Analysis of common rail pressure signal of dual-fuel large industrial engine for identification of injection duration of pilot diesel injectors

In this paper, we address the problem of identification of injection duration of common rail (CR) diesel pilot injectors of dual-fuel engines. In these pilot injectors, the injected volume is small and the repeatability of injections and identification of drifts of injectors are important factors, which need to be taken into account in order to achieve good repeatability (shot-to-shot with every cylinder) and therefore a well-balanced engine and furthermore reduced overall wear. This information can then be used for calibration and diagnostics purposes to guarantee engine longevity facilitated by consistent operating conditions throughout the life of the unit. A diagnostics method based on analysis of CR pressure with experimental results is presented in this paper. Using the developed method, the relative duration of injection events can be identified for multiple injectors. We use the phenomenon of drop in rail pressure due to an injection event as a feature of the injection process. The method is based on filtered CR pressure data during and after the injection event. First, the pressure signal during injection is extracted after control of each injection event. After that, the signal is normalized and filtered. Then a derivative of the filtered signal is calculated. Change in the derivative of the filtered signal larger than a predefined threshold indicates an injection event that can be detected and its relative duration can be identified. We present the experimental results and demonstrate the efficacy of the proposed methods using two different types of pressure sensors. We are able to properly identify a change of ≥10 μs (2%, 500 μs) in injection time. This shows that the developed method detects drifts in injection duration and the magnitude of drift. This information can be used for adaptive control of injection duration, so that finally the injected fuel volume is the same as the original.

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Authors: Krogerus, T., Hyvönen, M., Huhtala, K.
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Scopus rating (2014): SJR 1.667 SNIP 2.331 CiteScore 4.14
Scopus rating (2013): SJR 1.811 SNIP 2.595 CiteScore 4.31
Scopus rating (2012): SJR 1.852 SNIP 2.465 CiteScore 3.99
Scopus rating (2011): SJR 2.093 SNIP 2.427 CiteScore 4.1
Scopus rating (2010): SJR 1.984 SNIP 2.319
Scopus rating (2009): SJR 2.012 SNIP 2.277
Scopus rating (2008): SJR 1.635 SNIP 2.184
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Scopus rating (2006): SJR 1.278 SNIP 1.64
Scopus rating (2005): SJR 1.623 SNIP 1.73
Scopus rating (2004): SJR 1.273 SNIP 1.883
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ASJC Scopus subject areas: Mechanical Engineering, Signal Processing, Modelling and Simulation, Applied Mathematics
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10.1016/j.fuel.2017.11.152
Links:
Research output: Scientific › peer-review › Article
**MergeTree: A Fast Hardware HLBVH Constructor for Animated Ray Tracing**

Ray tracing is a computationally intensive rendering technique traditionally used in offline high-quality rendering. Powerful hardware accelerators have been recently developed that put real-time ray tracing even in the reach of mobile devices. However, rendering animated scenes remains difficult, as updating the acceleration trees for each frame is a memory-intensive process. This article proposes MergeTree, the first hardware architecture for Hierarchical Linear Bounding Volume Hierarchy (HLBVH) construction, designed to minimize memory traffic. For evaluation, the hardware constructor is synthesized on a 28nm process technology. Compared to a state-of-the-art binned surface area heuristic sweep (SAH) builder, the present work speeds up construction by a factor of 5, reduces build energy by a factor of 3.2, and memory traffic by a factor of 3. A software HLBVH builder on a graphics processing unit (GPU) requires 3.3 times more memory traffic. To take tree quality into account, a rendering accelerator is modeled alongside the builder. Given the use of a toplevel build to improve tree quality, the proposed builder reduces system energy per frame by an average 41% with primary rays and 13% with diffuse rays. In large (> 500K triangles) scenes, the difference is more pronounced, 62% and 35%, respectively.

**General information**

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Organisations: Pervasive Computing, Research area: Computer engineering, Research Development Services  
Authors: Viitanen, T., Koskela, M., Jääskeläinen, P., Kultala, H., Takala, J.  
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Scopus rating (2016): CiteScore 5.69 SJR 2.45 SNIP 2.496  
Scopus rating (2015): SJR 2.171 SNIP 3.744 CiteScore 6.24  
Scopus rating (2014): SJR 2.098 SNIP 3.813 CiteScore 6  
Scopus rating (2013): SJR 2.381 SNIP 3.624 CiteScore 6.18  
Scopus rating (2012): SJR 1.683 SNIP 4.089 CiteScore 4.77  
Scopus rating (2011): SJR 1.857 SNIP 3.88 CiteScore 5.81  
Scopus rating (2010): SJR 1.767 SNIP 4.03  
Scopus rating (2009): SJR 1.294 SNIP 3.477  
Scopus rating (2008): SJR 1.44 SNIP 3.427  
Scopus rating (2007): SJR 2.16 SNIP 4.247  
Scopus rating (2006): SJR 1.526 SNIP 4.444  
Scopus rating (2005): SJR 1.141 SNIP 4.096  
Scopus rating (2004): SJR 0.588 SNIP 3.226  
Scopus rating (2003): SJR 0.833 SNIP 2.504  
Scopus rating (2002): SJR 1.835 SNIP 2.213  
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Scopus rating (2000): SJR 1.838 SNIP 2.458  
Scopus rating (1999): SJR 1.517 SNIP 3.939  
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http://urn.fi/URN:NBN:fi.tty-201710122006  
Research output: Scientific - peer-review › Article

**Concurrent Execution System for Action Languages**

Traditional methods of managing concurrent processes are difficult and prone to errors. We propose that actions can provide a much simpler approach to the problem. In this paper, we use Temporal Logic of Actions to define an execution system that can be used to concurrently execute programs created with action languages. Important features of the
Ecosystem Approach on Medical Game Development: The Relevant Actors, Value Propositions and Innovation barriers

This paper explores the medical game ecosystem and reveals the reciprocal value propositions of the relevant actors of medical game ecosystems, as well as barriers that may be complicating or hindering realization of the value propositions. The case comprises an emerging medical game ecosystem in Finland in the traumatic brain injury (TBI) rehabilitation context. This study presents 12 actor groups, their value propositions, and the barriers between the actors. This paper gives a comprehensive view of the actual medical game ecosystem that is needed to utilize the full potential of gamification and serious games in the health care sector.

Ethics as a skill of software engineer?

One problem of the increasing intelligence of the systems is that the number of decisions having an ethical component is increasing, too. Traditionally, the designers of the system seldom made ethical decisions; the ethics was left for the user. However, when the system itself makes decisions, the ethical consequences have to be solved when the system is made. Since these decisions are mostly implemented by software, it is often the programmers that have to make these decisions. Another problem is, if a programmer is asked to make illegal or unethical software. The well-known example of emission faking by car manufactures is an example of such software, but this seems to be far more common than this.

We have several ethic codes as the ethical guidelines for engineering. They give full ethical responsibility to engineers on the design and implementation of systems. The specific problem with software is that the programmers do not necessarily realise the ethical nature of the system; either they do not understand the application area enough to see it, or they do not know the full context of the piece of software they are implementing. The conclusion discusses how to embed the awareness of ethical questions in software engineering education.
Problems of enterprise architecture adoption in the public sector: root causes and some solutions

Enterprise architecture (EA) is a comprehensive approach aimed at understanding and aligning an organization’s business strategy and processes, information resources, and information technologies. However, implementing this approach in an organization is not an easy task as organizations have their preexisting siloes and fragmented procedures and departments. Comprehensive, inter-organizational practices, such as EA, usually break old procedures and habits, shift decision-making power, and challenge old values. This makes EA endeavors extremely difficult. In this paper, we conduct a qualitative multiple-case study. We use institutional theory to identify problems and their root causes in EA adoption in three cases. We also discuss possible solutions—by identifying eight root causes and several examples, both successful and not-so-successful—to mitigate or overcome these problems. We also argue that institutional theory and its three pillars provide a usable lens to analyze EA adoption.
Fast Hardware Construction and Refitting of Quantized Bounding Volume Hierarchies

There is recent interest in GPU architectures designed to accelerate ray tracing, especially on mobile systems with limited memory bandwidth. A promising recent approach is to store and traverse Bounding Volume Hierarchies (BVHs), used to accelerate ray tracing, in low arithmetic precision. However, so far there is no research on refitting or construction of such compressed BVHs, which is necessary for any scenes with dynamic content. We find that in a hardware-accelerated tree update, significant memory traffic and runtime savings are available from streaming, bottom-up compression. Novel algorithmic techniques of modulo encoding and treelet-based compression are proposed to reduce backtracking inherent in bottom-up compression. Together, these techniques reduce backtracking to a small fraction. Compared to a separate top-down compression pass, streaming bottom-up compression with the proposed optimizations saves on average 42% of memory accesses for LBVH construction and 56% for refitting of compressed BVHs, over 16 test scenes. In architectural simulation, the proposed streaming compression reduces LBVH runtime by 20% compared to a single-precision build, and 41% compared to a single-precision build followed by top-down compression. Since memory traffic dominates the energy cost of refitting and LBVH construction, energy consumption is expected to fall by a similar fraction.

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Scopus rating (2013): SJR 1.074 SNIP 1.869 CiteScore 2.68
Scopus rating (2012): SJR 0.771 SNIP 2.043 CiteScore 2.28
Scopus rating (2011): SJR 0.879 SNIP 1.691 CiteScore 2.2
Scopus rating (2010): SJR 0.814 SNIP 1.792
Scopus rating (2009): SJR 0.685 SNIP 1.81
Scopus rating (2008): SJR 0.688 SNIP 2.348
Scopus rating (2007): SJR 0.768 SNIP 1.753
Scopus rating (2006): SJR 0.664 SNIP 2.331
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Scopus rating (2004): SJR 0.376 SNIP 2.004
Scopus rating (2003): SJR 0.48 SNIP 1.633
Scopus rating (2002): SJR 1.187 SNIP 1.038
A bibliometric study on authorship trends and research themes in knowledge management literature

General information
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Organisations: Industrial and Information Management, Research group: Business Data Research Group, Research group: Business Ecosystems, Networks and Innovations, Research group: Knowledge and Learning Research Center, University of Exeter, Lappeenranta University of Technology
Authors: Jussila, J. J., Mustafee, N., Aramo-Immonen, H., Menon, K., Hajikhani, A., Helander, N.
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Research output: Scientific - peer-review › Conference contribution

Learning of a tracker model from multi-radar data for performance prediction of air surveillance system

A valid model of the air surveillance system performance is highly valued when making decisions related to the optimal control of the system. We formulate a model for a multi-radar tracker system by combining a radar performance model with a tracker performance model. A tracker as a complex software system is hard to model mathematically and physically. Our novel approach is to utilize machine learning to create a tracker model based on measurement data from which the input and target output for the model are calculated. The measured data comprises the time series of 3D coordinates of cooperative aircraft flights, the corresponding target detection recordings from multiple radars, and the related multi-radar track recordings. The collected data is used to calculate performance measures for the radars and the tracker at specific locations in the air space. We apply genetic programming to learning such rules from radar performance measures that explain tracker performance. The easily interpretable rules are intended to reveal the real behavior of the system providing comprehension for its control and further development. The learned rules allow predicting tracker performance level for the system control in all radar geometries, modes, and conditions at any location. In the experiments, we show the feasibility of our approach to learning a tracker model and compare our rule learner with two tree classifiers, another rule learner, a neural network, and an instance-based classifier using the real air surveillance data. The tracker model created by our rule learner outperforms the models by the other methods except for the neural network whose prediction performance is equal.

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Authors: Ruotsalainen, M., Jylhä, J.
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Pages: 2128-2136
Publication date: Jun 2017
Foundational eHealth Curricula for the health care workforce
The European Union supported project EU*US eHealth work aims at developing the eHealth skills and competencies of the people working in health care. A part of this work is to develop curricula describing what the personnel should learn about the various aspects of eHealth.

Explaining the challenges in ERP development networks with triggers, root causes, and consequences

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Scopus rating (2013): SJR 0.511 SNIP 1.041 CiteScore 1.74
Scopus rating (2012): SJR 0.442 SNIP 0.712 CiteScore 1.2
Scopus rating (2011): SJR 0.486 SNIP 1.028 CiteScore 1.13
Scopus rating (2010): SJR 0.239 SNIP 0.401
Scopus rating (2009): SJR 0.122 SNIP 0
Visualizing the Geography of Platform Boundary Resources: The Case of the Global API Ecosystem

Platform boundary resources play an increasingly transformative role in the global digital ecosystem. In this study, we focus on one type of platform boundary resource, namely application programming interfaces (APIs). Guided by two competing assumptions—1) that geographic boundaries are blurred and potentially less important in a digitally connected world, and 2) that geographic proximity matters for co-innovation—we investigate the global footprint of APIs. Using a data-driven visual network analysis approach to examine more than 15,000 APIs and mashups, we first map the global locations of where APIs are being created. We then examine how API mashups connect these locations globally and regionally. Our results show that while APIs are globally distributed, they are mainly concentrated in major entrepreneurial regions. We also find that there is a skewed distribution, with the U.S. and Silicon Valley in particular leading the way. We conclude with both theoretical and managerial implications.

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Organisations: Industrial and Information Management, Research group: MAT Intelligent Information Systems Laboratory, Research group: Business Data Research Group, Research group: Business Ecosystems, Networks and Innovations
Authors: Huhtamäki, J., Basole, R. C., Still, K., Russell, M. G., Seppänen, M.
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   Links:

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Research output: Scientific · peer-review · Conference contribution

Analysing the role of crowdfunding in entrepreneurial ecosystems: A social media event study of two competing product launches

The aim of the explorative study is to understand the role of crowdfunding in the facilitation of customer engagement for entrepreneurial ecosystems, using data from two recent events of competing product launches. We conducted an event study that employed content analysis and emotion analysis, as well as social set analysis (SSA) of Facebook data to uncover and better understand crowdfunder (investor and customer) engagement and interactions before, during and after a crowdfunding campaign event. Our paper focuses especially on the role of Jollas tablet crowdfunding campaign in the development of its fanbase in relation with Nokias tablet launch during Slush 2014 event. On the basis of the above analyses and related literature, we present propositions about various types of engagement with the potential to facilitate the evolution of entrepreneurial ecosystems. We discuss the results, and evaluate the implications of crowdfunding on customer engagement for entrepreneurial ecosystems, and conclude with directions for future work. One of the key contributions of the study is the introduction of a new data source and approach for co-creative interaction between companies and their customers, as well as an approach to support the study of ecosystems from a customer perspective.

Karan Menon, Hannu Kärkkäinen, Jari Jussila, Jukka Huhtamäki, Raghava Rao Mukkamala, Lester Allan Lasrado, Ravi Vatrapu, Abid Hussain

General information
State: Accepted/In press
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Industrial and Information Management, Research group: Business Data Research Group
Application for pre-processing and visualization of electrodermal activity wearable data

Using sensors to gather physiological data about users can provide valuable insights that are not available merely using traditional measures. Electrodermal activity (EDA) can act as an indicator for both physiological and psychological arousal. Measuring arousal has several application areas. For instance, prolonged and often recurring high arousal levels can indicate that a person is suffering from chronic stress. At the other extreme, for example, in elderly care constant low arousal levels can signal that the senior citizens are not getting enough activity and attention from the care personnel. In the context of events, measurement of arousal can indicate when the persons get excited and when they are more calm. This study presents a pilot study of EDA measurements conducted during a trade fair. Providing timely and meaningful information for a group of people being measured, however, requires pre-processing the data and creating visualizations that enable both individual and collective level sense-making of the results. The aim of this study was to develop a process and an open source application that can automatically pre-process large amounts of data from wearable sources, and create visualizations, to be used in events for immediate sense-making.

