quality of the presentation made by the team developing the concept? Except that both decisions are based on a surface analysis of the situations, they both reflect a fundamental human's cognitive feature. Human brain is profoundly trying to minimize the efforts required to solve a cognitive task and is using when possible an automatic mode relying on recognition, memory, and causality. This mode is even used in some occasion without the engineer being conscious of it. Such type of tendencies are naturally pushing engineers to rush into known solutions, to avoid analyzing the context of a design problem, to avoid modelling design problems and to take decision based on isolated evidences. Those behaviors are familiar to experience teachers and engineers. This tendency is magnified by the time pressure imposed to the engineering design process. Early phases in particular have to be kept short despite the large impact of decisions taken at this stage. Few support tools are capable of supporting a deep analysis of the early design conditions and problems regarding the fuzziness and complexity of the early stage. The present article is hypothesizing that the natural ability of humans to deal with cause-effects relations push toward the massive usage of causal graphs analysis during the design process and specifically during the early phases. A global framework based on graphs is presented in this paper to efficiently support the early stages. The approach used to generate graphs, to analyze them and to support creativity based on the analysis is forming the central contribution of this paper.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Intelligent dexterity for secure networked infrastructure and applications (IDSNIA), Aalto University
Contributors: Coatanéa, E., Nonsiri, S., Christophe, F., Mokammel, F.
Publication date: 2014

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Title of host publication: 34th Computers and Information in Engineering Conference
Volume: 1A
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ISBN (Electronic): 9780791846285
ASJC Scopus subject areas: Mechanical Engineering, Computer Graphics and Computer-Aided Design, Computer Science Applications, Modelling and Simulation
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Source: Scopus
Source ID: 84961306932
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Maturity assessment for implementing and using product lifecycle management in project-oriented engineering companies

Product lifecycle management (PLM) is a systematic and holistic way to approach challenges that exist in managing product-related information along a product's lifecycle from product design to its disposal. There is an established set of information management approaches that address important subsets of lifecycle information management challenges, e.g., product data management (PDM), customer relationship management (CRM) and enterprise resource planning (ERP). A common characteristic of PLM is that implementation is a very challenging and complex long-term process, requiring changes in organisation, systems, conventions and importantly, skills and capabilities. The aim of this paper is to discuss the issue of PLM maturity assessment and its use and application in the specific industrial context of project-oriented engineering companies. Within this context, the empirical part of the paper studies the usefulness and tailoring needs of generic capability maturity assessment in implementing and facilitating PLM.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Information Management and Logistics, Research group: Novi, Augmented Human Activities (AHA), Managing digital industrial transformation (mDIT), Lappeenranta University of Technology
Contributors: Kärkkäinen, H., Myllärniemi, J., Okkonen, J., Silventoinen, A.
Number of pages: 23
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Peer-reviewed: Yes

Publication information

Journal: International Journal of Electronic Business
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Original language: English
ASJC Scopus subject areas: Business, Management and Accounting(all), Computer Science Applications
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Source: Scopus
Source ID: 84946840351
Research output: Contribution to journal › Article › Scientific › peer-review

Mode coupling in few-mode large-mode-area fibers

We present an experimental study on mode coupling characteristics of few-mode large-mode-area (LMA) fibers, which are widely used in high power fiber lasers. The modal power allocation is measured by modal decomposition of the nearfield intensity profile of the output beam. Cut-back measurements are carried out with commonly-used fibers with different fiber geometries. The evolution of the modal power content due to mode coupling is presented. The influence of the fiber geometry on mode coupling is discussed.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Frontier Photonics, nLIGHT Corporation
Contributors: Ye, C., Koponen, J., Aallos, V., Petit, L., Kimmelma, O., Kokki, T.
Publication date: 2014

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Beam quality, Few-mode, Large-mode-area fiber, Mode coupling, Mode decomposition, Silica optical fiber
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URLs:

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Source: Scopus
Source ID: 84900835091
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Optical and topographic changes in water-responsive patterned cholesteric liquid crystalline polymer coatings

In this work, we present patterned water-responsive coatings, which alter both their topological and optical properties. The polymer coatings are based on a hydrogen-bonded cholesteric liquid crystalline polymer network. A two-step photopolymerization procedure leads to a patterned coating with repeating liquid crystalline and isotropic areas. The cholesteric liquid crystalline areas reflect green light, whilst the isotropic areas are transparent for visible light. Treatment with alkaline solution results in a hygroscopic polymer salt coating. When placed in demineralized water, the polymer films swells, leading to an enhancement of the surface topography structure in which the liquid crystalline areas swell more. Moreover, the pitch of the helical organization in the cholesteric areas increases due to this swelling leading to a color change from green to red.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Eindhoven University of Technology, School of Mathematical Sciences
Contributors: Stumpel, J. E., Broer, D. J., Bastiaansen, C. W. M., Schenning, A. P. H. J.
Publication date: 2014

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Publication series

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ISSN (Electronic): 1996-756X
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Keywords: cholesteric liquid crystals, patterned surfaces, responsive optical coatings, responsive surface topographies, water-responsive
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http://www.scopus.com/inward/record.url?scp=84902324488&partnerID=8YFLogxK (Link to publication in Scopus)

Bibliographical note

EXT="Stumpel, Jelle"
Source: Scopus
Source ID: 84902324488
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Pulsed high-power yellow-orange VECSEL

We report on the development of a pulsed high-power frequency doubled vertical-external-cavity surface-emitting laser (VECSEL) with a peak output power of 14 W and emission spectrum near 588 nm. The semiconductor gain chip was grown by molecular beam epitaxy and comprised 10 GaInAs quantum wells. The gain structure was designed to be antiresonant at 1180 nm. The fundamental wavelength was frequency doubled to the yellow-orange spectral range using a 10-mm long critically phase matched lithium triborate nonlinear crystal, situated at the mode waist of the V-shaped laser cavity. The emission spectrum was narrowed down to FWHM of < 0.2 nm by employing a 1.5 mm birefringent filter and a 100-μm-thick etalon inside the cavity. By directly modulating the pump laser of the VECSEL, we were able to produce pulse widths down to 570 ns with average and peak output power of 81 mW and 14 W, respectively. The repetition rate was kept constant at 10 kHz throughout the measurements. The maximum peak power obtained was pump power limited. In comparison, at the same coolant temperature, a maximum of 8.5 W was achieved in continuous wave. The maximum optical-to-optical conversion efficiency (absorbed peak pump power to peak output power) was calculated to be 20-21 %.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications, Frontier Photonics, Optoelectronics Research Centre, Tampere University of Technology
Contributors: Kantola, E., Leinonen, T., Ranta, S., Tavast, M., Guina, M.
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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: Frequency doubling, Gain modulation, High-efficiency, High-power, Pulsed, SHG, Yellow-orange VECSEL
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Bibliographical note
Contribution: organisation=orc,FACT1=1
Portfolio EDEND: 2014-08-31
Publisher name: SPIE - International Society for Optical Engineering
Source: researchoutputwizard
Source ID: 654
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Transparency of intentions decreases privacy concerns in ubiquitous surveillance

An online experiment (n=1,897) was carried out to understand how data disclosure practices in ubiquitous surveillance affect users' privacy concerns. Information about the identity and intentions of a data collector was manipulated in hypothetical surveillance scenarios. Privacy concerns were found to differ across the scenarios and moderated by knowledge about the collector's identity and intentions. Knowledge about intentions exhibited a stronger effect. When no information about intentions was disclosed, the respondents postulated negative intentions. A positive effect was found for disclosing neutral intentions of an organization or unknown data collector, but not for a private data collector. The findings underline the importance of disclosing intentions of data use to users in an easily understandable manner.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Mathematical modelling with wide societal impact (MathImpact), Cluster of Excellence on Multimodal Computing and Interaction, Saarland University, Aalto University, Helsinki Institute for Information Technology HIIT, Department of Information and Service Economy
Contributors: Oulasvirta, A., Suomalainen, T., Hamari, J., Lampinen, A., Karvonen, K.
Publication date: 2014
Peer-reviewed: Yes

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Volume: 17
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ASJC Scopus subject areas: Human-Computer Interaction, Applied Psychology, Communication, Computer Science Applications, Social Psychology, Medicine(all)
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http://www.scopus.com/inward/record.url?scp=84907285570&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84907285570
Research output: Contribution to journal › Article › Scientific › peer-review

Learning sparse representations for view-independent human action recognition based on fuzzy distances

In this paper, a method aiming at view-independent human action recognition is presented. Actions are described as series of successive human body poses. Action videos representation is based on fuzzy vector quantization, while action classification is performed by a novel classification algorithm, the so-called Sparsity-based Learning Machine (SbLM), involving two optimization steps. The first one determines a non-linear data mapping to a high-dimensional feature space determined by an l1-minimization process exploiting an overcomplete dictionary formed by the training samples. The second one, involves a training process in order to determine the optimal separating hyperplanes in the resulted high-dimensional feature space. The performance of the proposed human action recognition method is evaluated on two publicly available action recognition databases aiming at different application scenarios.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
Number of pages: 10
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Peer-reviewed: Yes

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Original language: English
ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Cognitive Neuroscience
Keywords: Action classification, Activity recognition, Fuzzy vector quantization, Sparse data representation
DOIs:
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Source: Scopus
Source ID: 84884142409
Research output: Contribution to journal › Article › Scientific › peer-review

Netmes: Assessing gene network inference algorithms by network-based measures

Gene regulatory network inference (GRNI) algorithms are essential for efficiently utilizing large-scale microarray datasets to elucidate biochemical interactions among molecules in a cell. Recently, the combination of network-based error measures complemented with an ensemble approach became popular for assessing the inference performance of the GRNI algorithms. For this reason, we developed a software package to facilitate the usage of such metrics. In this paper, we present netmes, an R software package that allows the assessment of GRNI algorithms. The software package netmes is available from the R-Forge web site https://r-forge.r-project.org/projects/netmes/.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Bahçeşehir University, Yildiz Technical University, UMIT - The Health and Life Sciences University, Computational Biology and Machine Learning Lab., Faculty of Medicine, Health and Life Sciences, Queen's University, Belfast, Northern Ireland
Contributors: Altay, G., Kurt, Z., Dehmer, M., Emmert-Streib, F.
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Peer-reviewed: Yes

Publication information

Journal: Evolutionary Bioinformatics
Volume: 10

ISSN (Print): 1176-9343
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Original language: English
ASJC Scopus subject areas: Ecology, Evolution, Behavior and Systematics, Computer Science Applications, Genetics
Keywords: Gene regulatory networks, Global network-based measures, Local network-based measures, Metrics for assessing ensemble datasets, R package for the network-based measures
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10.4137/EBO.S13481
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http://www.scopus.com/inward/record.url?scp=84893596910&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84893596910
Research output: Contribution to journal › Article › Scientific › peer-review

Social Network Games: Players' Perspectives

This article presents the results of an interview study on how people perceive and play social network games on Facebook. During recent years, social games have become the biggest genre of games if measured by the number of registered users. These games are designed to cater for large audiences in their design principles and values, a free-to-play revenue model and social network integration that make them easily approachable and playable with friends. Although these games have made the headlines and have been seen to revolutionize the game industry, we still lack an understanding of how people perceive and play them. For this article, we interviewed 18 Finnish Facebook users from a larger questionnaire respondent pool of 134 people. This study focuses on a user-centric approach, highlighting the emergent experiences and the meaning-making of social games players. Our findings reveal that social games are usually regarded as single player games with a social twist, and as suffering partly from their design characteristics, while still providing a wide spectrum of playful experiences for different needs. The free-to-play revenue model provides an easy access to social games, but people disagreed with paying for additional content for several reasons.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Mathematical modelling with wide societal impact (MathImpact)
Contributors: Paavilainen, J., Hamari, J., Stenros, J., Kinnunen, J.
Number of pages: 27
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Publication date: Dec 2013
Peer-reviewed: Yes

Publication information

Journal: SIMULATION AND GAMING
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Issue number: 6
ISSN (Print): 1046-8781
Ratings:
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Original language: English
ASJC Scopus subject areas: Business, Management and Accounting (miscellaneous), Computer Science Applications
Keywords: attitudes, experience, Facebook, free-to-play, frustration, game design, gameplay, interviews, micropayments, motivation, perception, playful experience, sociability, social games, social networks, user study, video games
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10.1177/1046878113514808
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http://www.scopus.com/inward/record.url?scp=84891936877&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84891936877
Research output: Contribution to journal › Article › Scientific › peer-review

[COMMODE] a large-scale database of molecular descriptors using compounds from PubChem

Background: Molecular descriptors have been extensively used in the field of structure-oriented drug design and structural chemistry. They have been applied in QSPR and QSAR models to predict ADME-Tox properties, which specify essential features for drugs. Molecular descriptors capture chemical and structural information, but investigating their interpretation and meaning remains very challenging.Results: This paper introduces a large-scale database of molecular descriptors called COMMODE containing more than 25 million compounds originated from PubChem. About 2500 DRAGON-descriptors have been calculated for all compounds and integrated into this database, which is accessible through a web

interface at http://commode.i-med.ac.at.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: Research Community on Data-to-Decision (D2D), Oncotyrol, Institute for Bioinformatics and Translational Research, Innsbruck Medical University, Computational Biology and Machine Learning Lab., Faculty of Medicine, Health and Life Sciences, Queen's University, Belfast, Northern Ireland
Contributors: Dander, A., Mueller, L. A. J., Gallasch, R., Pabinger, S., Emmert-Streib, F., Graber, A., Dehmer, M.
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Original language: English
ASJC Scopus subject areas: Information Systems, Computer Science Applications, Information Systems and Management, Health Informatics
Keywords: Chemical databases, Molecular descriptors, PubChem, QSAR, QSPR
DOIs:

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Source: Scopus
Source ID: 84887399081
Research output: Contribution to journal › Article › Scientific › peer-review

Wearable and implantable antennas for wireless body-centric sensing systems
In this poster abstract, we present recent advances on implantable and wearable antennas for wireless body-centric sensing systems. Prominent examples of such systems are the wireless brainmachine interface (BMI) system and wearable embroidered antennas. In the poster, we present more detailed simulation and measurement results.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research group: Wireless Identification and Sensing Systems Research Group, Department of Electronics and Communications Engineering, Sensing Systems for Wireless Medicine (MediSense), Nano Communication Centre, Berkeley, Electrical Engineering Department, University of California, Los Angeles (UCLA)
Contributors: Björninen, T., Moradi, E., Koski, K., Sydänheimo, L., Ukkonen, L., Muller, R., Ledochowitsch, P., Rabaey, J. M., Rahmat-Samii, Y.
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Source: Scopus
Source ID: 84947068176
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Importance of the ion-pair interactions in the OPEP coarse-grained force field: Parametrization and validation
We have derived new effective interactions that improve the description of ion pairs in the Optimized Potential for Efficient protein structure Prediction (OPEP) coarse-grained force field without introducing explicit electrostatic terms. The iterative

Boltzmann inversion method was used to extract these potentials from all-atom simulations by targeting the radial distribution function of the distance between the center of mass of the side chains. The new potentials have stabilities, and number of ion pairs. Our modeling, by refining the packing of the charged amino acids, impacts the stability of secondary structure motifs and the population of intermediate states during temperature folding/unfolding; it also improves the aggregation propensity of peptides. The new version of the OPEP force field has the potentiality to describe more realistically a large spectrum of situations where salt-bridges are key interactions. (Figure Presented)

General information
Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Multi-scaled biodata analysis and modelling (MultiBAM), Université Paris Diderot, Laboratoire de Biochimie Théorique, Institut Universitaire de France
Contributors: Sterpone, F., Nguyen, P. H., Kalimeri, M., Derreumaux, P.
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Volume: 9
Issue number: 10
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Original language: English
ASJC Scopus subject areas: Physical and Theoretical Chemistry, Computer Science Applications
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Bibliographical note
EXT="Kalimeri, Maria"
Source: Scopus
Source ID: 84891948959
Research output: Contribution to journal › Article › Scientific › peer-review

Comparison of Saltation, Amplitude Modulation, and a Hybrid Method of Vibrotactile Stimulation
Illusory vibrotactile movement can be used to provide directional tactile information on the skin. Our research question was how the presentation method affects the perception of vibrotactile movement. Illusion of vibrotactile mediolateral movement was elicited to a left dorsal forearm to investigate cognitive and emotional experiences to vibrotactile stimulation. Eighteen participants were presented with stimuli delivered to a linearly aligned row of three vibrotactile actuators. Three presentation methods were used-saltation, amplitude modulation, and a hybrid method-to form 12 distinct patterns of movement. First, the stimuli were compared pairwise using a two-alternative forced-choice procedure (same-different judgments). Second, the stimuli were rated using three nine-point bipolar scales measuring the continuity, pleasantness, and arousal of each stimulus. The stimuli presented with the amplitude modulation method were rated significantly more continuous and pleasant, and less arousing. Strong correlations between the cognition-related scale of continuity and the emotion-related scales of pleasantness and arousal were found: More continuous stimuli were rated more pleasant and less arousing.

General information
Publication status: Published
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Organisations: Augmented Human Activities (AHA)
Contributors: Raisamo, J., Raisamo, R., Surakka, V.
Number of pages: 5
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Journal: IEEE Transactions on Haptics
Volume: 6
Issue number: 4

Article number: 6517847
ISSN (Print): 1939-1412
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Original language: English
ASJC Scopus subject areas: Human-Computer Interaction, Computer Science Applications, Medicine(all)
Keywords: evaluation/methodology, haptic I/O, Information interfaces and representation (HCI), user interfaces
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10.1109/TOH.2013.25
URLs:
http://www.scopus.com/inward/record.url?scp=84890532189&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84890532189
Research output: Contribution to journal › Article › Scientific › peer-review

Transfer learning using a nonparametric sparse topic model

In many domains data items are represented by vectors of counts; count data arises, for example, in bioinformatics or analysis of text documents represented as word count vectors. However, often the amount of data available from an interesting data source is too small to model the data source well. When several data sets are available from related sources, exploiting their similarities by transfer learning can improve the resulting models compared to modeling sources independently. We introduce a Bayesian generative transfer learning model which represents similarity across document collections by sparse sharing of latent topics controlled by an Indian buffet process. Unlike a prominent previous model, hierarchical Dirichlet process (HDP) based multi-task learning, our model decouples topic sharing probability from topic strength, making sharing of low-strength topics easier. In experiments, our model outperforms the HDP approach both on synthetic data and in first of the two case studies on text collections, and achieves similar performance as the HDP approach in the second case study.

General information

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Contributors: Faisal, A., Gillberg, J., Leen, G., Peltonen, J.
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Peer-reviewed: Yes

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Ratings:
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ASJC Scopus subject areas: Artificial Intelligence, Computer Science Applications, Cognitive Neuroscience
Keywords: Latent Dirichlet allocation, Nonparametric Bayesian inference, Small sample size, Sparsity, Topic models, Transfer learning
DOIs:
10.1016/j.neucom.2012.12.038
URLs:
http://www.scopus.com/inward/record.url?scp=84877602437&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84877602437
Research output: Contribution to journal › Article › Scientific › peer-review

Transforming homo economicus into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service

During recent years, the addition of game mechanisms to non-game services has gained a relatively large amount of attention. Popular discussion connects gamification to successful marketing and increased profitability through higher customer engagement, however, there is a dearth of empirical studies that confirm such expectations. This paper reports the results of a field experiment, which gamifies a utilitarian peer-to-peer trading service by implementing the game mechanism of badges that users can earn from a variety of tasks. There were 3234 users who were randomly assigned to treatment groups and subjected to different versions of the badge system in a 2 × 2 design. The results show that the mere implementation of gamification mechanisms does not automatically lead to significant increases in use activity in the

studied utilitarian service, however, those users who actively monitored their own badges and those of others in the study showed increased user activity.

General information

Publication status: Published
MoE publication type: A1 Journal article-refereed
Organisations: Mathematical modelling with wide societal impact (MathImpact), Department of Information and Service Economy, Aalto University
Contributors: Hamari, J.
Number of pages: 10
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Publication information

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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Marketing, Management of Technology and Innovation
Keywords: Badges, Collaborative consumption, Game design, Gamification, Service marketing, Social commerce
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Source: Scopus
Source ID: 84883135229
Research output: Contribution to journal › Article › Scientific › peer-review

Indirect measurement of the vascular endothelial glycocalyx layer thickness in human submucosal capillaries with a plug-in for ImageJ

Background: The thickness of vascular endothelial glycocalyx layer can be measured indirectly during a spontaneous leukocyte passage from oral submucosal capillaries in humans. The subsequent differences in red blood cell (RBC) column widths, before a spontaneous white blood cell passage (pre-WBC) and after a spontaneous WBC passage (post-WBC) can be used in off-line analysis to measure glycocalyx thickness: [pre-WBC width - post-WBC width]/2. We created and validated a semi-automatic plug-in for ImageJ to measure the endothelial glycocalyx layer thickness. Methods: Video clips presenting human sublingual microvasculature were created with a side-stream dark field imaging device. Spontaneous leukocyte passages in capillaries were analyzed from video clips with ImageJ. The capillary glycocalyx layer thickness was measured by the indirect approach with two manual and two semi-automatic methods. Results: There were no statistically significant differences between glycocalyx layer thicknesses measured with different methods, even though small inter-method differences in RBC column thicknesses could be detected. Inter-rater differences were systematically smaller with both semi-automatic methods. Intra-rater coefficient of variation [CV] (95% CI) was largest when measurements were made completely manually [9.2% (8.4-10.0)], but improved significantly with automatic image enhancement prior to manual measurement [7.2% (6.4-8.0)]. CV could be improved further when using semi-automatic analysis with an in-frame median filter radius of 1 pixel [5.8% (5.0-6.6)], or a median filter radius of 2 pixels [4.3% (3.5-5.1)]. Conclusions: Semi-automatic analysis of glycocalyx decreased the intra-rater CV and the inter-rater differences compared to the manual method. On average, each of the four methods yielded equal results for the glycocalyx thickness. Being the only feasible bed side method in most clinical scenarios, indirect measurement of glycocalyx thickness with orthogonal polarization spectral imaging or side-stream dark field imaging device and our plug-in can advance the study of glycocalyx layer pathology in man.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Helsinki University Central Hospital, University of Helsinki, Uppsala University, Tampere University Hospital
Contributors: Liuhanen, S., Sallisalmi, M., Pettilä, V., Oksala, N., Tenhunen, J.
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Peer-reviewed: Yes

Publication information
Journal: Computer Methods and Programs in Biomedicine
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ISSN (Print): 0169-2607
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Software, Health Informatics
Keywords: Endothelial surface layer, Glycocalyx, Imagej, Open source, Side-stream dark field
DOIs:
10.1016/j.cmpb.2012.10.019
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http://www.scopus.com/inward/record.url?scp=84875094399&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84875094399
Research output: Contribution to journal › Article › Scientific › peer-review

Using building simulation to model the drying of flooded building archetypes
With a changing climate, London is expected to experience more frequent periods of intense rainfall and tidal surges, leading to an increase in the risk of flooding. This paper describes the simulation of the drying of flooded building archetypes representative of the London building stock using the EnergyPlus-based hygrothermal tool 'University College London-Heat and Moisture Transfer (UCL-HAMT)' in order to determine the relative drying rates of different built forms and envelope designs. Three different internal drying scenarios, representative of conditions where no professional remediation equipment is used, are simulated. A mould model is used to predict the duration of mould growth risk following a flood on the internal surfaces of the different building types. Heating properties while keeping windows open dried dwellings fastest, while purpose built flats and buildings with insulated cavity walls were found to dry slowest.