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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Industrial and Information Management, Research group: Business Data Research Group, Research group: Knowledge and Learning Research Center, Moodmetric
Authors: Suoja, K., Liukkonen, J., Jussila, J., Salonius, H., Venho, N., Sillanpää, V., Vuori, V., Helander, N.
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Forecasting sales in industrial services: modeling business potential with installed base information

Purpose – The purpose of this paper is to examine how installed base information could help servitizing original equipment manufacturers (OEMs) forecast and support their industrial service sales, and thus increase OEMs’ understanding regarding the dynamics of their customers’ lifetime values (CLVs). Design/methodology/approach – This work constitutes a constructive research aiming to arrive at a practically relevant, yet scientific model. It involves a case study that employs statistical methods to analyze real-life quantitative data about sales and the global installed base. Findings – The study introduces a forecasting model for industrial service sales, which considers the characteristics of the installed base and predicts the number of active customers and their yearly volume. The forecasting model performs well compared to other approaches (Croston's method) suitable for similar data. However, reliable results require comprehensive, up-to-date information about the installed base. Research limitations/implications – The study contributes to the servitization literature by introducing a new method for utilizing installed base information and, thus, a novel approach for improving business profitability. Practical implications – OEMs can use the forecasting model to predict the demand for - and measure the performance of - their industrial services. To-the-point predictions can help OEMs organize field services and service production effectively and identify potential customers, thus managing their CLV accordingly. At the same time, the findings imply new requirements for managing the installed base information among the OEMs, to understand and realize the industrial service business potential. However, the results have their limitations concerning the design and use of the statistical model in comparison with alternative approaches. Originality/value – The study presents a unique method for employing installed base information to manage the CLV and supplement the servitization literature.

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Authors: Stormi, K., Laine, T., Suomalainen, P., Elomaa, T.
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Forecasting stock prices from limit order book using convolutional neural networks

In today's financial markets, where most trades are performed in their entirety by electronic means and the largest fraction of them is completely automated, an opportunity has risen from analyzing this vast amount of transactions. Since all the transactions are recorded in great detail, investors can analyze all the generated data and detect repeated patterns of the price movements. Being able to detect them in advance, allows them to take profitable positions or avoid anomalous events in the financial markets. In this work we proposed a deep learning methodology, based on Convolutional Neural Networks (CNNs), that predicts the price movements of stocks, using as input large-scale, high-frequency time-series derived from the order book of financial exchanges. The dataset that we use contains more than 4 million limit order events and our comparison with other methods, like Multilayer Neural Networks and Support Vector Machines, shows that CNNs are better suited for this kind of task.
Master data management and its organizational implementation: an ethnographical study within the public sector

Purpose: Master data management (MDM) aims to improve the value of an organization's most important data, such as customer data, by bridging the silos between organizational units and information systems. However, incorporating data management practices into an organization is not a simple task. The purpose of this paper is to provide a new understanding of the challenges in establishing and developing the MDM function within an organization.

Design/methodology/approach: This paper reports an ethnographic study within a municipality. The data were collected from two consecutive MDM development projects over the time period of 32 months by observing MDM-related activities and interviewing appropriate actors. Observations, interviews, and impressions were documented to a diary that was later qualitatively analyzed. Various project documentation were also used. Findings: In total 15 challenges were identified. Seven of these were not identified earlier in the literature. New challenges included legislation-driven challenges, mutual understanding of master data domains, and the level of granularity for those domains. Eight issues, such as data owner and data definitions, were MDM specific, others being more generic. All of the issues were identified as preconditions or as affecting factors for the others. Three of the issues were identified as pivotal. The issues emphasize strong alignment between the complex concept of MDM and the organization adopting it. Research limitations/implications: This research was based on a single qualitative case study, and caution should be exercised with regard to generalizations. The findings increase understanding about the complex organizational phenomena. The study offers public sector and private sector practitioners insights of the organizational issues that establishing a MDM function can encounter. Originality/value: The issues discovered in the research shed light on the strong alignment between the complex concept of MDM and the organization. The results of this study assist researchers in their endeavor to understand the organizational aspects of MDM, and to build theoretical models, frameworks, practices, and explanations.

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Authors: Vilminko-Heikkinen, R., Pekkola, S.
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Scopus rating (2014): SJR 0.417 SNIP 0.893 CiteScore 1.4
Scopus rating (2013): SJR 0.405 SNIP 1.163 CiteScore 1.68
Scopus rating (2012): SJR 0.472 SNIP 1.086 CiteScore 1.54
Scopus rating (2011): SJR 0.458 SNIP 1.108 CiteScore 1.53
Scopus rating (2010): SJR 0.457 SNIP 1.02
Scopus rating (2009): SJR 0.407 SNIP 0.808
Scopus rating (2008): SJR 0.533 SNIP 0.997
Scopus rating (2007): SJR 0.411 SNIP 0.613
Scopus rating (2006): SJR 0.216 SNIP 0.201
Scopus rating (2005): SJR 0.142 SNIP 0.128
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MULTI-POS: Lessons Learnt from Fellows and Supervisors
The path to a successful and cooperative network is not always smooth. Marie Curie networks are, by definition, networks of people with various technical and cultural backgrounds and with different personalities, individual work and life targets, and personal ways of solving the challenges that each has to cope with. The larger a network is, the more likely it is that some conflicts or personality mismatches appear, but this is not necessarily a bad thing, and it can be used as a learning
and growth lesson. This chapter addresses the various challenges that were encountered during the MULTI-POS implementation and it summarizes the lessons learnt by both the fellows and the supervisors. The goal of this chapter is to offer some generic guidelines in forming and running large international networks, such as the Marie Curie training networks, and to enable the people interested in such collaborations to pro-actively identify and tackle some of the inherent challenges in such networks.

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Organisations: Department of Electronics and Communications Engineering, Research group: Wireless Communications and Positioning, Research group: System-on-Chip for GNSS, Wireless Communications and Cyber-Physical Embedded Computing, Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Chalmers University of Technology
Authors: Lohan, E., Nurmi, J., Seco-Granados, G., Wymeersch, H., Nykänen, O.
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ASJC Scopus subject areas: Electrical and Electronic Engineering
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Research output: Scientific - peer-review » Chapter

**Nursing students’ experiential learning processes using an online 3D simulation game**
The growing use of game-based simulation in healthcare education reflects the opportunities afforded to learners by serious games, which simulate real-world situations and enable students to emulate the roles of healthcare professionals in a safe and engaging learning environment. As part of a design-based research project to design, test, and evaluate an online 3D simulation game for use in game-based simulation in healthcare education, the present study applied Kolb’s experiential learning theory to investigate nursing students’ experiential learning processes during a 3D simulation game. The data, collected from eight nursing students, comprised audio and video recordings from gaming sessions and focus group interviews. The results indicate that in 3D simulation game, patient-related experiences were supported by audiovisual authenticity, the authenticity of scenarios, and interactivity. Feedback triggered students to reflect on their own learning processes. Students conceptualised knowledge by applying nursing theory, and they internalised procedures that can be used in real life. They also had an opportunity to experiment by exploring and making decisions in the gaming environment. One of the main issues arising from these findings is that 3D simulation games used in game-based simulation should share familiar characteristics of leisure games to ensure an engaging learning experience.

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Scopus rating (2015): SJR 0.457 SNIP 0.791 CiteScore 0.97
Scopus rating (2014): SJR 0.358 SNIP 0.66 CiteScore 0.85
Scopus rating (2013): SJR 0.403 SNIP 0.617 CiteScore 0.57
Scopus rating (2012): SJR 0.216 SNIP 0.612 CiteScore 0.5
Scopus rating (2011): SJR 0.438 SNIP 0.803 CiteScore 0.59
Pyramid Encoding for Fast Additive Quantization

The problem of approximate nearest neighbor (ANN) search in Big Data has been tackled with a variety of recent methods. Vector quantization based solutions have been maintaining the dominant position, as they operate in the original data space, better preserving inter-point distances. Additive quantization (AQ) in particular has pushed the state-of-the-art in search accuracy, but high computational costs of encoding discourage the practical application of the method. This paper proposes pyramid encoding, a novel technique, which can replace the original beam search to provide a significant complexity reduction at the cost of a slight decrease in retrieval performance. AQ with pyramid encoding is experimentally shown to obtain results comparable with the baseline method in accuracy, while offering significant computational benefits.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Signal Processing, Department of Engineering, Aarhus University
Authors: Muravev, A., Ozan, E., Iosifidis, A., Gabbouj, M.
Number of pages: 4
Pages: 2575-2579
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Publisher: IEEE
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ASJC Scopus subject areas: Computer Science(all)
Keywords: compact encoding, image retrieval, Vector Quantization, nearest neighbor search
DOIs: 10.23919/EUSIPCO.2017.8081662

Bibliographical note
jufoid=55867
Research output: Scientific - peer-review › Conference contribution

Robust Direction Estimation with Convolutional Neural Networks-based Steered Response Power

The steered response power (SRP) methods can be used to build a map of sound direction likelihood. In the presence of interference and reverberation, the map will exhibit multiple peaks with heights related to the corresponding sound's spectral content. Often in realistic use cases, the target of interest (such as speech) can exhibit a lower peak compared to an interference source. This will corrupt any direction dependent method, such as beamforming.

Regression has been used to predict time-frequency (TF) regions corrupted by reverberation, and static broadband noise can be efficiently estimated for TF points. TF regions dominated by noise or reverberation can then be de-emphasized to obtain more reliable source direction estimates. In this work, we propose the use of convolutional neural networks (CNNs) for the prediction of a TF mask for emphasizing the direct path speech signal in time-varying interference. SRP with phase transform (SRP-PHAT) combined with the CNN-based masking is shown to be capable of reducing the impact of time-varying interference for speaker direction estimation using real speech sources in reverberation.
General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Signal Processing, Research group: Audio research group - ARG
Authors: Pertilä, P., Cakir, E.
Pages: 6125-6129
Publication date: 2017

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Publisher: IEEE
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Research output: Scientific - peer-review › Conference contribution

Strengthening social ties via ICT in the organization
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Industrial and Information Management
Authors: Torro, O., Pirkkalainen, H.
Number of pages: 10
Pages: 5511-5520
Publication date: 2017

Host publication information
Keywords: social ties, ICT-mediated interaction, information and communications technology
Links:
https://scholarspace.manoa.hawaii.edu/bitstream/10125/41828/1/paper0679.pdf
http://shidler.hawaii.edu/events/2017/01/04/hawaii-international-conference-on-system-sciences-50th-anniversary
Research output: Scientific - peer-review › Conference contribution

Systematic literature review on enterprise architecture in the public sector
Enterprise architecture (EA) is an approach to improve the alignment between the organization’s business and their information technologies. It attempts to capture the status of the organizations’ business architecture, information resources, information systems, and technologies so that the gaps and weaknesses in their processes and infrastructures can be identified, and development directions planned. For this reason, EA has become a popular approach also in the public sector to increase their efficiency and ICT utilization. Yet researchers have largely ignored this context, and it seems that quite little is known about how EA is developed, implemented, or adapted in different countries and in the public sector. We thus conducted a systematic literature review to identify the major research topics and methods in studies focusing on public sector EA. We analyzed 71 identified articles from the past 15 years. Our analysis shows that the development viewpoint, case studies in developed countries, and local settings seem to form mainstream EA research in the public sector. Taken together, it seems that public sector EA is scattered, and there is no strong, single research stream. Instead the researchers conduct local case studies. This means the knowledge on EA development, implementation or adaptation, their challenges and best practices does not accumulate. There is consequently a need for more research in general, and targeted research in some specific segments.

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Organisations: Industrial and Information Management
Authors: Dang, D. D., Pekkola, S.
Pages: 57-154
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: ELECTRONIC JOURNAL OF E-GOVERNMENT
Volume: 15
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.
Training Radial Basis Function Neural Networks for Classification via Class-specific Clustering

In training radial basis function neural networks (RBFNNs), the locations of Gaussian neurons are commonly determined by clustering. Training inputs can be clustered on a fully unsupervised manner (input clustering), or some supervision can be introduced, for example, by concatenating the input vectors with weighted output vectors (input-output clustering). In this paper, we propose to apply clustering separately for each class (class-specific clustering). The idea has been used in some previous works, but without evaluating the benefits of the approach. We compare the class-specific, input, and input-output clustering approaches in terms of classification performance and computational efficiency when training RBFNNs. To accomplish this objective, we apply three different clustering algorithms and conduct experiments on 25 benchmark data sets. We show that the class-specific approach significantly reduces the overall complexity of the clustering, and our experimental results demonstrate that it can also lead to a significant gain in the classification performance, especially for the networks with a relatively few Gaussian neurons. Among other applied clustering algorithms, we combine, for the first time, a dynamic evolutionary optimization method, multidimensional particle swarm optimization, and the class-specific clustering to optimize the number of cluster centroids and their locations.
Project types and industrial collaboration in project-based learning

Project-based learning is important in engineering education as it makes the students test their skills in a real-life setting. We have organised project-based learning for software engineering students since 1991. Already in the early times, the projects were based on collaboration with near-by companies and other customers. This collaboration with external organisations, called customers in this paper, creates strong links between education and surrounding society.

In this paper, we report the experiences from our project courses. Especially we describe 1) how the courses have helped collaboration between students, teachers and companies, 2) the different categories for topics and goals of the projects. Based on the analysis, we outline a new project type, a technology exploration project.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Systä, K., Vuori, M., Järvinen, H., Ahtee, T., Sten, H.
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ASJC Scopus subject areas: Computer Science(all)
Keywords: project courses, engineering education, innovation, university-industry collaboration
Electronic versions:
systa-project-types-and-industrial-collaboration
Links:
http://urn.fi/URN:NBN:fi:tty-201709201899
Research output: Scientific - peer-review › Conference contribution

The nexus between social media behaviour, negative consumer emotions and brand disloyalty
Perceived risks in social media use – a longitudinal study among university students.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Pori Department, Research group: Business Ecosystems, Networks and Innovations, Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT)
Authors: Aramo-Immonen, H., Jussila, J. J., Ilvonen, I., Helander, N.
Number of pages: 4
Pages: 777-780
Publication date: 2 Nov 2016
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Publisher: ACM
Editor: Jose Garcia-Penalvo, F.
ISBN (Electronic): 978-1-4503-4747-1
Keywords: social media, social media risks, knowledge management, E-Learning
DOI:
10.1145/3012430.3012606
Links:
https://2016.teemconference.eu/
Publisher: ACM
Identifying weak ties from publicly available social media data in an event
The concept of weak ties was introduced by Granovetter through the seminal paper titled "Strength of weak ties". Since then the role of weak ties in general and their specific role as occupying the structural hole has been explored in many different fields. In this study, we identify actual or potential weak ties using publicly available social media data in the context of an event. Our case study environment is community managers' online discussions in social media in connection to the yearly-organized Community Manager Appreciation Day (CMAD 2016) event in Finland. We were able to identify potential weak ties using the conversation based structural holes, making use of social network analysis methods (like clustering) and content analysis in the context of events. We add to the understanding of and useful data sources for the Strength of weak ties theory originated from Granovetter, and developed further by other researchers. Our approach may be used in future to make more sophisticated conference recommendation systems, and significantly automate the data extraction for making useful contact recommendations from them for conference participants.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Information Management and Logistics, Research group: Novi, Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Managing digital industrial transformation (mDIT)
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Publication date: 17 Oct 2016

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Title of host publication: AcademicMindtrek '16 Proceedings of the 20th International Academic Mindtrek Conference
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Keywords: weak ties, social media
ASJC Scopus subject areas: Computational Theory and Mathematics, Sociology and Political Science
DOIs: 10.1145/2994310.2994354
Links: http://www.mindtrek.org/2016/
Research output: Scientific - peer-review Conference contribution

The 5C categorization of social media tools
Social media can offer potential business benefits in the company context. However, successful social media initiative calls for careful strategic planning and approaching social media tools as enablers for reaching a purpose. A categorization of social media tools is called for to help the strategic choices and evaluation between the tools. To date, no coherent classification exists, and those suggested approach social media tools from a substantival perspective of what a tool is. From strategic planning viewpoint it is more practical to take the functional perspective of what a tool does. In this paper, we present a framework for categorizing social media tools by the actions they enable. The 5C categorization is based on the actions enabled by the social media tools: communicating, collaborating, connecting, completing, and combining. In order to demonstrate how the 5C categorization can be used as a framework to assess social media tools we conducted an empirical study of social media based crowdsourcing platforms in business-to-business setting. The 5C categorization can be utilized in planning a social media strategy as it forwards the understanding of which tools are suitable for certain purpose and provides a scheme to evaluate and compare different social media tools and applications.