General information
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MoE publication type: A1 Journal article-refereed
Organisations: University College London
Contributors: Taylor, J., Biddulph, P., Davies, M., Ridley, I., Mavrogianni, A., Oikonomou, E., Lai, K. M.
Number of pages: 22
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Publication date: 1 Mar 2013
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Journal: JOURNAL OF BUILDING PERFORMANCE SIMULATION
Volume: 6
Issue number: 2
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ASJC Scopus subject areas: Architecture , Building and Construction, Modelling and Simulation, Computer Science Applications
Keywords: flood, hygrothermal, mould
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Source: Scopus
Source ID: 84871083708
Research output: Contribution to journal › Article › Scientific › peer-review

Variable switching point predictive torque control
In this paper an approach to include a variable switching time point into predictive torque control (PTC) is introduced. In PTC the switching frequency is limited by the sampling frequency; its theoretical maximum value is half the sampling frequency. In reality, however, the switching frequency is lower than this value, resulting in high current and torque ripples compared to modulator-based control methods. In order to overcome this an optimization problem is formulated and solved in real-time. The goal is to find the time point at which the switches of the inverter should change state in order to not only achieve the regulation of the torque and the flux magnitude to their references, but also the minimization of the

torque ripple. Further advantages of the proposed method include the design flexibility and great performance during transients. Experimental results that verify the performance of the presented control strategy are included.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Smart Energy Systems (SES), Department of Electrical and Computer Engineering, National Technical University of Athens, Technische Universitat Munchen, University of Stellenbosch
Contributors: Karamanakos, P., Stolze, P., Kennel, R., Manias, S., Mouton, T.
Number of pages: 6
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

A novel framework for design and implementation of adaptive stream mining systems

With the increasing need for accurate mining and classification from multimedia data content, and the growth of such multimedia applications in mobile and distributed architectures, stream mining systems require increasing amounts of flexibility, extensibility, and adaptivity for effective deployment. To address this challenge, we propose a novel approach that rigorously integrates foundations of dataflow modeling for high level signal processing system design, and adaptive stream mining based on dynamic topologies of classifiers. In particular, we introduce a new design environment, called the lightweight dataflow for dynamic data driven application systems (LiD4E) environment. LiD4E provides formal semantics, rooted in dataflow principles, for design and implementation of a broad class of multimedia stream mining topologies. We demonstrate the capabilities of LiD4E using a face detection application that systematically adapts the type of classifier used based on dynamically changing application constraints.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Signal Processing Research Community (SPRC), University of Maryland
Contributors: Sudusinghe, K., Won, S., Van Der Schaar, M., Bhattacharyya, S.
Publication date: 2013

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URLs:

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Source: Scopus
Source ID: 84885660099
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Bio-inspired service management framework: Green data-centres case study

The internet is evolving into a full-scale distributed service platform, offering a plethora of services from communications to business, entertainment, social connectivity and much more. The range of services and applications offered is diversifying, with new applications constantly emerging. For example, utility-based computing (e.g. HPC and cloud computing) which relies heavily on data-centre resources. These services will be more dynamic and sophisticated, providing a range of complex capabilities, which puts further burden on datacentres, in terms of supporting and managing these services. At

the same time, society is becoming acutely aware of the significant energy burden the communications industry, and in particular data-centres, are becoming. With these trends in mind we propose a biologically inspired service framework that supports services which can autonomously carry out management functions. We then apply this framework to address the emerging problem of a sustainable future internet by autonomously migrating services to greener locations.

General information

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Organisations: Wireless Communications and Positioning (WICO), Waterford Institute of Technology, Telecommunications Software and Systems Group (TSSG), University of Massachusetts Boston, Imperial College London and Nanyang Technological University
Contributors: Carroll, R., Balasubramaniam, S., Suzuki, J., Lee, C., Donnelly, W., Botvich, D.
Number of pages: 15
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ISSN (Print): 1741-847X
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Keywords: Bio-inspired services, Genetic algorithm, Green data-centres
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Source ID: 84886912413
Research output: Contribution to journal › Article › Scientific › peer-review

Checking visual data flow programs with finite process models

A visual data flow language (VDFL) allows graphical presentation of a computer program in the form of a directed graph, where data tokens travel through the arcs of the graph, and the vertices present e.g. the input token streams, calculations, comparisons, and conditionals. Amongst their benefits, VDFLs allow parallel computing and they are presumed to improve the quality of programming due to their intuitive readability. Thus, they are also suitable for computing education. However, the token-based computational model allowing parallel processing may make the programs more complicated than what they look. We propose a method for checking properties of VDFL programs using finite state processes (FSPs) using a commonly available labelled transition system analyser (LTSA) tool. The method can also be used to study different VDFL programming constructs for development or re-design of VDFLs. For our method, we have implemented a compiler that compiles a textual representation of a VDFL into FSPs.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Research Community on Data-to-Decision (D2D), Mathematical modelling with wide societal impact (MathImpact), Ita-Suomen yliopisto
Contributors: Nummenmaa, J., Marttila-Kontio, M., Nummenmaa, T.
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ISBN (Electronic): 9789633062289
ASJC Scopus subject areas: Computer Science Applications, Software
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Chip-to-package wireless power transfer and its application to mm-Wave antennas and monolithic radiometric receivers

A chip-to-package wireless power transfer concept is applied to MMIC and antennas on LCP substrate is presented. Electromagnetic simulations show the feasibility of the proposed approach. As a benchmarking topology at the working frequency of 35.4 GHz, an Archimedean spiral antenna matched to a heterogeneous transformer, which couples the power received by the antenna to the chip, has been simulated. Transistor level circuit simulations are also proposed for the LNA and the detector, which together will constitute the system-on-chip (SoC) radiometer to be integrated in the LCP-SoP.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), University of Perugia, Georgia Institute of Technology
Contributors: Aluigi, L., Thai, T. T., Tentzeris, M. M., Roselli, L., Alimenti, F.
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications, Electrical and Electronic Engineering, Communication
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Source: Scopus
Source ID: 84876750099
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Design and simulation of a slotted patch antenna sensor for wireless strain sensing

In this work, a slotted patch antenna is employed as a wireless sensor for monitoring structural strain and fatigue crack. Using antenna miniaturization techniques to increase the current path length, the footprint of the slotted patch antenna can be reduced to one quarter of a previously presented folded patch antenna. Electromagnetic simulations show that the antenna resonance frequency varies when the antenna is under strain. The resonance frequency variation can be wirelessly interrogated and recorded by a radiofrequency identification (RFID) reader, and can be used to derive strain/deformation. The slotted patch antenna sensor is entirely passive (battery-free), by exploiting an inexpensive off-the-shelf RFID chip that receives power from the wireless interrogation by the reader.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Virginia Tech
Contributors: Yi, X., Cho, C., Cook, B., Wang, Y., Tentzeris, M. M., Leon, R. T.
Publication date: 2013

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ASJC Scopus subject areas: Applied Mathematics, Computer Science Applications, Electrical and Electronic Engineering, Electronic, Optical and Magnetic Materials, Condensed Matter Physics
Keywords: RFID, Slotted patch antenna, Strain sensor, Wireless passive sensor
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Source: Scopus
Source ID: 84878419679
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Exploiting RSS measurements among neighbouring devices: A matter of trust

In this paper we present experimental evaluations of cooperative ranging-based approaches in mobile positioning. Our main contribution is represented by experimental investigations, analysis of the errors introduced in the distance estimation and exploitation of the knowledge of environmental perturbations with a NLLS algorithm, highlighting the limits of such cooperative schemes, proving that the effect of cooperation might be very limited in real-life scenarios.

General information

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MoE publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Wireless Communications and Positioning (WICO) , Aalborg University
Contributors: Rosa, F. D., Paakki, T., Nurmi, J., Pelosi, M.
Publication date: 2013

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ISBN (Print): 9781479940431
ASJC Scopus subject areas: Computer Science Applications
Keywords: Cooperation, peer-to-peer, Positioning, WiFi
DOIs:

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Source: Scopus
Source ID: 84902204262
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

How do students solve parsons programming problems? - Execution-based vs. line-based feedback

In large introductory programming classes, there typically are no resources for adequate individual guidance. Automatic feedback for programming tasks can facilitate students' learning by allowing them to get immediate individual feedback regardless of time and place. This paper presents a study on how the type of automatic feedback in Parsons problems affects how students solve them. Students on their first programming class were divided into two groups and, in two assignments, each group in turn received different type of feedback. The type of feedback had an effect on how students constructed their programs and how quickly they were able to complete them. With feedback based on execution as opposed to the visible arrangement of code, the programs were more frequently executable when feedback was requested and, overall, feedback was requested less frequently. Based on the analysis, we discuss possible future improvements to automatic feedback in this type of an assignment.

General information

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Organisations: Regulation of learning and active learning methods (REALMEE), Aalto University, Department of Computer Science and Eng.
Contributors: Helminen, J., Ihantola, P., Karavirta, V., Alaoutinen, S.
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ASJC Scopus subject areas: Computer Science Applications, Education
Keywords: Automatic Feedback, Parsons Puzzles, Python
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Source ID: 84881103728
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Inkjet printing of radio frequency electronics: Design methodologies and application of novel nanotechnologies

We discuss here the use of inkjet printing technology as an attractive alternative for the fabrication of radio frequency (RF) electronics. Inkjet printing is compared to widelyused traditional methods such as wet etching and mechanical milling with discussion of the advantages and potential disadvantages afforded by the technology. Next the paper presents the current state of the art for RF printed electronics, including fundamental fabrication technologies, methodologies, and materials. Included are detailed discussions of the fabrication of foundational conductive elements, integration of external elements via low temperature bonding techniques, and enhancement strategies focusing on the addition of novel materials. We then present some current challenges related to inkjet printing, along with some exciting recent advances in materials technology seeking to overcome the current limitations and to expand the frontier of the technology. Following are multiple examples detailing the successful use of inkjet printing methods in the creation of novel RF devices, providing proof of concept and illustrating in greater detail the concepts presented in the theoretical sections.