General information
State: Published
Low-energy algorithm for self-controlled wireless sensor nodes

In Internet of Things (IoT), the lifespan of Wireless Sensor Networks (WSN) has often become an issue. Sensor nodes are typically battery powered. However, high energy consumption by Radio Frequency (RF) module limits the lifespan of sensor nodes. In conventional WSN, the frequency of data transmission is normally fixed or adjusted according to requests from the gateway. In this paper, we present a WSN system for intelligent sensing. We propose a low-energy algorithm for sensor data transmission from sensor nodes for such system. In this algorithm, the sensor nodes are able to self-control their data transmission according to the trends of data. We adopt Adaptive Duty Cycle for adjustment of data transmission frequency and Compressive Sensing (CS) for sensor data compression. The simulation results show that Collective Transmission with CS-based data compression achieves 83.34% of RF energy reduction for the best-case transmission and 83.31% of RF energy reduction in the worst-case transmission, compared to the Continuous Transmission.
Developing a conceptual model for the relationship between social media behavior, negative consumer emotions and brand disloyalty

Companies have been facing the dark side of social media. Particularly, the odds of customer complaints and brand insults have increased tremendously. Social media has given a voice to disappointed consumers. They use the voice when they feel negative emotions, for example, due to product failures, service problems or unethical behavior. It seems reasonable to expect that the more ubiquitous social media becomes, the more it persuades people to share also their negative experiences. However, although social media raises new challenges for companies, it also gives them new opportunities. Social media enables companies to trace disappointed customers, evaluate their impressiveness and communicate with them. The conceptual paper aims to develop a model for the relationship between social media behavior, negative consumer emotions and brand disloyalty. The argument of this paper is that although social media gives consumers more power which is manifested in sharing negative emotions related to the company, the effect this has on brand disloyalty depends on the company’s behavior.
Industrial impact on topics and types of Master's theses: Empirical study of software engineering theses made in 1990-2016

One of the ways universities and industry co-operate is making the master's theses on the topics of industrial partners. In this paper 578 theses on software engineering from 1990 until 2016 are evaluated to see how the needs of the industry on information technology in Finland have affected the topics, type, language and orientation of the theses. Also the size of the company and the gender of students were recorded as well. All the theses have been supervised by either of the authors and they represent about 30 percent of theses on software engineering at Tampere University of Technology.

Our strongest hypothesis was that during 2000-2005 golden era of Nokia would affect greatly on the numbers so that the major part of the theses were made for a large company, mobility is one of the most general topics and there are several constructive theses that are part of bigger projects. Other initial hypotheses were that the number of theses in English has been increased since 1990, the number of females has been the same or increasing slightly, and the orientation of the theses (constructive or research-oriented) has not changed much, the constructive ones being much more common.

The results partly proved the hypotheses, but interestingly enough, we got some surprises especially on the language of the theses and the gender on students.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Järvinen, H., Mikkonen, T.
Number of pages: 11
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Publisher: European Society for Engineering Education SEFI
Editors: Järvinen, H., Clark, R.
ISBN (Electronic): 9782873520144
ASJC Scopus subject areas: Computer Science(all)
Keywords: software engineering education, thesis, industrial impact
Electronic versions:
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Links:
http://urn.fi/URN:NBN:fi:tty-201709151888
Research output: Scientific - peer-review › Conference contribution

SCP-ECG V3.0: An Enhanced Standard Communication Protocol for Computer-assisted Electrocardiography

The main goal of the SCP-ECG standard is to address ECG data and related metadata structuring, semantics and syntax, with the objective of facilitating interoperability and thus supporting and promoting the exchange of the relevant information for unary and serial ECG diagnosis. Starting with version V3.0, the standard now also provides support for the storage of continuous, long-term ECG recordings and affords a repository for selected ECG sequences and the related metadata to accommodate stress tests, drug trials and protocol-based ECG recordings. The global and per-lead measurements sections have been extended and three new sections have been introduced for storing beat-by-beat and/or spike-by-spike measurements and annotations. The used terminology and the provided measurements and annotations have been harmonized with the ISO/IEEE 11073-10102 Annotated ECG standard. Emphasis has also been put on harmonizing the Universal Statement Codes with the CDISC and the categorized AHA statement codes and similarly the drug and implanted devices codes with the ATC and NASPE/BPEG codes.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Sleep and Sensory Signal Analysis Group-SSSAG, SFR Santé Lyon-Est: eTechSanté, Université de Lyon, The University of Cagliari, A.M.P.S. LCC, Institute of Cardiovascular and Medical Sciences, University of Glasgow
Authors: Pani, D., Rubel, P., Fayn, J., Badilini, F., Macfarlane, P., Värri, A.
Number of pages: 4
Pages: 309-312
Publication date: 12 Sep 2016

Host publication information
Title of host publication: Computers in Cardiology Conference
Volume: 43
Place of publication: Vancouver, Canada
Integrating mobile orienteering to team forming activity in a software engineering course

One of the most important skills software engineers need when entering work life is working in teams, including communicating, collaborating, as well as coordinating work in a team. This paper presents a team building activity aiming to support the first phases of team formation with a mobile orienteering activity. Created tasks at orienteering checkpoints were related to communication, collaboration and work division. Students were enthusiastic about the activity and expressed in their group reports on the activity that it supported the team building activity well, helped break the ice and supported agreeing the ways of working. Students also liked getting out of the classroom. The approach seems promising and we will investigate in the future similar type of activities in the first phases of team formation as well as will explore further integrating physical activity to the exercise sessions.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Väätäjä, H., Ahtinen, A.
Publication date: Sep 2016

Blogging as a virtual co-learning environment in the international course context

Co-learning, also known as collaborative learning, is a method of learning and teaching in which a team of learners together explore a significant question or create a meaningful project. A group of learners working together over the Internet on a shared assignment of creating a blog is an example of a virtual co-learning environment [1]. According to Järvenpää et al. [2], a virtual team member’s trust in his/her team operates as a moderator, indirectly affecting the relationships between team communication and perceptual learning outcomes. Therefore, we first executed team-building exercises in virtual teams. Secondly, we instructed students to use blogging tools and create their own blog pages. Thirdly, we carried out a survey among students to assess the learning experiences in such a virtual co-learning environment. We have experimented with blogging as a co-learning environment among university students in the international course context. These experiments were conducted among a group of 39 students enrolled on an international knowledge management graduate course. We observed team building in virtual teams via team-building exercises [2]. We assessed the content of the blog pages and conducted a survey at the end of the course. In the paper, we discuss co-learning in virtual teams, introduce the results from the survey questionnaire and introduce live links to some sample blog pages.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Pori Department, Research group: Business Ecosystems, Networks and Innovations, Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT), University of Calabria
Authors: Aramo-Immonen, H., Ammirato, S., Jussila, J.
Number of pages: 9
Pages: 1383-1391
Publication date: 4 Jul 2016
Experienced risks in social media use – longitudinal study among university students
Several recent studies indicate that there is a need for increased use of ICT and social media in the Finnish education [1], [2]. This research was conducted in order to explore the attitude towards social media use among university students. The motivation for seeking answer to the research question: “What risks students experience in social media use?” derived from the need to discover learning barriers in social media based learning environments. In particular, there is a need for novel interaction means in order to co-create and learn informally [3] also beyond the traditional classroom. The assumptions, beliefs and attitudes towards social media are studied from the perspective of perceived risks of the students. The study was conducted among graduate students attending “Communities and Social Media in Knowledge Management” course between the years 2012-2016. A web-based survey was executed annually, with a total of 113 respondents. Based on the results we were able to categorize the perceived risks and derive implications on how to lower learning barriers of students in social media based learning environments.

Car Type Recognition with Deep Neural Networks
In this paper we study automatic recognition of cars of four types: Bus, Truck, Van and Small car. For this problem we consider two data driven frameworks: a deep neural network and a support vector machine using SIFT features. The accuracy of the methods is validated with a database of over 6500 images, and the resulting prediction accuracy is over
97%. This clearly exceeds the accuracies of earlier studies that use manually engineered feature extraction pipelines.

**General information**

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Signal Processing, Department of Signal Processing, Research group: Vision
Authors: Huttunen, H., Shokrollahi Yancheshmeh, F., Chen, K.
Pages: 1115-1120
Publication date: Jun 2016

**Host publication information**

Title of host publication: 2016 IEEE Intelligent Vehicles Symposium, IV 2016
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Links: https://arxiv.org/abs/1602.07125
Research output: Scientific - peer-review › Conference contribution

**Vastuuilisuusmallin kokeiluprojekti henkilöliikenneyrityksissä**

The Finnish Transport Safety Agency Trafi is developing a management and procedure model for road transport companies with the purpose of reinforcing the safety culture of commercial traffic and promoting environmentally sustainable practices.

The two previous trial studies concerning the responsibility model focused on goods traffic. This third stage moved the focus on passenger traffic.

The trial was participated in by nine public transport and taxi companies of different sizes from around the country. Nine parties, both public and private, that order transports were interviewed to get an understanding of the views held by those who order such transports.

The study was commissioned by Trafi and implemented by the Verne Traffic Research Centre of the Tampere University of Technology. The project manager in charge was researcher Lasse Nykänen. In addition to Mr Nykänen, the research group consisted of his assistant Arttu Lauhkonen.

The steering group for the study met twice in the course of the project. The steering group was led by Sanna Ström. The other members were Juhani Intosalmi, Marke Lahtinen and Mikko Västilä from Trafi, and Lasse Nykänen and Arttu Lauhkonen from Traffic Research Centre Verne.

**General information**

State: Published
Ministry of Education publication type: D4 Published development or research report or study
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Authors: Nykänen, L., Lauhkonen, A.
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Transatlantic collection of health informatics competencies

The electronic collection, processing and management of information is becoming increasingly important in healthcare. Because of the nature of the healthcare provision and delivery process, where the health, safety and quality of human lives are impacted on a daily basis, it is critical that those who work in the field are competent and able to perform all clinical, administrative, research and technology-impacted facets of their roles.

The United States and the European Union have been working to encourage broader and more effective use of Information and Communications Technology (ICT) within healthcare. The development, use and governance of ICT within healthcare, often called health informatics, requires a number of competences which need to be identified and integrated into relevant skills assessment, education and training. Ultimately, this will help produce a more proficient and a more confident mobile health informatics-empowered workforce.

A structured set of health information technology and eHealth implementation competences was collected in a co-operation project by voluntary experts in USA and European Union. The project took a deliberately broad starting point, seeking and reviewing an extensive range of related competencies. The skills cover the following domains of professions working with health information technology: direct patient care; administrative; engineering/information, communication, and technology (ICT); informatics; and research and biomedicine. The aggregation of over one thousand competencies was classified to a baseline set of skills and four levels of expertise in 33 focus areas according to Bloom’s taxonomy. The data set also contains definitions of 268 ‘typical’ professional roles. The use of the collection of competencies is supported by an open access web tool through which all the competencies can be searched through a query mechanism.

The limitation of this work is that only the Acute Care segment of roles and competencies impacted by ICT was evaluated within the scope of this project, however, this subset of other care settings such as ambulatory, rehabilitative care, surgery, and others serves as a representative set of roles and competencies within the health care field as well as a being an important proof of concept for future usefulness of the work if extended beyond its current span. This project has made a contribution to the potential improvement of workforce mobility internationally.

General information

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Organisations: Department of Signal Processing, Research group: Sleep and Sensory Signal Analysis Group-SSSAG, Omni Micro Systems, UK Council for Health Informatics Professions, UTHealth School of Biomedical Informatics, Irish Computer Society, Medical Business Solutions, CAL2CAL Corporation, European Health Telematics Association, Esac Inc., RTI International, Scottish Centre for Telehealth and Telecare, NHS 24, European Commission
Authors: Värri, A., Blake, R., Roberts, J., Fenton, S., Cleary, M., Zacks, S., Datta, G., Kaye, R., Parker, J., Nguyen, C., Dougherty, M., Barry, N., Cunningham, F.
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Research output: Scientific - peer-review › Article

Gene set analysis approaches for RNA-seq data: performance evaluation and application guideline

Transcriptome sequencing (RNA-seq) is gradually replacing microarrays for high-throughput studies of gene expression. The main challenge of analyzing microarray data is not in finding differentially expressed genes, but in gaining insights into the biological processes underlying phenotypic differences. To interpret experimental results from microarrays, gene set analysis (GSA) has become the method of choice, in particular because it incorporates pre-existing biological knowledge (in a form of functionally related gene sets) into the analysis. Here we provide a brief review of several statistically different GSA approaches (competitive and self-contained) that can be adapted from microarrays practice as well as those specifically designed for RNA-seq. We evaluate their performance (in terms of Type I error rate, power, robustness to the
sample size and heterogeneity, as well as the sensitivity to different types of selection biases) on simulated and real RNA-seq data. Not surprisingly, the performance of various GSA approaches depends only on the statistical hypothesis they test and does not depend on whether the test was developed for microarrays or RNA-seq data. Interestingly, we found that competitive methods have lower power as well as robustness to the samples heterogeneity than self-contained methods, leading to poor results reproducibility. We also found that the power of unsupervised competitive methods depends on the balance between up- and down-regulated genes in tested gene sets. These properties of competitive methods have been overlooked before. Our evaluation provides a concise guideline for selecting GSA approaches, best performing under particular experimental settings in the context of RNA-seq.

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Authors: Rahmatallah, Y., Emmert-Streib, F., Glazko, G.
Pages: 393-407
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Scopus rating (2015): SJR 3.989 SNIP 2.067 CiteScore 6.37
Scopus rating (2014): SJR 3.687 SNIP 2.098 CiteScore 5.58
Scopus rating (2013): SJR 2.844 SNIP 1.983 CiteScore 4.96
Scopus rating (2012): SJR 3.131 SNIP 1.922 CiteScore 5.71
Scopus rating (2011): SJR 4.176 SNIP 4.102 CiteScore 9.53
Scopus rating (2010): SJR 3.443 SNIP 2.922
Scopus rating (2009): SJR 3.084 SNIP 2.543
Scopus rating (2008): SJR 2.066 SNIP 1.62
Scopus rating (2006): SJR 5.927 SNIP 1.381
Scopus rating (2005): SJR 2.232
Scopus rating (2004): SJR 1.597
Scopus rating (2003): SJR 1.095
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Scopus rating (2001): SJR 0.462
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Research output: Scientific - peer-review › Article

Wearable monitoring of physical functioning and disability changes, circadian rhythms and sleep patterns in nursing home residents
Sleep problems and disrupted circadian rhythms are common among older adults and may be associated with several health issues and physical functioning status. Wearable continuous monitoring of physical activity enables unobtrusive monitoring of circadian activity and sleep patterns. The objective of this retrospective study was to analyze whether physical functioning status (Activities of Daily Living assessment of Resident Assessment Instrument) is associated with diurnal activity rhythm and sleep patterns measured with wearable activity sensor in nursing home residents during their normal daily life. Continuous activity data were collected by the wearable sensor from 16 nursing home residents (average age of 90.7 years, 7 demented subjects, 1 female) in their daily life over several months (12-18 months). The subjects’ physical activity and sleep were quantified by several parameters from the activity data. In the cross-sectional analysis, physical functioning status was associated with the strength (RHO=0.78, P<0.05) and the stability (RHO=0.72, P<0.05) of the activity rhythm when the level of dementia was not controlled. In the longitudinal analysis (12-18 months), at an individual level the activity rhythm indices and activity level had the strongest correlations with changes in physical
functioning but the associations were to some extent individual. In these long-term case recordings, decrease in the physical functioning was most strongly associated with decreasing levels of activity, stability and strength of the activity rhythm, and with increasing fragmentation of rhythm and daytime passivity. Daily wearable monitoring of physical activity may hence reveal information about functioning state and health of older adults. However, since the changes in activity patterns implying changes in physical functioning status may not be consistent between the individuals, a multivariate approach is recommended for monitoring of these changes by continuous physical activity measurement.

Deep Neural Networks for Dynamic Range Compression in Mastering Applications

The process of audio mastering often, if not always, includes various audio signal processing techniques such as frequency equalization and dynamic range compression. With respect to the genre and style of the audio content, the parameters of these techniques are controlled by a mastering engineer, in order to process the original audio material. This operation relies on musical and perceptually pleasing facets of the perceived acoustic characteristics, transmitted from the audio material under the mastering process. Modeling such dynamic operations, which involve adaptation regarding the audio content, becomes vital in automated applications since it significantly affects the overall performance.

In this work we present a system capable of modelling such behavior focusing on the automatic dynamic range compression. It predicts frequency coefficients that allow the dynamic range compression, via a trained deep neural network, and applies them to unmastered audio signal served as input. Both dynamic range compression and the prediction of the corresponding frequency coefficients take place inside the time-frequency domain, using magnitude spectra acquired from a critical band filter bank, similar to humans’ peripheral auditory system. Results from conducted listening tests, incorporating professional music producers and audio mastering engineers, demonstrate on average an equivalent performance compared to professionally mastered audio content. Improvements were also observed when
Flow Cytometry-Based Classification in Cancer Research: A View on Feature Selection

In this paper, we study the problem of feature selection in cancer-related machine learning tasks. In particular, we study the accuracy and stability of different feature selection approaches within simplistic machine learning pipelines. Earlier studies have shown that for certain cases, the accuracy of detection can easily reach 100% given enough training data. Here, however, we concentrate on simplifying the classification models with and seek for feature selection approaches that are reliable even with extremely small sample sizes. We show that as much as 50% of features can be discarded without compromising the prediction accuracy. Moreover, we study the model selection problem among the $\ell_1$ regularization path of logistic regression classifiers. To this aim, we compare a more traditional cross-validation approach with a recently proposed Bayesian error estimator.

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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Laboratory of Biosystem Dynamics-LBD, Research group: Computational Systems Biology, Pori Department, Research group: Data-analytics and Optimization, Research group: Vision, BioMediTech
Authors: Hassan, S. S., Ruusuvuori, P., Latonen, L., Huttunen, H.
Pages: 75-85
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Scopus rating (2016): SJR 0.588 SNIP 0.328 CiteScore 1.24
Scopus rating (2015): SJR 0.546 SNIP 0.409 CiteScore 1.46
Scopus rating (2014): SJR 0.94 SNIP 0.748 CiteScore 1.75
Scopus rating (2013): SJR 0.865 SNIP 0.552 CiteScore 1.37
Scopus rating (2012): SJR 0.391 SNIP 0.436 CiteScore 1.07
Scopus rating (2011): SJR 0.585 SNIP 0.478 CiteScore 1.31
Scopus rating (2010): SJR 0.56 SNIP 0.584
Scopus rating (2009): SJR 0.509 SNIP 0.391
Scopus rating (2008): SJR 0.483 SNIP 0.246
Scopus rating (2007): SJR 0.454 SNIP 0.325
Scopus rating (2006): SJR 0.246 SNIP 0.164
Original language: English
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Health figures: an open source JavaScript library for health data visualization

Background
The way we look at data has a great impact on how we can understand it, particularly when the data is related to health and wellness. Due to the increased use of self-tracking devices and the ongoing shift towards preventive medicine, better understanding of our health data is an important part of improving the general welfare of the citizens. Electronic Health Records, self-tracking devices and mobile applications provide a rich variety of data but it often becomes difficult to understand. We implemented the hFigures library inspired on the hGraph visualization with additional improvements. The purpose of the library is to provide a visual representation of the evolution of health measurements in a complete and useful manner.

Results
We researched the usefulness and usability of the library by building an application for health data visualization in a health coaching program. We performed a user evaluation with Heuristic Evaluation, Controlled User Testing and Usability Questionnaires. In the Heuristics Evaluation the average response was 6.3 out of 7 points and the Cognitive Walkthrough done by usability experts indicated no design or mismatch errors. In the CSUQ usability test the system obtained an average score of 6.13 out of 7, and in the ASQ usability test the overall satisfaction score was 6.64 out of 7.

Conclusions
We developed hFigures, an open source library for visualizing a complete, accurate and normalized graphical representation of health data. The idea is based on the concept of the hGraph but it provides additional key features, including a comparison of multiple health measurements over time. We conducted a usability evaluation of the library as a key component of an application for health and wellness monitoring. The results indicate that the data visualization library was helpful in assisting users in understanding health data and its evolution over time.

General information
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Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI
Authors: Ledesma, A., Al-Musawi, M., Nieminen, H.
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Scopus rating (2013): SJR 0.693 SNIP 1.236 CiteScore 2.02
Scopus rating (2012): SJR 0.783 SNIP 1.229 CiteScore 2.14
Scopus rating (2011): SJR 1.053 SNIP 1.634 CiteScore 2.57
Scopus rating (2010): SJR 1.084 SNIP 1.678
Scopus rating (2009): SJR 0.87 SNIP 1.508
Scopus rating (2008): SJR 0.797 SNIP 1.576
Scopus rating (2007): SJR 0.653 SNIP 1.415
Scopus rating (2006): SJR 0.426 SNIP 1.125
Scopus rating (2005): SJR 0.3 SNIP 0.812
Scopus rating (2004): SJR 0.258 SNIP 1.073
Scopus rating (2003): SJR 0.351 SNIP 1.957
Scopus rating (2002): SJR 0.547 SNIP 0.244
Original language: English
Keywords: Data visualization, Health data, Health informatics, Javascript
Electronic versions:
hFiguresLedesmaEtAl
Real-Time Patient-Specific ECG Classification by 1-D Convolutional Neural Networks

Goal: This paper presents a fast and accurate patient-specific electrocardiogram (ECG) classification and monitoring system. Methods: An adaptive implementation of 1-D convolutional neural networks (CNNs) is inherently used to fuse the two major blocks of the ECG classification into a single learning body: feature extraction and classification. Therefore, for each patient, an individual and simple CNN will be trained by using relatively small common and patient-specific training data, and thus, such patient-specific feature extraction ability can further improve the classification performance. Since this also negates the necessity to extract hand-crafted manual features, once a dedicated CNN is trained for a particular patient, it can solely be used to classify possibly long ECG data stream in a fast and accurate manner or alternatively, such a solution can conveniently be used for real-time ECG monitoring and early alert system on a light-weight wearable device. Results: The results over the MIT-BIH arrhythmia benchmark database demonstrate that the proposed solution achieves a superior classification performance than most of the state-of-the-art methods for the detection of ventricular ectopic beats and supraventricular ectopic beats. Conclusion: Besides the speed and computational efficiency achieved, once a dedicated CNN is trained for an individual patient, it can solely be used to classify his/her long ECG records such as Holter registers in a fast and accurate manner. Significance: Due to its simple and parameter invariant nature, the proposed system is highly generic, and, thus, applicable to any ECG dataset.
Learning to rank salient segments extracted by multispectral quantum cuts

In this paper, a learn-to-rank algorithm is proposed and applied over the segment pool of salient objects generated by an extension of the unsupervised Quantum-Cuts algorithm. The existing Quantum Cuts is extended in a multiresolution approach as follows. First, superpixels are extracted from the input image using the simple linear iterative k-means algorithm; second, a scale space decomposition is applied prior to Quantum Cuts in order to capture salient details at different scales; and third, multispectral approach is followed to generate multiple proposals instead of a single proposal as in Quantum Cuts. The proposed learn-to-rank algorithm is then applied to these multiple proposals in order to select the most appropriate one. Shape and appearance features are extracted from the proposed segments and regressed with respect to a given confidence measure resulting in a ranked list of proposals. This ranking yields consistent improvements in an extensive collection of benchmark datasets containing around 18k images. Our analysis on the random forest regression models that are trained on different datasets shows that, although these datasets are of quite different characteristics, a model trained in the most complex dataset consistently provides performance improvements in all the other datasets, hence yielding robust salient object segmentation with a significant performance gap compared to the competing methods.
Longitudinal study on text entry by gazing and smiling
This study presents the results of a longitudinal study on multimodal text entry where objects were selected by gazing and smiling. Gaze was used to point at the desired characters and smiling movements were performed to select them. Participants (N=12) took part in the experiments where they entered text for a total of 2.5 hours in ten 15-minute-long sessions during one-month time period. The results showed that the text entry rate improved with practice from 4.1 to 6.7 words per minute. However, the learning curve had not reached its plateau phase at the end of the experiment. Subjective ratings showed that the participants appreciated this multimodal technique.

General information
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Organisations: Department of Automation Science and Engineering, Research area: Measurement Technology and Process Control
Authors: Tuisku, O., Rantanen, V., Surakka, V.
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http://urn.fi/URN:NBN:fi:tty-201604043770
Source: Bibtex
Source-ID: urn:eb698cb5baacfe79bf61cb6df26c10e9
Research output: Scientific - peer-review > Conference contribution

Recurrent Neural Networks for Polyphonic Sound Event Detection in Real Life Recordings
In this paper we present an approach to polyphonic sound event detection in real life recordings based on bi-directional long short term memory (BLSTM) recurrent neural networks (RNNs). A single multilabel BLSTM RNN is trained to map acoustic features of a mixture signal consisting of sounds from multiple classes, to binary activity indicators of each event class. Our method is tested on a large database of real-life recordings, with 61 classes (e.g. music, car, speech) from 10 different everyday contexts. The proposed method outperforms previous approaches by a large margin, and the results are further improved using data augmentation techniques. Overall, our system reports an average F1-score of 65.5% on 1 second blocks and 64.7% on single frames, a relative improvement over previous state-of-the-art approach of 6.8% and 15.1% respectively.

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Organisations: Department of Signal Processing, Research group: Audio research group, Research group: Vision
Authors: Parascandolo, G., Huttunen, H., Virtanen, T.
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Links: https://arxiv.org/abs/1604.00861
Depth Assisted Composition of Synthetic and Real 3D Scenes

In media production, previsualization is an important step. It allows the director and the production crew to see an estimate of the final product during the filmmaking process. This work focuses on a previsualization system for composite shots, which involves real and virtual content. The system visualizes a correct perspective view of how the real objects in front of the camera operator look placed in a virtual space. The aim is to simplify the workflow, reduce production time and allow more direct control of the end result. The real scene is shot with a time-of-flight depth camera, whose pose is tracked using a motion capture system. Depth-based segmentation is applied to remove the background and content outside the desired volume, the geometry is aligned with a stream from an RGB color camera and a dynamic point cloud of the remaining real scene contents is created. The virtual objects are then also transformed into the coordinate space of the tracked camera, and the resulting composite view is rendered accordingly. The prototype camera system is implemented as a self-contained unit with local processing, and it runs at 15 fps and produces a 1024x768 image.

General information
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Organisations: Department of Signal Processing, Research group: 3D MEDIA
Authors: Cortes, S., Suominen, O., Gotchev, A.
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DOIs:
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Research output: Scientific - peer-review › Conference contribution

Non-uniform resampling in perspective compensated large scale 3D visualization

The presented work addresses the problem of non-uniform resampling that arises when an image shown on a spatially immersive projection display, such as walls of a room, is intended to look undistorted for the viewer at different viewing angles. A possible application for the proposed concept is in commercial motion capture studios, where it can be used to provide real-time visualization of virtual scenes for the performing actor. We model the viewer as a virtual pinhole camera, which is being tracked by the motion capture system. The visualization surfaces, i.e. displays or projector screens, are assumed to be planar with known dimensions, and are utilized along with the tracked position and orientation of the viewer. As the viewer moves, the image to be shown is geometry corrected, so that the viewer receives the intended image regardless of the relative pose of the visualization surface. The location and orientation of the viewer result in constant recalculation of the projected sampling grid, which causes a non-uniform sampling pattern and drastic changes in sampling rate. Here we observe and compare the ways to overcome the consequent problems in regular-to-irregular resampling and aliasing, and propose a method to objectively evaluate the quality of the geometry compensation.

General information
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Authors: Shcherban, M., Suominen, O., Gotchev, A.
Publication date: Feb 2016

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Links:
http://urn.fi/URN:NBN:fi:ttv-201708171685

Bibliographical note
INT="Shcherban, Maria"
Research output: Scientific - peer-review › Conference contribution

Visualizing informal learning behavior from conference participants’ Twitter data with the Ostinato Model

Network analysis is a valuable method for investigating and mapping the phenomena driving the social structure and sharing the findings with others. This article contributes to an emerging field of ‘smart data’ research on Twitter by
presenting a case study of how community managers in Finland used this social media platform to construct an informal learning environment around an annually organized conference. In this empirical study we explore informal learning behavior in the project context, especially by analyzing and visualizing informal learning behavior from Twitter data using the Ostinato Model introduced in this paper. Ostinato is an iterative, user-centric, process-automated model for data-driven visual network analytics.

**General information**

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Organisations: Pori Department, Research group: Business Ecosystems, Networks and Innovations, Department of Information Management and Logistics, Research group: Novi, Department of Mathematics, Research group: MAT

Intelligent Information Systems Laboratory, Managing digital industrial transformation (mDIT), Bath University

Authors: Aramo-Immonen, H., Kärkkäinen, H., Jussila, J., Joel-Edgar, S., Huhtamäki, J.

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- Scopus rating (2014): SJR 1.519 SNIP 2.327 CiteScore 4.16
- Scopus rating (2013): SJR 1.727 SNIP 2.531 CiteScore 4.16
- Scopus rating (2012): SJR 1.528 SNIP 2.099 CiteScore 3.47
- Scopus rating (2011): SJR 1.492 SNIP 2.083 CiteScore 3.67
- Scopus rating (2010): SJR 1.2 SNIP 1.695
- Scopus rating (2009): SJR 0.881 SNIP 1.533
- Scopus rating (2008): SJR 1.016 SNIP 1.837
- Scopus rating (2007): SJR 1.016 SNIP 2.321
- Scopus rating (2006): SJR 0.715 SNIP 1.604
- Scopus rating (2005): SJR 0.731 SNIP 1.574
- Scopus rating (2004): SJR 0.56 SNIP 1.371
- Scopus rating (2003): SJR 0.505 SNIP 1.437
- Scopus rating (2002): SJR 0.675 SNIP 1.352
- Scopus rating (2001): SJR 0.638 SNIP 0.998
- Scopus rating (2000): SJR 0.503 SNIP 1.133
- Scopus rating (1999): SJR 0.401 SNIP 0.772

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Keywords: learning, informal learning, memory aids, Communities of Practice, Social network analysis, Visual network analysis, Twitter

DOIs:

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ORG=pla,0.34

ORG=tlo,0.33

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Research output: Scientific - peer-review › Article

**Design-inclusive UX research: design as a part of doing user experience research**

Since the third wave in human–computer interaction (HCI), research on user experience (UX) has gained momentum within the HCI community. The focus has shifted from systematic usability requirements and measures towards guidance on designing for experiences. This is a big change, since design has traditionally not played a large role in HCI research. Yet, the literature addressing this shift in focus is very limited. We believe that the field of UX research can learn from a field where design and experiential aspects have always been important: design research. In this article, we discuss why design is
needed in UX research and how research that includes design as a part of research aimed at supporting and advancing UX design practice. We do this by investigating types of design-inclusive UX research and by learning from real-life cases of UX-related design research. We report the results of an interview study with 41 researchers in three academic research units where design research meets UX research. Based on our interview findings, and building on existing literature, we describe the different roles design can play in research projects. We also report how design research results can inform designing for experience methodologically or by providing new knowledge on UX. The results are presented in a structured palette that can help UX researchers reflect and focus more on design in their research projects, thereby tackling experience design challenges in their own research.