General information

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Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Electrical and Computer Engineering
Contributors: Le, T., Lin, Z., Vyas, R., Lakafosis, V., Yang, L., Traille, A., Tentzeris, M. M., Wong, C. P.
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ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Annealing, CNT, Conductive silver ink, Direct write, Electrical design, Flexible circuits, Graphene, Inkjet-printed electronics, Low temperature bonding, Microwave, Organic electronics, Paper-based electronics, Sensors, SOP
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Source: Scopus
Source ID: 84878547011
Research output: Contribution to journal › Article › Scientific › peer-review

Magnetomechanical coupled FE simulations of rotating electrical machines

Purpose - The purpose is to implement and compare different approaches for modelling the magnetostriction phenomenon in iron sheet used in rotating electrical machines. Design/methodology/approach - In the force-based approach, the magnetostriction is modelled as a set of equivalent forces, which produce the same deformation of the material as the magnetostriction strains. These forces among other magnetic forces are computed from the solution of the finite element (FE) field computation and used as loads for the displacement-based mechanical FE analysis. In the strain-based approach, the equivalent magnetostrictive forces are not needed and an energy-based model is used to define magnetomechanically coupled constitutive equations of the material. These equations are then space-discretised and solved with the FE method for the magnetic field and the displacements. Findings - It is found that the equivalent forces method can reproduce the displacements and strains of the structure but it results in erroneous stress states. The energy-based method has the ability to reproduce both the stress and strains correctly; thus enabling the analysis of stress-dependent quantities such as the iron losses and the magnetostriction itself. Research limitations/implications - The investigated methods do not account for hysteresis and other dynamic effects. They also require long computation times. With the available computing resources, the computation time does not present any problem as far as they are not used in everyday design procedures but the modelling of dynamic effect needs to be elaborated. Originality/value - The developed and implemented methods are verified with measurements and simulation experiments and applied to as complex structure as an electrical machine. The problems related to the different approaches are investigated and explained through simulations. © Emerald Group Publishing Limited.

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MoE publication type: A1 Journal article-refereed
Organisations: Department of Mechanical Engineering and Industrial Systems, Life Cycle Effectiveness of the Built Environment (LCE@BE), Smart Energy Systems (SES), Aalto University
Contributors: Belahcen, A., Fonteyn, K., Kouhia, R., Rasilo, P., Arkkio, A.
Number of pages: 16
Pages: 1484-1499
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Volume: 32
Issue number: 5
Article number: 17095978
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computational Theory and Mathematics, Applied Mathematics
Keywords: Coupled systems, Electrical equipment, Finite element simulation, Iron, Iron losses, Magnetoelasticity, Stress, Stress analysis
DOIs:

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Portfolio EDEND: 2013-10-29
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Source: researchoutputwizard
Source ID: 1975
Research output: Contribution to journal › Article › Scientific › peer-review

Multidimensional sequence classification based on fuzzy distances and discriminant analysis
In this paper, we present a novel method aiming at multidimensional sequence classification. We propose a novel sequence representation, based on its fuzzy distances from optimal representative signal instances, called statemes. We also propose a novel modified clustering discriminant analysis algorithm minimizing the adopted criterion with respect to both the data projection matrix and the class representation, leading to the optimal discriminant sequence class representation in a low-dimensional space, respectively. Based on this representation, simple classification algorithms, such as the nearest subclass centroid, provide high classification accuracy. A three step iterative optimization procedure for choosing statemes, optimal discriminant subspace and optimal sequence class representation in the final decision space is proposed. The classification procedure is fast and accurate. The proposed method has been tested on a wide variety of multidimensional sequence classification problems, including handwritten character recognition, time series classification and human activity recognition, providing very satisfactory classification results.

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Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
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Issue number: 11
ISSN (Print): 1041-4347
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Original language: English
ASJC Scopus subject areas: Computational Theory and Mathematics, Information Systems, Computer Science Applications
Keywords: clustering-based discriminant analysis, codebook learning, fuzzy vector quantization, Sequence classification
DOIs:
10.1109/TKDE.2012.223
Source: Scopus
Source ID: 84884791250
Research output: Contribution to journal › Article › Scientific › peer-review

Multi-physics modeling and simulation of a slotted patch antenna for wireless strain sensing

This research studies multi-physics simulation of a slotted patch antenna sensor. In our previous work, a folded patch antenna was designed for passive wireless strain and crack sensing. When experiencing deformation, the antenna shape changes, causing shift in electromagnetic resonance frequency of the antenna. The wireless interrogation system utilizes the principle of electromagnetic backscattering and adopts off-the-shelf 900MHz radiofrequency identification (RFID) technology. In this research, a slotted patch antenna sensor is designed, while maintaining antenna resonance frequency to be around 900MHz. The slotted antenna detours surface current using slotted patterns, so that the electrical length is kept similar as previous folded patch antenna sensor yet sensor footprint is reduced. To accurately describe both mechanical and electromagnetic behaviors of the antenna sensor, a multi-physics coupled simulation approach is pursued. A multiphysics finite element model uses the same geometry and meshing for both mechanical and electromagnetic simulations. Because electromagnetism has little influence on the mechanical behavior of the sensor, displacement field and electrical field can be solved separately using segregated steps. Known as sequential coupling, the solution method involves two or more analyses, each solving for a different physical field. The mechanics-electromagnetics coupled simulation is implemented using a commercial software package, COMSOL. Strain sensing performance predicted by the multi-physics simulation is presented.

General information

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Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, School of Civil and Environmental Engineering, Georgia Institute of Technology, School of Electrical and Computer Engineering, Virginia Tech
Contributors: Yi, X., Wang, Y., Tentzeris, M. M., Leon, R. T.
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ASJC Scopus subject areas: Computer Science Applications, Health Information Management
URLs:
http://www.scopus.com/inward/record.url?scp=84945174604&partnerID=8YFLogxK (Link to publication in Scopus)
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Source ID: 84945174604
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

On the optimal class representation in linear discriminant analysis

Linear discriminant analysis (LDA) is a widely used technique for supervised feature extraction and dimensionality reduction. LDA determines an optimal discriminant space for linear data projection based on certain assumptions, e.g., on using normal distributions for each class and employing class representation by the mean class vectors. However, there might be other vectors that can represent each class, to increase class discrimination. In this brief, we propose an optimization scheme aiming at the optimal class representation, in terms of Fisher ratio maximization, for LDA-based data projection. Compared with the standard LDA approach, the proposed optimization scheme increases class discrimination in the reduced dimensionality space and achieves higher classification rates in publicly available data sets.

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Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics

Contributors: Iosifidis, A., Tefas, A., Pitas, I.
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Keywords: Class representation, data projection, linear discriminant analysis (LDA), subspace learning
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Research output: Contribution to journal › Article › Scientific › peer-review

Person identification from actions based on dynemes and discriminant learning
In this paper we present a view-independent person identification method exploiting motion information. A multi-camera setup is used in order to capture the human body during action execution from different viewing angles. The method is able to incorporate several everyday actions in person identification. A comparative study of the discriminative ability of different actions for person identification is provided, denoting that several actions, except walk, can be exploited for person identification.

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Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
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ASJC Scopus subject areas: Biotechnology, Computer Science Applications
Keywords: Action-based person identification, Classification results fusion, Discriminant learning, Dyneme video representation
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Source: Scopus
Source ID: 84881350564
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Preparation of water-based carbon nanotube inks and application in the inkjet printing of carbon nanotube gas sensors
Water-based carbon nanotube (CNT) is highly desirable for inkjet printing devices due to its environmentally benign and low-cost features. To improve the dispersion of CNT in water, oxygen-containing functional groups are introduced into the surface of CNT via an acid oxidation process. The CNT-based gas sensor is fabricated by inkjet printing, which shows a high sensitivity toward NO_2. The application of inkjet-printed CNT in a printed RF antenna for wireless sensing is also discussed.

General information
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Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Georgia Tech Research Institute, Chinese University of Hong Kong
Contributors: Lin, Z., Le, T., Song, X., Yao, Y., Li, Z., Moon, K. S., Tentzeris, M. M., Wong, C. P.

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Original language: English
ASJC Scopus subject areas: Electronic, Optical and Magnetic Materials, Mechanics of Materials, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Carbon Nanotube, Inkjet Printing, Nanotechnology, Water-Based Ink, Wireless Gas Sensor
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Source: Scopus
Source ID: 84878587853
Research output: Contribution to journal › Article › Scientific › peer-review

Service-oriented approach to improve interoperability of e-learning systems
We present a design and open source implementation for a service oriented e-learning system, which utilizes external services for supporting a wide range of learning content and also offers a REST API for external clients to fetch information stored in the system. The design will separate different concerns, such as user authentication and exercise assessment, into separate services, which together form a complete e-learning environment. A key component of the design is identifying a general set of characteristics among existing exercise assessment systems, by which the assessment methods are grouped into three types: synchronous, asynchronous and static exercises.

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Organisations: Regulation of learning and active learning methods (REALMEE), Aalto University, Department of Computer Science and Eng., Houston Inc. Consulting Oy
Contributors: Karavirta, V., Ihantola, P., Koskinen, T.
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http://www.scopus.com/inward/record.url?scp=84885222805&partnerID=8YFLogxK (Link to publication in Scopus)
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Towards an approach for evaluating the quality of requirements
In engineering design, the needs of stakeholders are often captured and expressed in natural language (NL). While this facilitates such tasks as sharing information with nonspecialists, there are several associated problems including ambiguity, incompleteness, understandability, and testability. Traditionally, these issues were managed through tedious procedures such as reading requirements documents and looking for errors, but new approaches are being developed to assist designers in collecting, analysing, and clarifying requirements. The quality of the end-product is strongly related to the clarity of requirements and, thus, requirements should be managed carefully. This paper proposes to combine diverse requirements quality measures found from literature. These metrics are coherently integrated in a single software tool. This paper also proposes a new metric for clustering requirements based on their similarity to increase the quality of

requirement model. The proposed methodology is tested on a case study and results show that this tool provides designers with insight on the quality of individual requirements as well as with a holistic assessment of the entire set of requirements.

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Contributors: Mokammel, F., Coatanea, E., Christophe, F., Ba Khouya, M., Medyna, G.
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Article number: V02BT02A024
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ASJC Scopus subject areas: Mechanical Engineering, Computer Graphics and Computer-Aided Design, Computer Science Applications, Modelling and Simulation
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View-independent human action recognition based on multi-view action images and discriminant learning
In this paper a novel view-independent human action recognition method is proposed. A multi-camera setup is used to capture the human body from different viewing angles. Actions are described by a novel action representation, the so-called multi-view action image (MVAI), which effectively addresses the camera viewpoint identification problem, i.e., the identification of the position of each camera with respect to the person's body. Linear Discriminant Analysis is applied on the MVAIs in order to to map actions to a discriminant feature space where actions are classified by using a simple nearest class centroid classification scheme. Experimental results denote the effectiveness of the proposed action recognition approach.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research Community on Data-to-Decision (D2D), Aristotle University of Thessaloniki, Department of Informatics
Contributors: Iosifidis, A., Tefas, A., Pitas, I.
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ASJC Scopus subject areas: Computer Graphics and Computer-Aided Design, Computer Vision and Pattern Recognition, Computer Science Applications
Keywords: Discriminant Learning, Human Action Recognition, Multi-camera Setup, Multi-view Action Images
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Source: Scopus
Source ID: 84888154998
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Virtualizing power cords by wireless power transmission and energy harvesting
In this paper, we introduce two different approaches for the virtualization of power cords for electrical devices. The first approach is a new concept for routing electric power by wireless transfer on two-dimensional surfaces, such as floors and walls. Unlike any other existing wireless power transfer scheme, this method can deliver electric power over a wide range with minimal loss. We realize this method using multi-hop displacement of a magnetic antenna array. Each array element can be selectively resonated with adjacent elements to deliver power without physical contact. The second approach utilizes far-field RF energy harvesting. Using an efficient voltage multiplier and adaptive software-based control, it is possible to operate low-power wireless sensors continuously.