General information
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Organisations: Department of Pervasive Computing, Research area: User experience
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Scopus rating (2014): SJR 0.596 SNIP 1.167 CiteScore 1.39
Scopus rating (2013): SJR 0.735 SNIP 1.491 CiteScore 1.54
Scopus rating (2012): SJR 0.537 SNIP 1.152 CiteScore 1.37
Scopus rating (2011): SJR 0.538 SNIP 1.101 CiteScore 1.32
Scopus rating (2010): SJR 0.552 SNIP 0.836
Scopus rating (2009): SJR 0.592 SNIP 1.95
Scopus rating (2008): SJR 0.635 SNIP 1.85
Scopus rating (2007): SJR 0.852 SNIP 1.944
Scopus rating (2006): SJR 0.56 SNIP 1.383
Scopus rating (2005): SJR 0.473 SNIP 1.19
Scopus rating (2004): SJR 0.41 SNIP 0.869
Scopus rating (2003): SJR 0.334 SNIP 0.755
Scopus rating (2002): SJR 0.666 SNIP 0.986
Scopus rating (2001): SJR 0.553 SNIP 0.939
Scopus rating (2000): SJR 0.354 SNIP 1.073
Scopus rating (1999): SJR 0.36 SNIP 1.001
Original language: English
DOIs: 10.1080/0144929X.2015.1081292
Research output: Scientific - peer-review › Article

Interactive Visualization Tools to Improve Learning and Teaching in Online Learning Environments
This paper presents two interactive visualization tools for learning management systems (LMS) in order to improve learning and teaching in online courses. The first tool was developed at the Intelligent Information Systems Laboratory (IISLab) at the Tampere University of Technology (TUT). The tool is used to analyse students' activity from automatically recorded user log data and to build interactive visualizations. They provide valuable insights into the learning process and participation of students in a course offered to teachers and students. The second tool was developed at the Unitelma Sapienza University. It extends navigation and search functionalities in the discussion forum of an LMS with a topic-driven paradigm. The tool analyses forum content and automatically identifies discussion topics. It then enhances the original forum with a topic-driven navigation structure and an interactive search graph. Both tools have been developed as plug-ins for the Moodle LMS, but their analysis processes and techniques can be adopted into any LMS.

General information
Pointing and Selecting with Facial Activity

The aim of this paper was to evaluate the use of three facial actions (i.e., frowning, raising the eyebrows, and smiling) in selecting objects on a computer screen when gaze was used for pointing. Dwell time is the most commonly used selection technique in gaze-based interaction, and thus, a dwell time of 400 ms was used as a reference selection technique. A wireless, head-mounted prototype device that carried out eye tracking and contactless, capacitive measurement of facial actions was used for the interaction task. Participants (N=16) performed point-and-select tasks with three pointing distances (i.e., 60, 120, and 240 mm) and three target sizes (i.e., 25, 30, and 40 mm). Task completion times, pointing errors and throughput values based on Fitts' law were used to compare the selection techniques. The participants also rated the techniques with subjective ratings scales. The results showed that the different techniques performed equally well in many respects. However, throughput values varied from 8.38 bits/s (raising the eyebrows) to 15.33 bits/s (smiling) and were comparable to or, in the case of smiling, better than in earlier research with similar interaction techniques. The dwell time was found to be the least accurate selection technique in terms of the magnitudes of point-and-select errors. Smiling technique was rated as more accurate to use than the frowning or the raising techniques. The results give further support for methods that combine facial behavior to eye tracking when interacting with technology.
A Case Study on Participatory Approach to Support Shift to Experience Design of Work Tools in B2B Context

To support the shift from technology-driven to experience-driven design in a company developing work tools (materials handling equipment), we developed and applied a participatory approach to increase awareness and buy-in of experience design and related methods at the company. We 1) present user experience (UX) design guidelines developed for both designers and managers based on the participatory process, 2) report evaluation of the guidelines with designers, developers, and selected internal and external stakeholders, and 3) present a participatory approach to create personas and experience journey maps covering the product life-cycle. SWOT analysis of the guidelines revealed that guidelines need to be understandable without expert UX knowledge, managerial support is needed that was aimed to be supported by the guidelines developed for managers, and representative user participation is needed. Participants experienced positively the applied participatory approach, and the mindset change is proceeding in the case company.
Binaural rendering of microphone array captures based on source separation

This paper proposes a method for binaural reconstruction of a sound scene captured with a portable-sized array consisting of several microphones. The proposed processing is separating the scene into a sum of small number of sources, and the spectrogram of each of them is in turn represented as a small number of latent components. The direction of arrival (DOA) of each source is estimated, which is followed by binaural rendering of each source at its estimated direction. For representing the sources, the proposed method uses low-rank complex-valued non-negative matrix factorization combined with DOA-based spatial covariance matrix model. The binaural reconstruction is achieved by applying the binaural cues (head-related transfer function) associated with the estimated source DOA to the separated source signals. The binaural rendering quality of the proposed method was evaluated using a speech intelligibility test. The test results indicated that the proposed binaural rendering was able to improve the intelligibility of speech over stereo recordings and separation by minimum variance distortionless response beamformer with the same binaural synthesis in a three-speaker scenario. An additional listening test evaluating the subjective quality of the rendered output indicates no added processing artifacts by the proposed method in comparison to unprocessed stereo recording.
Design and application of a fish-shaped lateral line probe for flow measurement

We introduce the lateral line probe (LLP) as a measurement device for natural flows. Hydraulic surveys in rivers and hydraulic structures are currently based on time-averaged velocity measurements using propellers or acoustic Doppler devices. The long-term goal is thus to develop a sensor system, which includes spatial gradients of the flow field along a fish-shaped sensor body. Interpreting the biological relevance of a collection of point velocity measurements is complicated by the fact that fish and other aquatic vertebrates experience the flow field through highly dynamic fluid-body interactions. To collect body-centric flow data, a bioinspired fish-shaped probe is equipped with a lateral line pressure sensing array, which can be applied both in the laboratory and in the field. Our objective is to introduce a new type of measurement device for body-centric data and compare its output to estimates of conventional point-based technologies. We first provide the calibration workflow for laboratory investigations. We then provide a review of two velocity estimation workflows, independent of calibration. Such workflows are required as existing field investigations consist of measurements in environments where calibration is not feasible. The mean difference for uncalibrated LLP velocity estimates from 0 to 50 cm/s under in a closed flow tunnel and open channel flume was within 4 cm/s when compared to conventional measurement techniques. Finally, spatial flow maps in a scale vertical slot fishway are compared for the LLP, direct measurements, and 3D numerical models where it was found that the LLP provided a slight overestimation of the current velocity in the jet and underestimated the velocity in the recirculation zone.

General information
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Organisations: Department of Signal Processing, Research group: Vision
Authors: Tuhtan, J., Fuentes-Perez, J., Strokina, N., Toming, G., Musali, M., Noack, M., Kämäräinen, J., Kruusmaa, M.
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Peer-reviewed: Yes

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Scopus rating (2015): SJR 0.562 SNIP 0.824 CiteScore 1.11
Scopus rating (2014): SJR 0.922 SNIP 1.211 CiteScore 1.45
Scopus rating (2013): SJR 0.898 SNIP 1.117 CiteScore 1.28
Scopus rating (2012): SJR 1.012 SNIP 1.267 CiteScore 1.45
Scopus rating (2011): SJR 0.861 SNIP 1.105 CiteScore 1.43
Scopus rating (2010): SJR 1.214 SNIP 1.415
Scopus rating (2009): SJR 1.001 SNIP 1.065
Scopus rating (2008): SJR 1.293 SNIP 1.355
Scopus rating (2007): SJR 0.927 SNIP 1.028
Scopus rating (2006): SJR 1.155 SNIP 1.279
Scopus rating (2005): SJR 0.876 SNIP 1.058
Scopus rating (2004): SJR 1.113 SNIP 1.4
Scopus rating (2003): SJR 0.957 SNIP 1.29
Scopus rating (2002): SJR 0.992 SNIP 0.974
Scopus rating (2001): SJR 1.1 SNIP 1.334
Scopus rating (2000): SJR 0.876 SNIP 1.012
Scopus rating (1999): SJR 1.125 SNIP 1.126
Original language: English
DOIs: 10.1063/1.4946765
Research output: Scientific - peer-review › Article

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.

**Dominant Rotated Local Binary Patterns (DRLBP) for texture classification**

In this paper, we present a novel rotation-invariant and computationally efficient texture descriptor called Dominant Rotated Local Binary Pattern (DRLBP). A rotation invariance is achieved by computing the descriptor with respect to a reference in a local neighborhood. A reference is fast to compute maintaining the computational simplicity of the Local Binary Patterns (LBP). The proposed approach not only retains the complete structural information extracted by LBP, but it also captures the complimentary information by utilizing the magnitude information, thereby achieving more discriminative power. For feature selection, we learn a dictionary of the most frequently occurring patterns from the training images, and discard redundant and non-informative features. To evaluate the performance we conduct experiments on three standard texture datasets: Outex12, Outex 10 and KTH-TIPS. The performance is compared with the state-of-the-art rotation invariant texture descriptors and results show that the proposed method is superior to other approaches.
Embedded Linux Controlled Sensor Network

This study utilizes a simple model for constructing sensor nodes – master controller combinations in the Internet of Things. The model combines hardware and software for embedded systems which measure a predefined set of parameters. The master controller manages several sensor nodes, collects data from them and provides data for clients. The paper introduces a proof-of-concept implementation based on the model. The implementation uses an embedded Linux based small computer and microcontroller based sensor nodes in the context of condition measurement, and represents a way to use wireless data transfer between controller and nodes. The target of this study was to test the model, to determine how well a cost-efficient single-board computer could be used to gather sensory data from several sensor nodes, and how this data can be provided for clients over the public Internet.

General information

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Organisations: Pori Department, Research group: Software Engineering and Intelligent Systems
Authors: Saari, M., Baharudin, A., Sillberg, P., Rantanen, P., Soini, J.
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DOIs:
Enabling Centralised Management of Local Sensor Data Refinement in Machine Fleets

In modern mobile machines, a lot of measurement data is available to generate information about machine performance. Exploiting it locally in machines would enable optimising their operation and, thus, yield competitive advantage and reduce environmental load due to reduced emissions. However, optimisation requires extensive knowledge about machine performance and characteristics in various conditions. As physical machines may be located geographically far from each other, the management of ever evolving knowledge is challenging. This study introduces a software concept to enable centralised management of data refinement performed locally in the machines of a geographically distributed fleet. It facilitates data utilisation in end user applications that provide useful information for operators in the field. Whatever the further data analysis requirements are, multiple preprocessing tasks are performed: it enables outlier limit configuration, the calculation of derived variables, data set categorisation and context recognition. A functional prototype has been implemented for the refinement of real operational data collected from forestry machines. The results show that the concept has considerable potential to bring added value for enterprises due to improved possibilities in managing data utilisation.

Estimation of kinetic parameters of transcription from temporal single-RNA measurements

Gene expression dynamics in prokaryotes is largely controlled by the multi-step process of transcription initiation whose kinetics is subject to regulation. Since the number and duration of these steps cannot be currently measured in vivo, we propose a novel method for estimating them from time series of RNA numbers in individual cells.

We demonstrate the method's applicability on measurements of fluorescence-tagged RNA molecules in Escherichia coli cells, and compare with a previous method. We show that the results of the two methods agree for equal data. We also show that, when incorporating additional data, the new method produces significantly different estimates, which are in closer agreement with qPCR measurements. Unlike the previous method, the new method requires no preprocessing of the RNA numbers, using maximal information from the RNA time series. In addition, it can use data outside of the observed RNA productions. Overall, the new method characterizes the transcription initiation process with enhanced detail. (C) 2015 Elsevier Inc. All rights reserved.
Exploring ScrumBut—An empirical study of Scrum anti-patterns

Abstract The wide-spread adoption of the agile movement has rapidly changed the landscape of software industry. In particular, Scrum is an agile process framework that has become extremely popular in industry. However, the practical implementation of Scrum in companies rarely follows the text book ideals, as companies often deviate from the proposed Scrum practices for various reasons. While some deviations may be well motivated and reasonable, companies can also be tempted to adjust Scrum for the company without clearly understanding the consequences of the deviations. In this paper our aim is to identify ways of potentially harmful mishandling of Scrum in industry based on empirical data collected in semi-structured interviews involving 18 teams in 11 companies. The (mal)practices that were identified at least in three different teams are presented in a semi-formal manner as anti-patterns. The study resulted in 14 anti-patterns that express the context of the deviation, the deviation itself, the broken core principles of Scrum, and the possible consequences of the deviation. In addition, where available, we have included company recommendations regarding the deviations. Furthermore, we identify potential risk areas in Scrum based on an analysis of the relationships between anti-patterns and Scrum concepts.

General information

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Scopus rating (2012): SJR 0.947 SNIP 2.92 CiteScore 3.2
Scopus rating (2011): SJR 0.93 SNIP 3.165 CiteScore 3.33
Scopus rating (2010): SJR 0.718 SNIP 2.486
Scopus rating (2009): SJR 0.617 SNIP 1.796
How to Evaluate the Social Effects and User Experience of Systems Enhancing Collocated Interactions?
Enhancing collocated interactions with interactive technology has quickly gained plenty of interest in the HCI community. Our approach within this research domain is to design and study mobile and wearable technology that encourages and motivates social interaction between collocated people. This paper sheds light on the considerations related to evaluating systems that address the complex and delicate issues related to social interaction. How do we evaluate the effectiveness of enhancing social interaction? How do we know if a system or a prototype is of high quality? What are the quality attributes? We highlight various evaluation challenges we have encountered in our studies and provide considerations for future research.