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MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), University of Tokyo, Georgia Institute of Technology
Contributors: Kawahara, Y., Wei, W., Narusue, Y., Shigeta, R., Asami, T., Tentzeris, M.
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Keywords: RF energy harvesting, Wireless power transmission
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Wireless chipless passive electromagnetic transducers for SHM applications
The energy autonomy of wireless sensors is crucial especially for buried or inaccessible sensors that are often the case in SHM applications. This problem can be overcome by using classical passive sensors (RFID or SAW sensors) but they suffer from a problem of low reading distances (<10m). For few years emerged a new kind of passive sensors using electromagnetic transducers, combining very high autonomy, high resistance to harsh environment, potential interrogation distance higher than SAW sensors and wide variety of sensing principles. We started to work in this new research field in 2005 and several sensor principles have been validated in our lab (pressure, temperature, stress) with FMCW (Frequency Modulated Continuous Wave) Radar interrogation.

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MoE publication type: A4 Article in a conference publication
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Contributors: Pons, P., Aubert, H., Tentzeris, M.
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ASJC Scopus subject areas: Computer Science Applications, Health Information Management
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http://www.scopus.com/inward/record.url?scp=84945197244&partnerID=8YFLogxK (Link to publication in Scopus)
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Gene set analysis for self-contained tests: Complex null and specific alternative hypotheses
Motivation: The analysis of differentially expressed gene sets became a routine in the analyses of gene expression data. There is a multitude of tests available, ranging from aggregation tests that summarize gene-level statistics for a gene set to true multivariate tests, accounting for intergene correlations. Most of them detect complex departures from the null hypothesis but when the null hypothesis is rejected the specific alternative leading to the rejection is not easily identifiable. Results: In this article we compare the power and Type I error rates of minimum-spanning tree (MST)-based non-parametric multivariate tests with several multivariate and aggregation tests, which are frequently used for pathway analyses. In our simulation study, we demonstrate that MST-based tests have power that is for many settings comparable with the power of conventional approaches, but outperform them in specific regions of the parameter space corresponding

to biologically relevant configurations. Further, we find for simulated and for gene expression data that MST-based tests discriminate well against shift and scale alternatives. As a general result, we suggest a two-step practical analysis strategy that may increase the interpretability of experimental data: first, apply the most powerful multivariate test to find the subset of pathways for which the null hypothesis is rejected and second, apply MST-based tests to these pathways to select those that support specific alternative hypotheses.

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Contributors: Rahmatallah, Y., Emmert-Streib, F., Glazko, G.
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Source: Scopus
Source ID: 84870441671
Research output: Contribution to journal › Article › Scientific › peer-review

Elastic image registration for guiding focal laser ablation of prostate cancer: Preliminary results
Purpose: To guide ultrasound-driven prostate photodynamic therapy using information from MRI-based treatment planning. Methods: Robust points matching (RPM) and thin plate splines (TPS) are used to solve correspondences and to map optimally positioned landmarks from MR images to transrectal ultrasound (TRUS) images. The algorithm uses a reduced number of anatomical markers that are initialized on the images. Results: Both phantom and patient data were used to evaluate precision and robustness of the method. Mean registration error (±standard deviation) was of 2.18. ±. 0.25. mm and 1.55. ±. 0.31. mm for patient prostate and urethra, respectively. Repeated tests with different markers initialization conditions showed that the quality of registration was neither influenced by the number of markers nor to the human observer. Conclusion: This method allows for satisfyingly accurate and robust non rigid registration of MRI and TRUS and provides practitioners with substantial help in mapping treatment planning from pre-operative MRI to interventional TRUS.

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Organisations: Frontier Photonics, Univ Paris 06, Centre National de la Recherche Scientifique (CNRS), Pierre & Marie Curie University - Paris 6, Institut de Recherche pour le Developpement (IRD), Inria, Institut National de la Sante et de la Recherche Medicale (Inserm), Univ Sorbonne, CNRS,ICM,UMR S 1127,UMR 7225,U1127, INSERM,Inria Paris Rocquencourt,Inst Cerveau & Mo, Lille University Hospital - CHRU, CHU Angers, Univ Lille Nord de France
Contributors: Makni, N., Puech, P., Colin, P., Azzouzi, A., Mordon, S., Betrouni, N.
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Original language: English
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Source: Scopus
Source ID: 84865711653
Research output: Contribution to journal › Article › Scientific › peer-review

Implementation of a direct procedure for critical point computations using preconditioned iterative solvers

Computation of critical points on an equilibrium path requires the solution of a non-linear eigenvalue problem. These critical points could be either bifurcation or limit points. When the external load is parametrized by a single parameter, the non-linear stability eigenvalue problem consists of solving the equilibrium equations along the criticality condition. Several techniques exist for solution of such a system. Their algorithmic treatment is usually focused for direct linear solvers and thus use the block elimination strategy. In this paper special emphasis is given for a strategy which can be used also with iterative linear solvers. Comparison to the block elimination strategy with direct linear solvers is given. Due to the non-uniqueness of the critical eigenmode a normalizing condition is required. In addition, for bifurcation points, the Jacobian matrix of the augmented system is singular at the critical point and additional stabilization is required in order to maintain the quadratic convergence of the Newton's method. Depending on the normalizing condition, convergence to a critical point with negative load parameter value can happen. The form of the normalizing equation is critically discussed. Due to the slenderness of the buckling sensitive structures the resulting matrices are ill-conditioned and a good preconditioner is mandatory for efficient solution.

General information

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Organisations: Department of Mechanics and Design, Department of Civil Engineering, Life Cycle Effectiveness of the Built Environment (LCE@BE), Academy of Sciences of the Czech Republic, Institute of Computer Science of the Academy of Sciences of the Czech Republic, Department of Civil and Structural Engineering, Aalto University
Contributors: Kouhia, R., Tůma, M., Mäkinen, J., Fedoroff, A., Marjamäki, H.
Number of pages: 8
Pages: 110-117
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Volume: 108-109
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Keywords: Critical points, Equilibrium equations, Non-linear eigenvalue problem, Preconditioned iterations
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Source ID: 4554
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Elemental and mixed actinide dioxides: An ab initio study

We present a systematic study of the electronic, geometric, and magnetic properties of the actinide dioxides, UO_2, PuO_2, AmO_2, $U_{0.5}Pu_{0.5}O_2$, $U_{0.5}Am_{0.5}O_2$ and $Pu_{0.5}Am_{0.5}O_2$. For UO_2, PuO_2 and AmO_2, both density functional

and hybrid density functional theory (DFT and HDFT) have been used. The fractions of exact HartreeFock (HF) exchange chosen were 25% and 40% for the hybrid density functional. For $U_{0.5}Pu_{0.5}O_2$, $U_{0.5}Am_{0.5}O_2$ and $Pu_{0.5}Am_{0.5}O_2$, only HDFT with 40% exact HF exchange was used. Each compound has been studied at the nonmagnetic, ferromagnetic and anti-ferromagnetic configurations, with and without spinorbit coupling (SOC). The lattice parameters, magnetic structures, bulk moduli, band gaps and density of states have been computed and compared to available experimental data and other theoretical results. Pure DFT fails to provide a satisfactory qualitative description of the electronic and magnetic structures of the actinide dioxides. On the other hand, HDFT performs very well in the prediction and description of the properties of the actinide dioxides. Our total energy calculations clearly indicate that the ground-state structures are anti-ferromagnetic for all actinide dioxides considered here. The lattice constants and the band gaps expand with an increase of HF exchange in HDFT. The influence of SOC is found to be significant.

General information

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MoE publication type: A1 Journal article-refereed
Organisations: Computational Science X (CompX), University of Texas at Arlington, Pacific Northwest National Laboratory
Contributors: Ma, L., Atta-Fynn, R., Ray, A. K.
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ASJC Scopus subject areas: Physical and Theoretical Chemistry, Computational Theory and Mathematics, Computer Science Applications
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Source ID: 84862874223
Research output: Contribution to journal › Article › Scientific › peer-review

Rethinking Playing Research: DJ HERO and Methodological Observations in the Mix

Playing games has a crucial methodological role within the study of games. At the same time, detailed overviews of how academic playing is conducted are difficult to find. In this article, the authors begin with Espen Aarseth's outline of playing research and offer some updates to it in order to build a more context-aware approach. To exemplify the elaborated methodology, the authors apply it to the rhythm game DJ HERO. They emphasize in this article that a game not only creates a world of its own, but also is in many ways connected to the traditions directed by real-world culture and economics. Thus, playing research needs to go beyond the limits of gameworld and normative gameplay, and move toward a concept or assemblage of play that takes into account games as singular and multifaceted technocultural entities.

General information

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Contributors: Karppi, T., Sotamaa, O.
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Studying the Elusive Experience in Pervasive Games

Studying pervasive games is inherently difficult and different from studying computer or board games. This article builds upon the experiences of staging and studying several playful pervasive technology prototypes. It discusses the challenges and pitfalls of evaluating pervasive game prototypes and charts methods that have proven useful in previous research. The aim is to open discussion on the situated methodology of qualitative study of evaluating and researching pervasive play.

General information

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Contributors: Stenros, J., Waern, A., Montola, M.
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Original language: English
ASJC Scopus subject areas: Business, Management and Accounting (miscellaneous), Computer Science Applications
Keywords: ambiguity, design, design-play relationship, elusiveness, evaluation methods, experience, game genres, game studies, pervasive games, pervasive play, play experience, qualitative study, research methodology, situated methodology
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Organizational structure and the periphery of the gene regulatory network in B-cell lymphoma.

The physical periphery of a biological cell is mainly described by signaling pathways which are triggered by transmembrane proteins and receptors that are sentinels to control the whole gene regulatory network of a cell. However, our current knowledge about the gene regulatory mechanisms that are governed by extracellular signals is severely limited. The purpose of this paper is three fold. First, we infer a gene regulatory network from a large-scale B-cell lymphoma expression data set using the C3NET algorithm. Second, we provide a functional and structural analysis of the largest connected component of this network, revealing that this network component corresponds to the peripheral region of a cell. Third, we analyze the hierarchical organization of network components of the whole inferred B-cell gene regulatory network by introducing a new approach which exploits the variability within the data as well as the inferential characteristics of C3NET. As a result, we find a functional bisection of the network corresponding to different cellular components. Overall, our study allows to highlight the peripheral gene regulatory network of B-cells and shows that it is centered around hub transmembrane proteins located at the physical periphery of the cell. In addition, we identify a variety of novel pathological transmembrane proteins such as ion channel complexes and signaling receptors in B-cell lymphoma.