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Authors: Olsson, T., Jarusriboonchai, P., Paasovaara, S., Ojala, J., Olshannikova, E., Malapaschas, A., Väänänen, K.
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Electronic versions:
Links:
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Research output: Professional › Conference contribution

Increased cytoplasm viscosity hampers aggregate polar segregation in Escherichia coli
In Escherichia coli, under optimal conditions, protein aggregates associated with cellular aging are excluded from midcell by the nucleoid. We study the functionality of this process under sub-optimal temperatures from population and time lapse images of individual cells and aggregates and nucleoids within. We show that, as temperature decreases, aggregates become homogeneously distributed and uncorrelated with nucleoid size and location. We present evidence that this is due to increased cytoplasm viscosity, which weakens the anisotropy in aggregate displacements at the nucleoid borders that is responsible for their preference for polar localisation. Next, we show that in plasmolysed cells, which have increased cytoplasm viscosity, aggregates are also not preferentially located at the poles. Finally, we show that the inability of cells with increased viscosity to exclude aggregates from midcell results in enhanced aggregate concentration in between the nucleoids in cells close to dividing. This weakens the asymmetries in aggregate numbers between sister cells of subsequent generations required for rejuvenating cell lineages. We conclude that the process of exclusion of protein aggregates from midcell is not immune to stress conditions affecting the cytoplasm viscosity. The findings contribute to our understanding of E.coli's internal organisation and functioning, and its fragility to stressful conditions.
Dataflow modeling offers a myriad of tools for designing and optimizing signal processing systems. A designer is able to take advantage of dataflow properties to effectively tune the system in connection with functionality and different performance metrics. However, a disparity in the specification of dataflow properties and the final implementation can lead to incorrect behavior that is difficult to detect. This motivates the problem of ensuring consistency between dataflow properties that are declared or otherwise assumed as part of dataflow-based application models, and the dataflow behavior that is exhibited by implementations that are derived from the models. In this paper, we address this problem by introducing a novel dataflow validation framework (DVF) that is able to identify disparities between an application's formal dataflow representation and its implementation. DVF works by instrumenting the implementation of an application and monitoring the instrumentation data as the application executes. This monitoring process is streamlined so that DVF achieves validation without major overhead. We demonstrate the utility of our DVF through design and implementation case studies involving an automatic speech recognition application, a JPEG encoder, and an acoustic tracking application.
This article suggests a new methodological model for the study of hybrid media events with global appeal. This model, developed in the project on the 2015 Charlie Hebdo attacks in Paris, was created specifically for researching digital media—and in particular, Twitter. The article is structured as follows. Firstly, the methodological scope is discussed against the theoretical context, e.g. the theory of media events. In the theoretical discussion, special emphasis is given to i) disruptive, upsetting, or disintegrative media events and hybrid media events and ii) the conditions of today’s heterogeneous and globalised media communication landscape. Secondly, the article introduces a multi-method approach developed for the analysis of hybrid media events. In this model, computational social science—namely, automated content analysis (ACA) and social network analytics (SNA)—are combined with a qualitative approach—specifically, digital ethnography. The article outlines three key phases for research in which the interplay between quantitative and qualitative approaches is played out. In the first phase, preliminary digital ethnography is applied to provide the outline of the event. In the second phase, quantitative social network analytics are applied to construct the digital field for research. In this phase, it is necessary to map a) what is circulating on the websites and b) where this circulation takes place. The third and final phase applies a qualitative approach and digital ethnography to provide a more nuanced, in-depth interpretation of what (substance/content) is circulating and how this material connects with the ‘where’ in the digital landscape, hence constituting links and connections in the hybrid media landscape. In conclusion, the article reflects on how this multi-method approach contributes to understanding the workings of today’s hybrid media events: how they create and maintain symbolic battles over certain imagined constructs of social imaginaries of solidarity, belonging, contestation, and exclusion, a topic of core value for the theory of media events.
Joint Estimation of Bulk Flow Velocity and Angle Using a Lateral Line Probe

Measurement of complex natural flows, especially those occurring in rivers due to man-made structures, is often hampered by the limitations of existing flow measurement methods. Furthermore, there is a growing need for new measurement devices that are capable of measuring the hydrodynamic characteristics of complex natural flows required in environmental studies that often use fish as an indicator of ecological health. In this paper, we take the first step toward in situ natural flow measurements with a new biologically inspired probe design in conjunction with signal processing methods. The device presented in this paper is a dedicated hydrodynamically sensitive sensor array following the fish lateral line sensor modality. Low-level multidimensional sensor signals are transformed to the two key hydrodynamic primitives, bulk flow velocity and bulk flow angle. We show that this can be achieved via canonical signal transformation and kernel ridge regression, allowing velocity estimates with a less than 10 cm/s error. The approach provides robust velocity estimates not only when the sensor is ideally oriented parallel to the bulk flow, but also across the full range of angular deviations up to a completely orthogonal orientation by correcting the pressure field asymmetry for large angular deviations. Furthermore, we show that their joint estimation becomes feasible above a threshold current velocity of 0.45 m/s. The method demonstrated an error of 14 cm/s in velocity estimation in a river environment after training in laboratory conditions.

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Scopus rating (2013): SJR 0.736 SNIP 2.145 CiteScore 2.67
Scopus rating (2012): SJR 0.737 SNIP 1.835 CiteScore 2.21
Scopus rating (2011): SJR 0.669 SNIP 1.763 CiteScore 1.93
Scopus rating (2010): SJR 0.55 SNIP 1.235
Mobile Interactions Augmented by Wearable Computing: a Design Space and Vision

Wearable computing has a huge potential to shape the way we interact with mobile devices in the future. Interaction with mobile devices is still mainly limited to visual output and tactile finger-based input. Despite the visions of next-generation mobile interaction, the hand-held form factor hinders new interaction techniques becoming commonplace. In contrast, wearable devices and sensors are intended for more continuous and close-to-body use. This makes it possible to design novel wearable-augmented mobile interaction methods—both explicit and implicit. For example, the EEG signal from a wearable breast strap could be used to identify user status and change the device state accordingly implicit and the optical tracking with a head-mounted camera could be used to recognize gestural input explicit. In this paper, the authors outline the design space for how the existing and envisioned wearable devices and sensors could augment mobile interaction techniques. Based on designs and discussions in a recently organized workshop on the topic as well as other related work, the authors present an overview of this design space and highlight some use cases that underline the potential therein.

General information
State: Published
Modeling probability densities with sums of exponentials via polynomial approximation

Abstract We propose a method for optimization with semi-infinite constraints that involve a linear combination of functions, focusing on shape-constrained optimization with exponential functions. Each function is lower and upper bounded on sub-intervals by low-degree polynomials. Thus, the constraints can be approximated with polynomial inequalities that can be implemented with linear matrix inequalities. Convexity is preserved, but the problem has now a finite number of constraints. We show how to take advantage of the properties of the exponential function in order to build quickly accurate approximations. The problem used for illustration is the least-squares fitting of a positive sum of exponentials to an empirical probability density function. When the exponents are given, the problem is convex, but we also give a procedure for optimizing the exponents. Several examples show that the method is flexible, accurate and gives better results than other methods for the investigated problems.

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Organisations: Department of Signal Processing, Research group: SGN-SPAG, Department of Automatic Control and Computers, University Politehnica of Bucharest, Université de Pau et des Pays de l'Adour
Authors: Dumitrescu, B., Şicleru, B. C., Avram, F.
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Scopus rating (2014): SJR 1.082 SNIP 1.625 CiteScore 1.6
Scopus rating (2013): SJR 1.137 SNIP 1.483 CiteScore 1.44
Scopus rating (2012): SJR 0.984 SNIP 1.375 CiteScore 1.38
Scopus rating (2011): SJR 1.02 SNIP 1.386 CiteScore 1.44
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Scopus rating (2009): SJR 0.803 SNIP 1.34
Scopus rating (2008): SJR 0.859 SNIP 1.27
Morphological Differentiation Towards Neuronal Phenotype of SH-SY5Y Neuroblastoma Cells by Estradiol, Retinoic Acid and Cholesterol

Human SH-SY5Y neuroblastoma cells maintain their potential for differentiation and regression in culture conditions. The induction of differentiation could serve as a strategy to inhibit cell proliferation and tumor growth. Previous studies have shown that differentiation of SH-SY5Y cells can be induced by all-trans-retinoic-acid (RA) and cholesterol (CHOL). However, signaling pathways that lead to terminal differentiation of SH-SY5Y cells are still largely unknown. The goal of this study was to examine in the RA and CHOL treated SH-SY5Y cells the additive impacts of estradiol (E2) and brain-derived neurotrophic factor (BDNF) on cell morphology, cell population growth, synaptic vesicle recycling and presence of neurofilaments. The above features indicate a higher level of neuronal differentiation. Our data show that treatment for 10 days in vitro (DIV) with RA alone or when combined with E2 (RE) or CHOL (RC), but not when combined with BDNF (RB), significantly (p < 0.01) inhibited the cell population growth. Synaptic vesicle recycling, induced by high-K+ depolarization, was significantly increased in all treatments where RA was included (RE, RC, RB, RCB), and when all agents were added together (RCBE). Specifically, our results show for the first time that E2 treatment can alone increase synaptic vesicle recycling in SH-SY5Y cells. This work contributes to the understanding of the ways to improve suppression of neuroblastoma cells' population growth by inducing maturation and differentiation.
Private cloud deployment model in open-source mobile robots ecosystem

The focus of this paper is on secure cloud service platform for mobile robots ecosystem. Especially the emphasis is based on the scope of open-source software frameworks such as Apache Hadoop which offers numerous possibilities to employ open-source designing tools and deployment models for private cloud computing planning. This paper presents implementation of the OpenCRP (Open CloudRobotic Platform) locally-operated private cloud infrastructure and configuration methods by using Hadoop distributed file system (HDFS) for easing the ecosystem communications set-up in its entirety. For robot teleoperation, ROS (Robot Operating System) is used. The presented ecosystem utilizes security features for autonomous cloud robotic platform, software tools to manage user authentication and methods for large-scale robot-based data management and analysis. In addition to robot trial set-up of robot data storage and sharing, an ecosystem built with two low-cost mobile robots is presented.

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Robustness analysis of a hybrid of recursive neural dynamics for online matrix inversion

Encouraged by superior convergence performance achieved by a recently-proposed hybrid of recursive neural dynamics for online matrix inversion, we investigate its robustness properties in this paper when there exists large model implementation errors. Theoretical analysis shows that the perturbed dynamic system is still global stable with the tight
steady-state bound of solution error estimated. Moreover, this paper analyses global exponential convergence rate and finite convergence time of such a hybrid dynamical model to a relatively loose solution error bound. Computer simulation results substantiate our analysis on the perturbed hybrid neural dynamics for online matrix inversion when having large implementation errors.

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Scopus rating (2013): SJR 1.143 SNIP 1.478 CiteScore 1.92
Scopus rating (2012): SJR 1.04 SNIP 1.343 CiteScore 1.77
Scopus rating (2011): SJR 1.074 SNIP 1.347 CiteScore 1.78
Scopus rating (2010): SJR 0.86 SNIP 1.272
Scopus rating (2009): SJR 0.755 SNIP 1.071
Scopus rating (2008): SJR 0.778 SNIP 0.993
Scopus rating (2007): SJR 0.868 SNIP 1.117
Scopus rating (2006): SJR 0.807 SNIP 1.227
Scopus rating (2005): SJR 0.664 SNIP 1.214
Scopus rating (2004): SJR 0.472 SNIP 1.17
Scopus rating (2003): SJR 0.405 SNIP 1.127
Scopus rating (2002): SJR 0.478 SNIP 0.911
Scopus rating (2001): SJR 0.416 SNIP 0.725
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Situation Awareness Framework for Multi-machine Environments: An Application to Operator Assistive Collision Warning System
Mobile multi-machine environments consist of varying types of objects, either static or dynamic with the state known exactly or with some uncertainty. Sensors observe the environment from different positions and views, such as horizontally from the top of a mobile machine or vertically downward from an external observing machine. In this paper, we propose a simple grid-based framework for representing the information of varying types of objects in a 2-D environment and Bayesian methods for updating this information through observations and prediction models. This information about the current and near-future state of the environment is called situation awareness (SA). SA information can be utilized as the basis of the operator assistance system for enhancing the safety and efficiency of manual and semiautonomous multi-machine work environments. SA information can also be utilized in task planning of autonomous machines, via creating a dynamic costmap for path planning or entropy map for planning the optimal use of sensory systems. This paper aims at real-time mobile multi-machine environments; hence, the SA framework is kept simple for computational feasibility, but is also general enough to be applicable in other environments as well. Discussion on discretization errors and computational complexity are also covered.

General information
Purpose - The purpose of this paper is to create an organized picture of the current understanding of social media-based value creation and business models. Design/methodology/approach - Following the process model presented by Fink (2005), a systematic literature review of academic journal articles published between 2005 and 2014 was conducted. The research was grounded on the theoretical foundations of service-dominant logic. Findings - This study offers detailed descriptions and analyses of the major social media mechanisms affecting how value is created in social media-based value networks and the kinds of impact social media can have on present and future business models. Research limitations/implications - The study is limited to academic research literature on business organizations, excluding all studies related to public and non-profit organizations. Practical implications - Attention is given to developing an in-depth understanding of the functions and concrete value creation mechanisms of social media-based co-creation within the different organizational processes (e.g. in product and service development and customer services) and to updating the related practices and knowledge. Originality/value - This study provides new insight into the challenges related to research models and frameworks commonly used for observing value creation, thus highlighting the need for further studies and updates.

Social media-based value creation and business models

General information
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Organisations: Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT)
Software Developers as Users: Developer Experience of a Cross-Platform Integrated Development Environment

Software development is professional activity that demands a plethora of skills and qualities from the developer. For instance, developers need technical skills to create the code that implements the running software and social skills to be able to collaborate with peer developers and with various stakeholders. Development is an endeavor towards building complex systems that realize user and business requirements in technologically sophisticated manner. Considering the challenges of software development, developer experience is a highly unstudied topic. Developers are users of multifaceted development tools such as integrated development environments. Yet, little is known of how to support developers in their demanding tasks. This paper presents early results towards increasing the understanding of developer experience in order to enable improvement of development tools to better support software developers in their activities. We present qualitative results of a survey study with 45 developers from 21 countries considering developers' perception of a particular integrated development environment.
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.

The purpose of this paper is to introduce a model to manage knowledge security risks in organizations. Knowledge security risk management is a sensemaking process that should be carried out by managers, and the proposed model works as a tool for the sensemaking process. The model is illustrated with an analytical case example. The process model helps to identify knowledge security risks and provides a comprehensive approach to evaluating and balancing the costs and benefits of knowledge sharing and knowledge risk management. The paper addresses calls for research on the emerging topic of knowledge security and the important topic of new knowledge sharing tools from the combined perspectives of business benefits and risk management. The results presented in this paper are preliminary and conceptual, and further research on the topic is suggested. The process model proposed in this paper can be a valuable tool for practitioners aiming to develop knowledge sharing practices in companies, and at the same time need to consider the security of knowledge.
Towards Agile Enterprise Data Warehousing

Traditional business intelligence and data warehouse projects are very much sequential in nature. The process starts with data preparation and continues with the reporting needed by business measurements. This is somewhat similar to the waterfall model of software development and also shares some of its problems: the work is done in serial manner and the reaction time for possible design changes is often long. Agile principles are not well supported by the traditional serial workflow. By making the data preparation and reporting tasks parallel, it is possible to gain several advantages, such as shorter lead time and shorter feedback cycle. The solution proposed in this paper is based on enriched conceptual model that enables the business intelligence implementation process of different teams to change from serial to parallel workflow.

Keywords – data w

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Research output: Scientific - peer-review › Conference contribution

Urinary thrombomodulin levels were significantly higher following occupational exposure to chemicals, in the presence of dipstick protein, but not in the presence of dipstick blood

Currently, there are no biomarkers which can identify patients with an increased risk of developing urothelial cancer as a result of occupational chemical exposure. The aim of this study was to evaluate the relationships between final diagnosis and 22 biomarkers measured in urine, serum and plasma collected from 156 hematuric patients. Fourteen of the 80 patients (17.5%) with urothelial cancer and 13/76 (17.1%) of the controls were deemed to have a history of chemical exposure. We applied Fisher's exact tests to explore associations between chemical exposure and final diagnosis, and tumor stage and grade, where applicable; ANOVA and t-test to compare age across patients with and without chemical exposure; and Zelen's exact test to evaluate relationships across final diagnosis, chemical exposure and smoking.

Following pre-selection of biomarkers using Lasso, we identified biomarkers with differential levels across patients with and without chemical exposure using Welch's t-test. Using a one-sided t-test and considering multiple testing using FDR, we observed that TM levels in urine were significantly higher in samples from patients with a history of chemical exposure regardless of their diagnosis as control or urothelial cancer (one-sided t-test, p_UC = 0.014 and p_CTL = 0.043); in the presence of dipstick protein and when urinary pH levels ≤ 6 (p = 0.003), but not in the presence of dipstick blood (p = 0.115). Urothelial cancer patients with a history of chemical exposure were significantly younger (64.1 years) than those without chemical exposure (70.2 years) (one-sided t-test p-value = 0.012); and their tumors were higher grade (Fisher's exact test; p = 0.008). There was a strong association between a history of chemical exposure and smoking in urothelial cancer patients (Zelen's exact test; p = 0.025). Elevated urinary thrombomodulin levels could have the potential to identify chemical exposure in hematuric patients at high risk of developing urothelial cancer.

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Peer-reviewed: Yes
Visualizing co-authorship networks for actionable insights: action design research experiment

Increasing interest has been expressed in lowering the barrier for research access. Several approaches exist, including more active communication on research, the use of social computing-oriented networking tools for researchers, parallel publishing of research publications, and the use of research management systems for collecting, managing, and publishing bibliographical data. In this paper, we target the first step of research access, namely the use of publication metadata available in current research information systems. More specifically, we will take an action design research approach to experiment how visual network analytics could be used to create additional value for bibliographical data. We will tap into the current research information system of a selected university to develop a prototype of a self-service co-authorship network visualization and engage with four researchers to identify the key requirements for taking such an approach and to explore the potential value that could be created with visual analytics of bibliographical data. We contribute a set of design guidelines to support the development of computational visual network analytics tools for research collaboration analyses using bibliographical data.

General information
State: Published
Using multi-step proposal distribution for improved MCMC convergence in Bayesian network structure learning

Bayesian networks have become popular for modeling probabilistic relationships between entities. As their structure can also be given a causal interpretation about the studied system, they can be used to learn, for example, regulatory relationships of genes or proteins in biological networks and pathways. Inference of the Bayesian network structure is complicated by the size of the model structure space, necessitating the use of optimization methods or sampling techniques, such as Markov Chain Monte Carlo (MCMC) methods. However, convergence of MCMC chains is in many cases slow and can become even a harder issue as the dataset size grows. We show here how to improve convergence in the Bayesian network structure space by using an adjustable proposal distribution with the possibility to propose a wide range of steps in the structure space, and demonstrate improved network structure inference by analyzing phosphoprotein data from the human primary T cell signaling network.
Context Awareness for Navigation Applications

This thesis examines the topic of context awareness for navigation applications and asks the question, “What are the benefits and constraints of introducing context awareness in navigation?” Context awareness can be defined as a computer's ability to understand the situation or context in which it is operating. In particular, we are interested in how context awareness can be used to understand the navigation needs of people using mobile computers, such as smartphones, but context awareness can also benefit other types of navigation users, such as maritime navigators. There are countless other potential applications of context awareness, but this thesis focuses on applications related to navigation. For example, if a smartphone-based navigation system can understand when a user is walking, driving a car, or riding a train, then it can adapt its navigation algorithms to improve positioning performance.

We argue that the primary set of tools available for generating context awareness is machine learning. Machine learning is, in fact, a collection of many different algorithms and techniques for developing “computer systems that automatically improve their performance through experience” [1]. This thesis examines systematically the ability of existing algorithms from machine learning to endow computing systems with context awareness. Specifically, we apply machine learning techniques to tackle three different tasks related to context awareness and having applications in the field of navigation: (1) to recognize the activity of a smartphone user in an indoor office environment, (2) to recognize the mode of motion that a smartphone user is undergoing outdoors, and (3) to determine the optimal path of a ship traveling through ice-covered waters. The diversity of these tasks was chosen intentionally to demonstrate the breadth of problems encompassed by the topic of context awareness.

During the course of studying context awareness, we adopted two conceptual “frameworks,” which we find useful for the purpose of solidifying the abstract concepts of context and context awareness. The first such framework is based strongly on the writings of a rhetorician from Hellenistic Greece, Hermagoras of Temnos, who defined seven elements of “circumstance”. We adopt these seven elements to describe contextual information. The second framework, which we dub the “context pyramid” describes the processing of raw sensor data into contextual information in terms of six different levels. At the top of the pyramid is “rich context”, where the information is expressed in prose, and the goal for the computer is to mimic the way that a human would describe a situation.

We are still a long way off from computers being able to match a human’s ability to understand and describe context, but this thesis improves the state-of-the-art in context awareness for navigation applications. For some particular tasks, machine learning has succeeded in outperforming humans, and in the future there are likely to be tasks in navigation where computers outperform humans. One example might be the route optimization task described above. This is an example of a task where many different types of information must be fused in non-obvious ways, and it may be that computer algorithms can find better routes through ice-covered waters than even well-trained human navigators. This thesis provides only preliminary evidence of this possibility, and future work is needed to further develop the techniques outlined here. The same can be said of the other two navigation-related tasks examined in this thesis.
Dual-Mode Congestion Control Mechanism for Video Service

Video services represent over a half of Internet traffic. However, there is not any congestion control mechanism which would be suitable and widely used for all kinds of video services. This paper provides a study in which this kind of congestion control mechanism is further developed and improved based on the findings of our previous study. This mechanism offers a specific approach for congestion control because it can offer dual-mode congestion control services. There is a backward loading mode where the bandwidth is given away to other connections after the load level of a network exceeds a certain level. Instead, the other mode, a real-time mode, always wants its fair share of the bandwidth.

Management of distributed knowledge encapsulated in embedded devices

Embedded electronic devices are now to be found everywhere. In general, they can be used to collect different sorts of data (e.g. on temperature, humidity, illumination and locations). In some specific domains, such as industrial automation, embedded devices are used for process control. The devices may have a programme that can respond immediately to environmental changes perceived through sensors. In the control of large sites, where there are many devices, higher level decisions are made or processed in dedicated computers far away from the sources (devices) where the initial data are collected. This article shows how it is possible to manage portions of distributed knowledge, hosted in embedded devices, making it possible for each embedded device to hold and manage its piece of knowledge. In addition, presented approach allows keeping locus of control at the embedded device level, where the embedded device can make decisions knowing the status of the rest of the world, device contributions and their effects in the overall distributed system knowledge base.
Generative part-based Gabor object detector

Discriminative part-based models have become the approach for visual object detection. The models learn from a large number of positive and negative examples with annotated class labels and location (bounding box). In contrast, we propose a part-based generative model that learns from a small number of positive examples. This is achieved by utilizing "privileged information", sparse class-specific landmarks with semantic meaning. Our method uses bio-inspired complex-valued Gabor features to describe local parts. Gabor features are transformed to part probabilities by unsupervised Gaussian Mixture Model (GMM). GMM estimation is robustified for a small amount of data by a randomization procedure inspired by random forests. The GMM framework is also used to construct a probabilistic spatial model of part configurations. Our detector is invariant to translation, rotation and scaling. On part level invariance is achieved by pose quantization which is more efficient than previously proposed feature transformations. In the spatial model, invariance is achieved by mapping parts to an "aligned object space". Using a small number of positive examples our generative method performs comparably to the state-of-the-art discriminative method.
This publication introduces a state space exploration tool that is based on representing the model under verification as a piece of C++ code that obeys certain conventions. This approach facilitates experimenting with many kinds of modelling ideas. On the other hand, the use of stubborn sets and symmetries requires that either the modeller or a preprocessor tool analyses the model at a syntactic level and expresses stubborn set obligation rules and the symmetry mapping as suitable C++ functions. The tool supports the detection of illegal deadlocks, safety errors, and may progress errors. It also partially supports the detection of must progress errors.
Lossy-to-lossless progressive coding of depth-map images using competing constant and planar models

In this paper we propose an extension of our lossy-to-lossless progressive coding method by placing the planar model in a competition with the piecewise constant model during the region reconstruction stage of the algorithm. A sequence of lossy images is generated using an hierarchical segmentation, of the initial image, based on region merging. The progressive coding method is able to compress this sequence of images by encoding the elements that represent the differences between two consecutive images. The method is splitting some regions from the current image segmentation using an encoded set of contours, and it is defining a set of new regions, which are reconstructed using either the piecewise constant model or the planar model. An efficient solution is proposed for encoding the model parameters in a progressive way. Results show an improvement of 3-4 dB compared to the baseline method based only on constant regions, and for a wide range it achieves almost similar results with the non-progressive methods.

Priority Queue Classes with Priority Update

A limitation in the design of the interface of C++ containers (i.e., data structure implementations) is addressed. Priority queues and their use in Dijkstra's shortest path search algorithm are used as an example. Priority queues are often implemented using heaps. There is a problem, however: it may be necessary to change the priority of an element while it is in the queue, but finding the element from within a heap is costly. The problem may be solved by keeping track, in a variable that is outside the heap, of the position of the element in the heap. Unfortunately, this is impossible with the template class interface used by the C++ standard library priority queue. In this research, the problem is analysed in detail. Three interface designs and the corresponding implementations are suggested. They are compared experimentally to each other and the C++ design.
Rapid Customization of Image Processors Using Halide

Image processing applications typically involve data-oriented kernels with limited control divergence. In order to efficiently exploit the data level parallelism, image processors include SIMD instructions and other parallel computation resources. Generic processors that can be purchased off-the-shelf are adequate for most of the use scenarios of image processing. However, especially with embedded mobile devices, they might not be optimal for the algorithm, the environment, or the energy budget at hand. Such cases call for programmable customized architectures with just enough hardware resources to ensure the high priority applications reach their real time goals with minimal overheads. In order to maintain high engineer productivity, implementing image algorithms for customized processors should be as easy as with standard processors. This is emphasized at the processor codesign time; because the program is used to drive the processor design space exploration towards an optimized architecture, assembly programming is not feasible due to the required porting effort whenever the architecture is modified. In this paper we propose an image processor customization flow that exploits the domain-specific Halide language as an input to a processor co-design environment. In addition to efficiently exploiting standard resources in the customized processors, the flow provides an easy way to invoke special instructions from Halide programs. We validate the performance benefits of custom operations using example filters described with the Halide language.

Real-Time Vehicle Recognition and Improved Traffic Congestion Resolution

An intelligent traffic management system (E-Traffic Warden) is proposed, using image processing techniques along with smart traffic control algorithm. Traffic recognition was achieved using cascade classifier for vehicle recognition utilizing OpenCV and Visual Studio C/C++. The classifier was trained on 700 positive samples and 1140
negative samples. The results show that the accuracy of vehicle
detection is approximately 93 percent. The count of vehicles at
all approaches of intersection is used to estimate traffic. Traffic
build up is then avoided or resolved by passing the extracted
data to traffic control algorithm. The control algorithm shows
approximately 86 % improvement over Fixed-Delay controller
in worst case scenarios
Improving Code Density with Variable Length Encoding Aware Instruction Scheduling

Variable length encoding can considerably decrease code size in VLIW processors by reducing the number of bits wasted on encoding No Operations (NOPs). A processor may have different instruction templates where different execution slots are implicitly NOPs, but all combinations of NOPs may not be supported by the instruction templates. The efficiency of the NOP encoding can be improved by the compiler trying to place NOPs in such way that the usage of implicit NOPs is maximized. Two different methods of optimizing the use of the implicit NOP slots are evaluated: (a) prioritizing function units that have fewer implicit NOPs associated with them and (b) a post-pass to the instruction scheduler which utilizes the slack of the schedule by rescheduling operations with slack into different instruction words so that the available instruction templates are better utilized. Three different methods for selecting basic blocks to apply FUpriorization on are also analyzed: always, always outside inner loops, and only outside inner loops only in basic blocks after testing where it helped to decrease code size. The post-pass optimizer alone saved an average of 2.4% and a maximum of 10.5% instruction memory, without performance loss. Prioritizing function units in only those basic blocks where it helped gave the best case instruction memory savings of 10.7% and average savings of 3.0% in exchange for an average 0.3% slowdown. Applying both of the optimizations together gave the best case code size decrease of 12.2% and an average of 5.4%, while performance decreased on average by 0.1%.
Integer Linear Programming-Based Scheduling for Transport Triggered Architectures

Static multi-issue machines, such as traditional Very Long Instructional Word (VLIW) architectures, move complexity from the hardware to the compiler. This is motivated by the ability to support high degrees of instruction-level parallelism without requiring complicated scheduling logic in the processor hardware. The simpler-control hardware results in reduced area and power consumption, but leads to a challenge of engineering a compiler with good code-generation quality.

Transport triggered architectures (TTA), and other so-called exposed datapath architectures, take the compiler-oriented philosophy even further by pushing more details of the datapath under software control. The main benefit of this is the reduced register file pressure, with a drawback of adding even more complexity to the compiler side.

In this article, we propose an Integer Linear Programming (ILP)-based instruction scheduling model for TTAs. The model describes the architecture characteristics, the particular processor resource constraints, and the operation dependencies of the scheduled program. The model is validated and measured by compiling application kernels to various TTAs with a different number of datapath components and connectivity. In the best case, the cycle count is reduced to 52% when compared to a heuristic scheduler. In addition to producing shorter schedules, the number of register accesses in the compiled programs is generally notably less than those with the heuristic scheduler; in the best case, the ILP scheduler reduced the number of register file reads to 33% of the heuristic results and register file writes to 18%. On the other hand, as expected, the ILP-based scheduler uses distinctly more time to produce a schedule than the heuristic scheduler, but the compilation time is within tolerable limits for production-code generation.

Large-Scale Water Simulation in Games

Water is an important element in the nature. It is also often encountered in digital games and other virtual environments, but unfortunately interaction with it is typically very limited. The main reason for this is probably the immense computational cost of simulating water behavior. Simulating water and other fluids by numerically solving Navier-Stokes equations is commonplace for offline engineering applications such as bridge building, weather prediction, or aeronautics. Since the 1990s, these methods have also been applied to computer graphics, but the focus has been in offline applications such as movie special effects. Recent advances in programmable graphics hardware have facilitated real-time fluid simulation in a large enough scale to be applicable in games. This far these methods have been mostly
used in games only for visual purposes. This thesis is motivated by the wish to see more games where also the gameplay is affected by water simulation.

The first part of this thesis studies the roles of interactive water in different kinds of games. Requirements for water simulation methods are formulated by examining those roles. The thesis then introduces some background theory and various methods for water simulation. The focus is in heightfield-based methods, which simplify the problem by assuming that the water surface can be represented as a vertical displacement from a neutral level. This assumption allows very large amounts of water to be simulated with the very limited resources available for this purpose in a typical game. Most of these methods work on a heightfield terrain and can be enriched with fully 3D effects such as splashes and waterfalls by adding a particle simulation system.

An important problem is coupling the water simulation with existing rigid body simulations that are largely used for the dynamics of game objects. The coupling includes effects such as floating, objects moving with the flow, and building dams out of bodies. The thesis introduces a new heightfield-based coupling method, which allows the building of dams from rigid bodies in the heightfield context, unlike the previous approaches. The proposed methods, including the underlying water simulation method and visualization, were implemented in parallel using graphics processing units. The methods were found to be fast enough to be applicable in games.

Finally, the most promising current simulation methods are compared from a games point-of-view using the criteria set in the beginning: performance, simplicity, visual quality, richness of behavior, and rigid body coupling. Since quality of experience is a subjective matter, user tests are recommended for comparison. Included in the thesis is one of the first such studies, which found out that leaving out the velocity self-advection step of a shallow water equation solver had no statistically significant effect on any of the measured psychological impacts. Based on the analysis, recommendations for the choice of simulation methods are given for different kinds of games.