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Contributors: de Matos Simoes, R., Tripathi, S., Emmert-Streib, F.
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ASJC Scopus subject areas: Molecular Biology, Structural Biology, Applied Mathematics, Modelling and Simulation, Computer Science Applications
Keywords: B-cell lymphoma, Gene expression data, Gene regulatory network, Statistical network inference
DOIs:

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Research output: Contribution to journal › Article › Scientific › peer-review

Body area nanonetworks with molecular communications in nanomedicine
Recent developments in nano and biotechnology enable promising therapeutic nanomachines (NMs) that operate on inter- or intracellular area of human body. The networks of such therapeutic NMs, body area nanonetworks (BAN ^{2}s), also empower sophisticated nanomedicine applications. In these applications, therapeutic NMs share information to perform computation and logic operations, and make decisions to treat complex diseases. Hence, one of the most challenging subjects for these sophisticated applications is the realization of BAN ^{2} through a nanoscale communication paradigm. In this article, we introduce the concept of a BAN ^{2} with molecular communication, where messenger molecules are used as communication carrier from a sender to a receiver NM. The current state of the art of molecular communication and BAN ^{2} in nanomedicine applications is first presented. Then communication theoretical efforts are reviewed, and open research issues are given. The objective of this work is to introduce this novel and interdisciplinary research field and highlight major barriers toward its realization from the viewpoint of communication theory.

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Contributors: Atakan, B., Akan, O. B., Balasubramaniam, S.
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Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Computer Networks and Communications
DOIs:

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Source: Scopus
Source ID: 84855682134
Research output: Contribution to journal › Article › Scientific › peer-review

Short-term power load forecasting using grey correlation contest modeling

Power load has the characteristic of nonlinear fluctuation and random growth. Aiming at the drawback that the forecasting accuracy of general GM(1,1) model goes down when there is a greater load mutation, this paper proposes a new grey model with grey correlation contest for short-term power load forecasting. In order to cover the impact of various certain and uncertain factors in climate and society on the model as fully as possible, original series are selected from different viewpoints to construct different forecasting strategies. By making full use of the characteristic that GM(1,1) model can give a perfect forecasting result in the smooth rise and drop phase of power load, and the feature that there are several peaks and valleys within daily power load, the predicted day is divided into several smooth segments for separate forecasting. Finally, the different forecasting strategies are implemented respectively in the different segments through grey correlation contest, so as to avoid the error amplification resulted from the improper choice of initial condition. A practical application verifies that, compared with the existing grey forecasting models, the proposed model is a stable and feasible forecasting model with a higher forecasting accuracy.

General information

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Organisations: Sensing Systems for Wireless Medicine (MediSense), Hunan University, Sany Smart Control Equipment Ltd., Georgia Institute of Technology
Contributors: Jin, M., Zhou, X., Zhang, Z. M., Tentzeris, M. M.
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ASJC Scopus subject areas: Engineering(all), Computer Science Applications, Artificial Intelligence
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Source ID: 81855218656
Research output: Contribution to journal › Article › Scientific › peer-review

A system for real-time detection and tracking of vehicles from a single car-mounted camera

A novel system for detection and tracking of vehicles from a single car-mounted camera is presented. The core of the system are high-performance vision algorithms: the WaldBoost detector [1] and the TLD tracker [2] that are scheduled so that a real-time performance is achieved. The vehicle monitoring system is evaluated on a new dataset collected on Italian motorways which is provided with approximate ground truth (GT0) obtained from laser scans. For a wide range of distances, the recall and precision of detection for cars are excellent. Statistics for trucks are also reported. The dataset with the ground truth is made public.

General information

Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Research Community on Data-to-Decision (D2D), Advanced Technology Division, Czech Technical University in Prague
Contributors: Caraffi, C., Vojir, T., Trefný, J., Šochman, J., Matas, J.
Number of pages: 8

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ASJC Scopus subject areas: Automotive Engineering, Mechanical Engineering, Computer Science Applications
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http://www.scopus.com/inward/record.url?scp=84871239330&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84871239330
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Design and synthesis for multimedia systems using the targeted dataflow interchange format

Development of multimedia systems that can be targeted to different platforms is challenging due to the need for rigorous integration between high-level abstract modeling, and low-level synthesis and optimization. In this paper, a new dataflow-based design tool called the targeted dataflow interchange format is introduced for retargetable design, analysis, and implementation of embedded software for multimedia systems. Our approach provides novel capabilities, based on principles of task-level dataflow analysis, for exploring and optimizing interactions across design components; object-oriented data structures for encapsulating contextual information for components; a novel model for representing parameterized schedules that are derived from repetitive graph structures; and automated code generation for programming interfaces and low-level customizations that are geared toward high-performance embedded-processing architectures. We demonstrate our design tool for cross-platform application design, parameterized schedule representation, and associated dataflow graph-code generation using a case study centered around an image registration application.

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MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing Research Community (SPRC), University of Maryland, SAIC, New Jersey Institute of Technology, Department of Electrical and Computer Engineering
Contributors: Shen, C. C., Wu, S., Sane, N., Wu, H. H., Plishker, W., Bhattacharyya, S. S.
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Original language: English
ASJC Scopus subject areas: Signal Processing, Media Technology, Computer Science Applications, Electrical and Electronic Engineering
Keywords: Dataflow graphs, design tools, embedded signal processing, scheduling, software synthesis
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10.1109/TMM.2012.2191397
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Source: Scopus
Source ID: 84861152678
Research output: Contribution to journal › Article › Scientific › peer-review

Evaluation of effectiveness of the stickgrip device for detecting the topographic heights on digital maps

Multimodal visualization of landscapes and cityscapes requires new concepts and metaphors for intuitive operations with multidimensional data in fully immersive virtual environments. Variations in lighting conditions and perceptual interpretation of the reduced topographic colors can significantly modify an assessment of the true elevation profiles on a digital map. This paper describes the results of the empirical evaluation of the new interaction technique that has potential to enhance

the imaging functionality of the two-dimensional maps. It was demonstrated that untrained subjects become much more accurate at detecting the altitudes in a range of 0-4000 m assigned within the palette when values of the light intensity had been associated with the haptic information. The results confirmed that the accuracy of the height estimation with the StickGrip haptic device appeared to be higher by about 32% in comparison to visual assessment.

General information
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Organisations: Augmented Human Activities (AHA)
Contributors: Evreinova, T. V., Evreinov, G., Raisamo, R.
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Source: Scopus
Source ID: 84872773600
Research output: Contribution to journal › Article › Scientific › peer-review

Face typing: Vision-based perceptual interface for hands-free text entry with a scrollable virtual keyboard
We present a novel vision-based perceptual user interface for hands-free text entry that utilizes face detection and visual gesture detection to manipulate a scrollable virtual keyboard. A thorough experimentation was undertaken to quantitatively define a performance of the interface in hands-free pointing, selection and scrolling tasks. The experiments were conducted with nine participants in laboratory conditions. Several face and head gestures were examined for detection robustness and user convenience. The system gave a reasonable performance in terms of high gesture detection rate and small false alarm rate. The participants reported that a new interface was easy to understand and operate. Encouraged by these results, we discuss advantages and constraints of the interface and suggest possibilities for design improvements.

General information
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Organisations: Augmented Human Activities (AHA)
Contributors: Gizatdinova, Y., Spakov, Ŏ., Surakka, V.
Number of pages: 7
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ASJC Scopus subject areas: Computer Vision and Pattern Recognition, Computer Science Applications
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Source: Scopus
Source ID: 84860699077
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

High-content screening data management for drug discovery in a small- to medium- size laboratory: Results of a collaborative pilot study focused on user expectations as indicators of effectiveness

High-content screening (HCS) technology provides a powerful vantage point to approach biological problems; it allows analysis of cell parameters, including changes in cell or protein movement, shape, or texture. As part of a collaborative pilot research project to improve bioscience research data integration, we identified HCS data management as an area ripe for advancement. A primary goal was to develop an integrated data management and analysis system suitable for small- to medium-size HCS programs that would improve research productivity and increase work satisfaction. A system was developed that uses Labmatrix, a Webbased research data management platform, to integrate and query data derived from a Cellomics STORE database. Focusing on user expectations, several barriers to HCS productivity were identified and reduced or eliminated. The impact of the project on HCS research productivity was tested through a series of 18 lab-requested integrated data queries, 7 of which were fully enabled, 7 partially enabled, and 4 enabled through data export to standalone data analysis tools. The results are limited to one laboratory, but this pilot suggests that through an "implementation research" approach, a network of small- to medium-size laboratories involved in HCS projects could achieve greater productivity and satisfaction in drug discovery research.

General information

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Organisations: Prostate cancer research center (PCRC), Wilmer Eye Institute, Fraunhofer Center for Experimental Software Engineering, BioFortis, Inc., University of Texas Health Science Center at Houston, Universite' Pierre et Marie Curie, Sorbonne, France, 13.12.2011, Johns Hopkins School of Medicine
Contributors: Berlinicke, C. A., Ackermann, C. F., Chen, S. H., Schulze, C., Shafranovich, Y., Myneni, S., Patel, V. L., Wang, J., Zack, D. J., Lindvall, M., Bova, G. S.
Number of pages: 11
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ASJC Scopus subject areas: Computer Science Applications, Medical Laboratory Technology
Keywords: Bioscience laboratory data management research, Drug discovery, High-content screening, Implementation research, Vision research
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Research output: Contribution to journal › Article › Scientific › peer-review

Multiobjective TDMA optimization for neuron-based molecular communication

This paper proposes and evaluates Neuronal TDMA, a TDMA-based signaling protocol framework for molecular communication, which utilizes neurons as a primary component to build in-body sensor-actuator networks (IBSANs). Neuronal TDMA leverages an evolutionary multiobjective optimization algorithm (EMOA) that optimizes the signaling schedule for nanomachines in IBSANs. The proposed EMOA uses a population of solution candidates, each of which represents a particular signaling schedule, and evolves them via several operators such as selection, crossover, mutation and offspring size adjustment. The evolution process is performed to seek Pareto-optimal signaling schedules subject to given constraints. Simulation results verify that the proposed EMOA efficiently obtains quality solutions. It outperforms several conventional EMOAs.

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Organisations: Wireless Communications and Positioning (WICO), University of Massachusetts Boston, Telecommunications Software and Systems Group (TSSG), Waterford Institute of Technology, Trinity College Dublin
Contributors: Suzuki, J., Balasubramaniam, S., Prina-Mello, A.
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ASJC Scopus subject areas: Computer Science Applications, Artificial Intelligence, Computer Networks and Communications
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Source: Scopus
Source ID: 84908577240
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

On the definition of dynamic software measures

The quantification of several software attributes (e.g., size, complexity, cohesion, coupling) is usually carried out in a static fashion, and several hundreds of measures have been defined to this end. However, static measurement may only be an approximation for the measurement of these attributes during software use. The paper proposes a theoretical framework based on Axiomatic Approaches for the definition of sensible dynamic software measures that can dynamically capture these attributes. Dynamic measures based on this framework are defined for dynamically quantifying size and coupling. In this paper, we also compare dynamic measures of size and coupling against well-known static measures by correlating them with fault-pronenesses of four case studies.

General information

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Organisations: Università degli Studi Dell'Insubria, Former organisation of the author
Contributors: Lavazza, L., Morasca, S., Taibi, D., Tosi, D.
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Source: Scopus
Source ID: 84867570388
Research output: Contribution to journal › Article › Scientific › peer-review

Systematic integration of flowgraph- and module-level parallelism in implementation of DSP applications on multiprocessor systems-on-chip

Increasing use of multiprocessor system-on-chip (MPSoC) technology is an important trend in the design and implementation of signal processing systems. However, the design of efficient DSP software for MPSoC platforms involves complex inter-related steps, including data decomposition, memory management, and inter-task and inter-thread synchronization. These design steps are challenging, especially under strict constraints on performance and power consumption, and tight time to market pressures. To facilitate these steps, we have developed a new dataflow based design flow within the targeted dataflow interchange format (TDIF) design tool. Our new MPSoC-oriented design flow, called TDIF-PPG, is geared towards analysis and mapping of embedded DSP applications on MPSoCs. An important feature of TDIF-PPG is its capability to integrate graph level parallelism for DSP system flowgraphs and actor level parallelism for DSP functional modules into the application mapping processing. Here, graph level parallelism is exposed by the dataflow graph application representation in TDIF, and actor level parallelism is modeled by a novel model for multiprocessor dataflow graph implementation that we call the parallel processing group (PPG) model. We demonstrate our approach through actor and subsystem design for software defined radio.

General information

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Organisations: Signal Processing Research Community (SPRC), University of Maryland, Department of Electrical and Computer Engineering
Contributors: Zhou, Z., Shen, C. C., Plishker, W., Wu, H. H., Bhattacharyya, S. S.
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Thermal effects on a passive wireless antenna sensor for strain and crack sensing
For application in structural health monitoring, a folded patch antenna has been previously designed as a wireless sensor that monitors strain and crack in metallic structures. Resonance frequency of the RFID patch antenna is closely related with its dimension. To measure stress concentration in a base structure, the sensor is bonded to the structure like a traditional strain gage. When the antenna sensor is under strain/deformation together with the base structure, the antenna resonance frequency varies accordingly. The strain-related resonance frequency variation is wirelessly interrogated and recorded by a reader, and can be used to derive strain/deformation. Material properties of the antenna components can have significant effects on sensor performance. This paper investigates thermal effects through both numerical simulation and temperature chamber testing. When temperature fluctuates, previous sensor design (with a glass microfiber-reinforced PTFE substrate) shows relatively large variation in resonance frequency. To improve sensor performance, a new ceramic-filled PTFE substrate material is chosen for re-designing the antenna sensor. Temperature chamber experiments are also conducted to the sensor with new substrate material, and compared with previous design.

General information
Publication status: Published
MoE publication type: A4 Article in a conference publication
Organisations: Sensing Systems for Wireless Medicine (MediSense), Georgia Institute of Technology, Georgia Institute of Technology, School of Electrical and Computer Engineering, Virginia Tech
Contributors: Yi, X., Vyas, R., Cho, C., Fang, C. H., Cooper, J., Wang, Y., Leon, R. T., Tentzeris, M. M.
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Source: Scopus
Source ID: 84861112128
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Wear and corrosion behaviour of HVOF coatings engineered from conventional WC-Co-Cr and conventional WC-Co-Cr added nanostructured Wc-Co powders
Tungsten carbide base coatings deposited by High Velocity Oxy-Fuel (HVOF) technique are the most common materials deposited in order to protect the components surface against wear and corrosion. The purpose of this study is to investigate the sliding and abrasion wear and also the corrosion behaviour of HVOF coatings engineered from conventional WC-10Co-4Cr and conventional WC-10Co-4Cr with addition of WC-15Co nanostructured powders. A 5%

addition of nanostructured WC-15Co powder was added to a conventional WC-10Co4Cr powder in order to improve the properties of the coating. The coatings have been characterized by SEM equipped with EDAX analyzer, XRD as well as the microhardness testing were performed. The wear behavior was evaluated by means of rubber wheel abrasion and ball-on-disk tests. The worn surfaces have been investigated by FESEM microscope and optical profilometer. The corrosion behavior of the coatings were tested with electrochemical open-cell potential measurements. The results showed that the nanostructured powder had a positive influence on sliding wear and corrosion behavior of the coating in comparison with the conventional coating.

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Organisations: Materials Science, Department of Materials Science, Engineering materials science and solutions (EMASS), Politehnica University of Timișoara
Contributors: Hulka, I., Șerban, V. A., Uțu, D., Koivuluoto, H., Vuoristo, P., Niemi, K.
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ASJC Scopus subject areas: Electrical and Electronic Engineering, Computer Science Applications, Materials Science(all)
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Source: Scopus
Source ID: 84923673812
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Wireless communications at the nanoscale
The importance of wireless communications is increasing thanks to the numerous types of services supported by wireless devices, which allow the realization of the always best connected vision. However, the dramatic boost toward miniaturization and nanoscale technologies requires rethinking of wireless communications on such a scale. While the transformation from wired to wireless communication has improved connectivity for end users and spawned new research areas, the field as a whole is approaching a crossroad. The main reason for this is the emergence of miniature devices, in particular devices that are built from nano components, which has led to new challenges for the wireless communication paradigm. Calcium signaling is a natural intercellular calcium wave found in biology cells that enables communication at short range between cells. Using this form of signaling can enable short-range communication that exploits a combination of biological constructs and engineered cells.

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Organisations: Wireless Communications and Positioning (WICO), Università degli Studi di Catania, Next-Generation Wireless Communications Laboratory (NWCL), Bio-Inspired Network Research Unit, TSSG, starMobile, Inc.
Contributors: Galluccio, L., Akan, O. B., Balasubramaniam, S., Sivakumar, R.
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Source: Scopus
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Wireless sensing and identification of passive electromagnetic sensors based on millimetre-wave FMCW RADAR
The wireless measurement of various physical quantities from the analysis of the RADAR Cross Sections variability of passive electromagnetic sensors is presented. A millimetre-wave Frequency-Modulated Continuous-Wave RADAR is used for both remote sensing and wireless identification of sensors. Long reading ranges (up to some decameters) may be reached at the expense of poor measurement resolution (typically 10%).

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Organisations: Sensing Systems for Wireless Medicine (MediSense), University of Toulouse, INP, LAAS-CNRS, IPDIA, Georgia Institute of Technology, CNRS UMR 5218, IPB
Contributors: Aubert, H., Chebila, F., Jatlaoui, M., Thai, T., Hallil, H., Traille, A., Bouaziz, S., Rifai, A., Pons, P., Menini, P., Tentzeris, M.
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
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http://www.scopus.com/inward/record.url?scp=84873122062&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84873122062
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Structural Measures for Network Biology Using QuACN
Background: Structural measures for networks have been extensively developed, but many of them have not yet demonstrated their sustainably. That means, it remains often unclear whether a particular measure is useful and feasible to solve a particular problem in network biology. Exemplarily, the classification of complex biological networks can be named, for which structural measures are used leading to a minimal classification error. Hence, there is a strong need to provide freely available software packages to calculate and demonstrate the appropriate usage of structural graph measures in network biology.Results: Here, we discuss topological network descriptors that are implemented in the R-package QuACN and demonstrate their behavior and characteristics by applying them to a set of example graphs. Moreover, we show a representative application to illustrate their capabilities for classifying biological networks. In particular, we infer gene regulatory networks from microarray data and classify them by methods provided by QuACN. Note that QuACN is the first freely available software written in R containing a large number of structural graph measures.Conclusion: The R package QuACN is under ongoing development and we add promising groups of topological network descriptors continuously. The package can be used to answer intriguing research questions in network biology, e.g., classifying biological data or identifying meaningful biological features, by analyzing the topology of biological networks.

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Organisations: Research Community on Data-to-Decision (D2D), Institute for Bioinformatics and Translational Research, Computational Biology and Machine Learning Lab., Faculty of Medicine, Health and Life Sciences, Queen's University, Belfast, Northern Ireland
Contributors: Mueller, L. A. J., Kugler, K. G., Graber, A., Emmert-Streib, F., Dehmer, M.
Publication date: 24 Dec 2011
Peer-reviewed: Yes

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ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computer Science Applications, Applied Mathematics, Structural Biology
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http://www.scopus.com/inward/record.url?scp=84155173344&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84155173344
Research output: Contribution to journal › Article › Scientific › peer-review

Distributed pervasive services using group service communication supporting body area networks

Body Area Network (BAN) provide critical data in healthcare monitoring environments, where such monitoring can be performed in a ubiquitous manner using various miniature device technologies. However, a key requirement in supporting the full capacity of a BAN is an efficient distribution, processing and application of the acquired data. The architecture and applications which capitalize on the huge potential of this data, provide significant added value to BANs. This paper proposes an architecture which is service oriented and integrates the data produced by BANs into a healthcare environment, supporting remote interactions between medical officers to maximise patient care. The dynamic interaction of distributed services in this diverse environment is a key ingredient in the way technology can enhance healthcare. The architecture defines group services which facilitate the control of the dynamic behaviour of services within this heterogeneous environment.

General information

Publication status: Published
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Organisations: Wireless Communications and Positioning (WICO), Waterford Institute of Technology, Telecommunications Software and Systems Group (TSSG), Technical University of Dortmund, Brigham and Women's Hospital
Contributors: Foley, C., Balasubramaniam, S., Botvich, D., Donnelly, W., Michaelis, S., Schmutzler, J., Stair, T.
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ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Artificial Intelligence
Keywords: Groups, Health-care, Monitoring, Policies, Services
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10.4108/ICST.BODYNETS2008.2960
URLs:
http://www.scopus.com/inward/record.url?scp=84912141219&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 84912141219
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Biological principles for future Internet architecture design

Currently, a large number of activities on Internet redesign are being discussed in the research community. While today's Internet was initially planned as a datagram-oriented communication network among research facilities, it has grown and evolved to accommodate unexpected diversity in services and applications. For the future Internet this trend is anticipated to continue even more. Such developments demand that the architecture of the new-generation Internet be designed in a dynamic, modular, and adaptive way. Features like these can often be observed in biological processes that serve as inspiration for designing new cooperative architectural concepts. Our contribution in this article is twofold. First, unlike previous discussions on biologically inspired network control mechanisms, we do not limit ourselves to a single method, but consider ecosystems and coexisting environments of entities that can cooperate based on biological principles. Second, we illustrate our grand view by not only taking inspiration from biology in the design process, but also sketching a possible way to implement biologically driven control in a future Internet architecture.

General information

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Organisations: Wireless Communications and Positioning (WICO), Waterford Institute of Technology, Osaka University, University of Cambridge
Contributors: Balasubramaniam, S., Leibnitz, K., Lio, P., Botvich, D., Murata, M.
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Original language: English
ASJC Scopus subject areas: Computer Science Applications, Computer Networks and Communications, Electrical and Electronic Engineering
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http://www.scopus.com/inward/record.url?scp=79960029644&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 79960029644
Research output: Contribution to journal › Article › Scientific › peer-review

Social interaction in games
Due to the popularity of social media networks and the games played on those platforms interest in the so-called social games has piqued. This article looks at those games in the context of general social aspects of game play. By approaching game play as an activity, it is possible to distinguish between different kinds of social interaction: the sociability players engage in around the game and the social play contained and mediated by the game. In charting the social space of playing, this article shows the inherent social aspects of singleplayer games - and the solitary aspects of social games.

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Organisations: Mathematical modelling with wide societal impact (MathImpact)
Contributors: Stenros, J., Paavilainen, J., Mäyrä, F.
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Research output: Contribution to journal › Article › Scientific › peer-review

BACOM: In silico detection of genomic deletion types and correction of normal cell contamination in copy number data

Motivation: Identification of somatic DNA copy number alterations (CNAs) and significant consensus events (SCEs) in cancer genomes is a main task in discovering potential cancer-driving genes such as oncogenes and tumor suppressors. The recent development of SNP array technology has facilitated studies on copy number changes at a genome-wide scale with high resolution. However, existing copy number analysis methods are oblivious to normal cell contamination and cannot distinguish between contributions of cancerous and normal cells to the measured copy number signals. This contamination could significantly confound downstream analysis of CNAs and affect the power to detect SCEs in clinical samples. Results: We report here a statistically principled in silico approach, Bayesian Analysis of COpy number Mixtures (BACOM), to accurately estimate genomic deletion type and normal tissue contamination, and accordingly recover the true copy number profile in cancer cells. We tested the proposed method on two simulated datasets, two prostate cancer datasets and The Cancer Genome Atlas high-grade ovarian dataset, and obtained very promising results supported by the ground truth and biological plausibility. Moreover, based on a large number of comparative simulation studies, the proposed method gives significantly improved power to detect SCEs after in silico correction of normal tissue contamination. We develop a cross-platform open-source Java application that implements the whole pipeline of copy number analysis of heterogeneous cancer tissues including relevant processing steps. We also provide an R interface, bacomR, for running BACOM within the R environment, making it straightforward to include in existing data pipelines.

General information

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Organisations: Prostate cancer research center (PCRC), Virginia Tech, Johns Hopkins School of Medicine, Wake Forest University School of Medicine
Contributors: Yu, G., Zhang, B., Bova, G. S., Xu, J., Shih, I. M., Wang, Y.
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ASJC Scopus subject areas: Biochemistry, Molecular Biology, Computational Theory and Mathematics, Computer Science Applications, Computational Mathematics, Statistics and Probability, Medicine(all)
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10.1093/bioinformatics/btr183
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Source: Scopus
Source ID: 79957859881

Research output: Contribution to journal › Article › Scientific › peer-review

Multithreaded simulation for synchronous dataflow graphs

For system simulation, Synchronous DataFlow (SDF) has been widely used as a core model of computation in design tools for digital communication and signal processing systems. The traditional approach for simulating SDF graphs is to compute and execute static schedules in single-processor desktop environments. Nowadays, however, multicore processors are increasingly popular desktop platforms for their potential performance improvements through thread-level parallelism. Without novel scheduling and simulation techniques that explicitly explore thread-level parallelism for executing SDF graphs, current design tools gain only minimal performance improvements on multicore platforms. In this article, we present a new multithreaded simulation scheduler, called MSS, to provide simulation runtime speedup for executing SDF graphs on multicore processors. MSS strategically integrates graph clustering, intracluster scheduling, actor vectorization, and intercluster buffering techniques to construct InterThread Communication (ITC) graphs at compile-time. MSS then applies efficient synchronization and dynamic scheduling techniques at runtime for executing ITC graphs in multithreaded environments. We have implemented MSS in the Advanced Design System (ADS) from Agilent Technologies. On an Intel dual-core, hyper-threading (4 processing units) processor, our results from this implementation demonstrate up to 3.5 times speedup in simulating modern wireless communication systems (e.g., WCDMA3G, CDMA 2000, WiMax, EDGE, and Digital TV).

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MoE publication type: A1 Journal article-refereed
Organisations: Signal Processing Research Community (SPRC), Agilent Technologies, Department of Electrical and Computer Engineering, University of Maryland
Contributors: Hsu, C. J., Pino, J. L., Bhattacharyya, S. S.
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Research output: Contribution to journal › Article › Scientific › peer-review

Forward simulation and inverse dipole localization with the lowest order Raviart - Thomas elements for electroencephalography
Electroencephalography is a non-invasive imaging modality in which a primary current density generated by the neural activity in the brain is to be reconstructed based on external electric potential measurements. This paper focuses on the finite element method (FEM) from both forward and inverse aspects. The goal is to establish a clear correspondence between the lowest order Raviart-Thomas basis functions and dipole sources as well as to show that the adopted FEM approach is computationally effective. Each basis function is associated with a dipole moment and a location. Four candidate locations are tested. Numerical experiments cover two different spherical multilayer head models, four mesh resolutions and two different forward simulation approaches, one based on FEM and another based on the boundary element method (BEM) with standard dipoles as sources. The forward simulation accuracy is examined through column- and matrix-wise relative errors as well as through performance in inverse dipole localization. A closed-form approximation of dipole potential was used as the reference forward simulation. The present approach is compared to the BEM and indirectly also to the recent FEM-based subtraction approach regarding both accuracy, computation time and accessibility of implementation.

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Organisations: Mathematical modelling with wide societal impact (MathImpact), Aalto University, Dipartimento di Matematica, Università di Genova, University of Warwick, University of Helsinki, CNR-SPIN
Contributors: Pursiainen, S., Sorrentino, A., Campi, C., Piana, M.
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Source ID: 79953662770
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Fault tolerant machine learning for nanoscale cognitive radio

We introduce a machine learning-based classifier that identifies free radio channels for cognitive radio. The architecture is designed for nanoscale implementation, under nanoscale implementation constraints; we do not describe all physical details but believe future physical implementation to be feasible. The system uses analog computation and consists of cyclostationary feature extraction and a radial basis function network for classification. We describe a model for nanoscale faults in the system, and simulate experimental performance and fault tolerance in recognizing WLAN signals, under different levels of noise and computational errors. The system performs well under expected non-ideal manufacturing and operating conditions.

General information

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Organisations: Research Community on Data-to-Decision (D2D), Aalto University, Nokia
Contributors: Pajarinen, J., Peltonen, J., Uusitalo, M. A.
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http://www.scopus.com/inward/record.url?scp=78650719880&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 78650719880
Research output: Contribution to journal › Article › Scientific › peer-review

A design tool for efficient mapping of multimedia applications onto heterogeneous platforms

Development of multimedia systems on heterogeneous platforms is a challenging task with existing design tools due to a lack of rigorous integration between high level abstract modeling, and low level synthesis and analysis. In this paper, we present a new dataflow-based design tool, called the targeted dataflow interchange format (TDIF), for design, analysis, and implementation of embedded software for multimedia systems. Our approach provides novel capabilities, based on the principles of task-level dataflow analysis, for exploring and optimizing interactions across application behavior; operational context; heterogeneous platforms, including high performance embedded processing architectures; and implementation constraints.

General information

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Organisations: Signal Processing Research Community (SPRC), University of Maryland, Department of Electrical and Computer Engineering
Contributors: Shen, C. C., Wu, H. H., Sane, N., Plishker, W., Bhattacharyya, S. S.
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http://www.scopus.com/inward/record.url?scp=80155156918&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 80155156918
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

A probability-based approach to modeling the risk of unauthorized propagation of information in on-line social networks

The unauthorized propagation of information is an important problem in the Internet, especially because of the increasing popularity of On-line Social Networks. To address this issue, many access control mechanisms have been proposed so far, but there is still a lack of techniques to evaluate the risk of unauthorized flow of information within social networks. This paper introduces a probability-based approach to modeling the likelihood that information propagates from one social network user to users who are not authorized to access it. The approach is demonstrated via an example, to show how it can be applied in practical cases.

General information

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Organisations: Università degli Studi Dell'Insubria
Contributors: Carminati, B., Ferrari, E., Morasca, S., Taibi, D.
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10.1145/1943513.1943522
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Source ID: 79952798687
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Bio-inspired service management framework: Green data-centres case study

Following the huge growth in usage over the last 10 years, the Internet has become a critical business and social tool. In the future however, this popularity will continue to rise, with the Internet evolving into a full scale distributed service platform, offering a plethora of services from communications to business, entertainment and much more. These services will be more dynamic and sophisticated providing a range of complex capabilities. However, this dynamic service environment will lead to overwhelming management problems if not dealt with adequately. At the same time, society is now acutely aware of the significant energy burden the communications industry is becoming. With these two trends in mind we propose a biologically-inspired service framework which supports services intelligently solving a number of management problems. We then as a case study application, use this framework to address the new, emerging problem of a sustainable future internet by migrating services to new, greener locations.

General information

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Organisations: Wireless Communications and Positioning (WICO), Waterford Institute of Technology
Contributors: Carroll, R., Balasubramaniam, S., Botvich, D., Donnelly, W.
Number of pages: 6
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ASJC Scopus subject areas: Computer Networks and Communications, Computer Science Applications
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http://www.scopus.com/inward/record.url?scp=79957554186&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source ID: 79957554186
Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Database-driven tool support for DisCo executable specifications

In spite of the advances in theory of formal specifications, they have not gained a wide popularity in the software development industry. This could be due to difficulties in understanding them or positioning them into the current work practices, however, we believe that one major problem is that the tool support still does not make the use of the formal specifications easy enough for the software developer. We discuss the required functionality for comprehensive tool support for executable DisCo specifications, and propose a tool architecture based on database technology, and finally, discuss our implementation of the core part of the tool set.

General information

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Organisations: Research Community on Data-to-Decision (D2D), Mathematical modelling with wide societal impact (MathImpact)
Contributors: Nummenmaa, J., Nummenmaa, T.
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ASJC Scopus subject areas: Computer Science Applications, Software
URLs:
http://www.scopus.com/inward/record.url?scp=84869824785&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Influence factors for sharing open science and open educational resources through social networking services

In a knowledge society it is crucial to serve the need for accurate and up-to-date knowledge produced by scientists. The possibilities of electronic communication through the use of social software provides means for open discourse and offers easier ways to make scientific and educational resources available that can be used in knowledge management and e-learning. Within this paper, we describe how researchers share knowledge in the form of artefacts. These artefacts consist of open science and open educational resources. The focus will be on understanding the influence factors for sharing these artefacts with social networking services. Through the research, an improved understanding of the decision making and sharing habits of a researcher will be obtained for the use of social software for globally distributed and open scientific communication.

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Organisations: Managing digital industrial transformation (mDIT), University of Jyväskylä
Contributors: Kalb, H., Pirkkalainen, H., Pawlowski, J., Schoop, E.
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ASJC Scopus subject areas: Computer Science Applications
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Source: Scopus
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

Multicolor nonlinear pulse compression by consecutive optical parametric amplification in quasi-phase matched structures

Simultaneous generation of the 2nd and 3rd harmonic, excited by linearly frequency-chirped fundamental pulse in quasiphase matched grating with linearly varying inverse domain sizes has been studied numerically with taking into account effects of the group velocity mismatches and dispersions. Mechanisms of efficient nonlinear pulse compressions and conversion efficiencies of the generated harmonics have been analyzed.

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Organisations: Frontier Photonics, Academy of Sciences of the Republic of Uzbekistan, Tashkent State Technical University, Nonlinear Optics and OptoElectronics Lab, University “Roma Tre”
Contributors: Sapaev, U. K., Yusupov, D. B., Assanto, G.
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Keywords: Cascading, Lithium niobate, Nonlinear pulse compression, Parametric effects, Quasi-phase matching, Simultaneous frequency doubling and tripling
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review

On delay distribution in IEEE 802.11 wireless networks

IEEE 802.11 wireless networks have received much attention over the past number of years. Still certain aspects of behavior of wireless networks have not been studied well enough. For example, understanding MAC layer packet delay distribution remains challenging yet. However, obtaining such distribution is highly beneficial for modeling QoS provided by wireless networks. This paper proposes a way of obtaining MAC delay distribution in case of single-hop networks. The proposed way is based on theory of terminating renewal processes and delivers approximation of good precision.

General information

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Organisations: Wireless Communications and Positioning (WICO), Waterford Institute of Technology, Telecommunications Software and Systems Group (TSSG)
Contributors: Ivanov, S., Botvich, D., Balasubramaniam, S.
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ASJC Scopus subject areas: Software, Signal Processing, Mathematics(all), Computer Science Applications, Computer Networks and Communications
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Research output: Chapter in Book/Report/Conference proceeding › Conference contribution › Scientific › peer-review