General information
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Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Kellomäki, T.
Number of pages: 91
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A comparison of feature detectors and descriptors for object class matching
Solid protocols to benchmark local feature detectors and descriptors were introduced by Mikolajczyk et al. [1,2]. The detectors and the descriptors are popular tools in object class matching, but the wide baseline setting in the benchmarks does not correspond to class-level matching where appearance variation can be large. We extend the benchmarks to the class matching setting and evaluate state-of-the-art detectors and descriptors with Caltech and ImageNet classes. Our experiments provide important findings with regard to object class matching: (1) the original SIFT is still the best descriptor; (2) dense sampling outperforms interest point detectors with a clear margin; (3) detectors perform moderately well, but descriptors? performance collapses; (4) using multiple, even a few, best matches instead of the single best has significant effect on the performance; (5) object pose variation degrades dense sampling performance while the best detector (Hessian-affine) is unaffected. The performance of the best detector-descriptor pair is verified in the application of unsupervised visual class alignment where state-of-the-art results are achieved. The findings help to improve the existing detectors and descriptors for which the framework provides an automatic validation tool.
Binomial Gaussian mixture filter

In this work, we present a novel method for approximating a normal distribution with a weighted sum of normal distributions. The approximation is used for splitting normally distributed components in a Gaussian mixture filter, such that components have smaller covariances and cause smaller linearization errors when nonlinear measurements are used for the state update. Our splitting method uses weights from the binomial distribution as component weights. The method preserves the mean and covariance of the original normal distribution, and in addition, the resulting probability density and cumulative distribution functions converge to the original normal distribution when the number of components is increased. Furthermore, an algorithm is presented to do the splitting such as to keep the linearization error below a given threshold with a minimum number of components. The accuracy of the estimate provided by the proposed method is evaluated in four simulated single-update cases and one time series tracking case. In these tests, it is found that the proposed method is more accurate than other Gaussian mixture filters found in the literature when the same number of components is used and that the proposed method is faster and more accurate than particle filters.
Perceptually adaptive filtering for stereoscopic video compression

Advances in multiview video coding aim to fulfill the required bandwidth and storage capacity of the 3D content. However, despite these evolutions, further compression efficiency can be achieved by taking into account the perceptual characteristics of 3D video. This paper presents a regionally adaptive filtering scheme for 3D video. The location and the strength of the smoothing filter are determined based on the degree of brightness of each individual pixel within the image. A series of systematic subjective tests were conducted, confirming that no quality degradation is introduced by application of such filtering and hence, keeping the perceived quality of the filtered content intact. At the same time, objective measurements show a Bjontegaard delta bitrate reduction of up to 33.55% and with an average of 21.35%.

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Organisations: Department of Signal Processing, Research group: Video
Authors: Homayouni, M., Aflaki, P., Hannuksela, M. M., Gabbouj, M.
Number of pages: 7
Range-Doppler surface: A tool to analyse human target in ultra-wideband radar

A novel concept, called range-Doppler surface (RDS), for human target analysis using ultra-wideband radar is proposed. The construction of RDS involves range-Doppler (RD) imaging, adaptive threshold detection and isosurface extraction. A Keystone-transform-based range migration compensation approach is proposed to allow high-quality RD imaging using ultra-wideband radar. Adaptive threshold detection is applied to detect the extended target in the RD image, and RDS is constructed by extracting an isosurface from a RD video sequence, which is defined as a sequence of RD images. In comparison with micro-Doppler profiles and high-resolution range profiles, RDS contains range, Doppler and time information simultaneously. An ellipsoid-based human motion model is designed for validation. RDSs simulated for different human activities are demonstrated and discussed. Finally, experimental results for single/two-people walking scenarios are presented to verify the simulation results. The use of the RDS opens a new area of human target analysis.
Behavioral Informatics and Computational Modeling in Support of Proactive Health Management and Care

Health-related behaviors are among the most significant determinants of health and quality of life. Improving health behavior is an effective way to enhance health outcomes and mitigate the escalating challenges arising from an increasingly aging population and the proliferation of chronic diseases. Although it has been difficult to obtain lasting improvements in health behaviors on a wide scale, advances at the intersection of technology and behavioral science may provide the tools to address this challenge. In this paper, we describe a vision and an approach to improve health behavior interventions using the tools of behavioral informatics, an emerging transdisciplinary research domain based on system-theoretic principles in combination with behavioral science and information technology. The field of behavioral informatics has the potential to optimize interventions through monitoring, assessing, and modeling behavior in support of providing tailored and timely interventions. We describe the components of a closed-loop system for health interventions. These components range from fine grain sensor characterizations to individual-based models of behavior change. We provide an example of a research health coaching platform that incorporates a closed-loop intervention based on these multiscale models. Using this early prototype, we illustrate how the optimized and personalized methodology and technology can support self-management and remote care. We note that despite the existing examples of research projects and our platform, significant future research is required to convert this vision to full-scale implementations.

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Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI, VTT Tech Res Ctr Finland, VTT Technical Research Center Finland
Authors: Pavel, M., Jimison, H. B., Korhonen, I., Gordon, C. M., Saranummi, N.
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Scopus rating (2014): SJR 0.84 SNIP 1.973 CiteScore 3.34
Scopus rating (2013): SJR 1.081 SNIP 2.073 CiteScore 3.53
Scopus rating (2012): SJR 0.816 SNIP 1.706 CiteScore 3
Scopus rating (2011): SJR 0.7 SNIP 1.715 CiteScore 3.04
Scopus rating (2010): SJR 0.686 SNIP 1.637
Scopus rating (2009): SJR 0.81 SNIP 1.94
Scopus rating (2008): SJR 0.826 SNIP 1.719
Scopus rating (2007): SJR 1.144 SNIP 2.187
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Scopus rating (2004): SJR 0.73 SNIP 1.689
Scopus rating (2003): SJR 0.849 SNIP 1.367
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Bibliographical note
Survey and evaluation of neural computation models for bio-integrated systems

Integrating neurobiological cultures with computer systems presents an opportunity to enhance computational energy efficiency. These Bio-Integrated Systems (BISs) require knowledge about structure and behavior of neural components and their interfacing. In the early design phases, modeling neurons offers cost, failure-free and retrial benefits compared to laboratory grown neural networks. The usefulness of these models lays in characteristics of being realistic but also computationally efficient.

This survey reviews computational models of spiking neurons and their changes in connections, known as plasticity. The review studies models that are faithful to real neural cultures, and are computational efficient for real-time BISs. Also, criteria and methods for comparing models with ‘in-vitro’ experiments are reviewed to conclude on the level of realism of models in comparison with biological setups. Izhikevich’s model of spiking neurons is recommended due to its accuracy in reproducing real neural firing patterns, computational efficiency, and ease of parameter adjustment. The model of Spike-timing dependent plasticity is recommended as current basis for representing neuron changes in connections. For the analysis of network connectivity and connectivity changes in BIS, the Cox method is recommended because it evaluates connections based on activities from all recorded neurons as opposed to pair-wise approaches.
Algebraic and Combinatorial Methods for Error-Correcting Codes with Applications to Fault-Tolerant Logic

In this thesis, algebraic and combinatorial tools are used in the study and applications of error-correcting codes and logic design. In the first part, decision diagrams and error-correcting codes are combined to introduce fault-tolerance to logic circuits. The proposed method introduces fault-tolerance to the representations of functions, and hence, no additional checker circuitry is needed in the implementations. With suitable technology, the layout and complexity of the final design is directly determined by the error-correcting decision diagram. The fault-tolerance analysis shows that, even with moderately high gate error probabilities, such robust constructions will have a significantly decreased probability of an incorrect output. In terms of complexity, using codes in the Lee metric reduces the number of nodes of the resulting diagram compared to using codes in the Hamming metric.

The second part of this thesis focuses on finding the largest code with a given minimum distance, which is an important problem in coding theory. The main result in this part is the sharpening of the linear programming bound of linear Lee codes, which is based on an invariance-type property of the Lee-compositions of a linear code. Based on this property, additional constraints can be introduced to the linear programming problem. The results show improvements to the bounds with several parameter values when compared to the general linear programming bound. Some other properties of the Lee-compositions of a linear code are studied, leading to a faster and more accurate execution of the linear programming problem. In addition, the sharpening of the linear programming bound is introduced for codes in the Euclidean distance.

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Authors: Astola, H.
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Effects of Intracellular and Partitioning Asymmetries in Escherichia coli
Cell divisions in Escherichia coli are, in general, morphologically symmetric. However, in a few cases, significant asymmetries between sister cells exist. These asymmetries between sister cells result in functional differences between them. For example, cells inheriting the older pole, over generations, accumulate more unwanted protein aggregates than their sister and, consequently, have a reduced growth rate. The reduced ability of these cells to reproduce shows that even these unicellular organisms are susceptible to the effects of aging. To understand senescence in these organisms, it is critical to investigate the sources as well as the functional consequences of asymmetries in division.
In this thesis, we characterize mechanisms responsible for functional and morphological asymmetries in division in E. coli cells, using live, single-cell, single-molecule imaging techniques and detailed stochastic models. First, to understand the functional asymmetries due to the heterogeneous spatial distribution of large, inert protein complexes, we study the kinetics of segregation and retention of such complexes by observing these events, one event at a time. For that, we track individual MS2-GFP tagged RNA complexes, as they move in the cell cytoplasm, and characterize the mechanisms responsible for their long-term spatial distribution and resulting partitioning. Next, to understand the morphological asymmetries, we study the difference in cell sizes between sister cells at division under different environmental conditions. Finally, we present the models and simulators developed to characterize and mimic these processes, as well as to explore their functional consequences.

Our results suggest that functional and morphological asymmetries in division, in the growth conditions studied, appear to be mostly driven by the nucleoid. In particular, we find that the fluorescent complexes are retained at the poles due to nucleoid occlusion. Further, the positioning of the point of division is also regulated by the degree of proximity between the two replicated nucleoids in the cell at the moment preceding division. Finally, based on simulation results of the models in extreme conditions, we suggest that asymmetries in these processes in division can enhance the mean vitality of E. coli cell populations. Overall, the results suggest that nucleoid occlusion contributes, in different ways, to heterogeneities in E. coli cells that ultimately generate phenotypic differences between sister cells.

### General information

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Research output: Collection of articles > Doctoral Thesis

### Technology Trees and Tools: Constructing Development Graphs for Digital Games

In the recent years, digital games have solidified their role as important parts of life for a considerable portion of the population. Game development has become an extremely important industrial branch with a great deal of competition between developers and publishers. There is only a limited amount of resources to put in the development of a game, but the modern customers expect high quality.

Taking these constraints into account, this dissertation focuses on developing implementations of a structure that is used widely in different games: technology trees (TTs). This term covers here also so-called skill trees, talent trees, perk trees, and other such structures used to limit and guide in-game development and define development possibilities. The aim is to propose methods and usage of tools helping to achieve high TT quality, simultaneously facilitating the actual development process and reducing human workload.

The main contributions of this dissertation consist of ideas, models, methods, and software tool prototypes constructed during the research work. The significance of the thesis is amplified by the fact that there are only very few previous academic studies focusing on TTs.

The thesis proposes a generic approach to implement TTs. The design and implementation work are facilitated by tool support and automated code generation. The central prototype tool, Tech Tree Tool (TTT) is introduced, first in its core form and then as improved by TT measuring (and limited automatic adjusting) capabilities. The challenge of modifying TTs...
during runtime is addressed, also taking advantage of related improvements on TTT. Because TTs are often operated by artificially intelligent entities, discussion on a generic artificial intelligence approach and related tools is included. Moreover, contemporary real-life TTs are analyzed and generic TTs characterized.

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Research output: Collection of articles › Doctoral Thesis

**Analysis of high-dimensional phase space via Poincaré section for patient-specific seizure detection**
In this paper, the performance of the phase space representation in interpreting the underlying dynamics of epileptic seizures is investigated and a novel patient-specific seizure detection approach is proposed based on the dynamics of EEG signals. To accomplish this, the trajectories of seizure and non-seizure segments are reconstructed in a high dimensional space using time-delay embedding method. Afterwards, Principal Component Analysis (PCA) was used in order to reduce the dimension of the reconstructed phase spaces. The geometry of the trajectories in the lower dimensions is then characterized using Poincaré section and seven features were extracted from the obtained intersection sequence. Once the features are formed, they are fed into a two-layer classification scheme, comprising the Linear Discriminant Analysis (LDA) and naïve Bayesian classifiers. The performance of the proposed method is then evaluated over the CHB-MIT benchmark database and the proposed approach achieved an 88.27% sensitivity and 93.21% specificity on average with 25% training data. Finally, we perform comparative performance evaluations against the state-of-the-art methods in this domain which demonstrate the superiority of the proposed method.

**General information**
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Video, Qatar University, University of Stavanger, Izmir University of Economics
Authors: Zabihi, M., Kiranyaz, S., Bahrami Rad, A., Kastaggelos, A. K., Gabbouj, M., Ince, T.
Pages: 386-398
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**Publication information**
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Scopus rating (2016): CiteScore 3.86 SJR 1.096 SNIP 1.619
Scopus rating (2015): SJR 1.3 SNIP 1.844 CiteScore 3.79
Scopus rating (2014): SJR 1.119 SNIP 2.102 CiteScore 4.23
SimpleTree: An Efficient Open Source Tool to Build Tree Models from TLS Clouds

An open source tool named SimpleTree, capable of modelling highly accurate cylindrical tree models from terrestrial laser scan point clouds, is presented and evaluated. All important functionalities, accessible in the software via buttons and dialogues, are described including the explanation of all necessary input parameters. The method is validated utilizing 101 point clouds of six different tree species, in the main evergreen and coniferous trees. All scanned trees have been destructively harvested to get accurate estimates of above ground biomass with which we assess the accuracy of the SimpleTree-reconstructed cylinder models. The trees were grouped into four data sets and for each one a Concordance Correlation Coefficient of at least 0.92 (0.92, 0.97, 0.92, 0.94) and an total relative error at most ~8 % (2.42%, 3.59%, –4.59%, 8.27%) was achieved in the comparison of the model results to the ground truth data. A global statistical improvement of derived cylinder radii is presented as well as an efficient optimization approach to automatically improve user given input parameters. An additional check of the SimpleTree results is presented via comparison to the results of trees reconstructed using an alternative, published method.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact)
Authors: Hackenberg, J., Spiecker, H., Calders, K., Disney, M., Raumonen, P.
Number of pages: 50
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Volume: 6
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ISSN (Print): 1999-4907
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Scopus rating (2015): SJR 0.632 SNIP 0.767 CiteScore 1.76
Scopus rating (2014): SJR 0.795 SNIP 0.972 CiteScore 1.84
Scopus rating (2013): SJR 0.633 SNIP 0.632 CiteScore 1.34
Scopus rating (2012): SJR 0.514 SNIP 0.912 CiteScore 1.18
Scopus rating (2011): SJR 0.25 SNIP 0.629
Original language: English
DOIs:
10.1109/TNSRE.2015.2505238
Research output: Scientific - peer-review › Article
MYSTERY SHOPPERS RECOGNISING KNOWLEDGE SHARING BARRIERS IN HIGHER EDUCATION

This study focuses on the knowledge sharing barriers in the space between learning and teaching in higher education as reported by mystery shoppers. There is surprisingly little context-specific research on learning and teaching in a knowledge intensive community like a university from the perspective of knowledge management (KM). Discussing learning and teaching within KM is based on considering students controversially as customers or stakeholders. Thus including them more meaningfully in assessing and developing teaching practices, or knowledge flow, seems justified. The specific aim of this paper is to first recognise possible knowledge sharing barriers and then categorize such barriers emerging from the material into three larger domains, namely, individual barriers, technological barriers and organisational barriers.

There were 45 students from all faculties participating in a mystery shopper project in a Finnish university of technology. They observed their learning experience for six weeks in order to supplement data from other sources, to add a student voice on the process of developing learning and teaching in higher education. The research approach represents qualitative content analysis in which knowledge-sharing barriers were recognised from the qualitative mystery shopper data. The results identify teaching practises that contribute to creating knowledge sharing barriers. More detailed and almost real-time contextual activity sampling is suggested as a method for further study and also an avenue for instant feedback for teaching staff. The results will provide data on current knowledge practices and learning processes in a technical university in Finland.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Language Centre, Department of Information Management and Logistics, Research group: Novi, University of Tampere
Authors: Tukiainen, M., Helander, N., Mäkinen, M.
Publication date: 16 Nov 2015

Host publication information
ISBN (Electronic): 978-84-608-2657-6
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https://iated.org/iceri/

Bibliographical note
ORG=kie,0.5
ORG=tlo,0.5
Research output: Scientific - peer-review » Conference contribution

University Students’ Perceptions of Academic Writing: An Academic Literacies Perspective

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Language Centre, Department of Information Management and Logistics, Research group: Novi, University of Tampere
Authors: Tukiainen, M., Mäkinen, M., Helander, N.
Number of pages: 7
Pages: 7589-7595
Publication date: 16 Nov 2015

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Bibliographical note
ORG=kie,0.5
ORG=tlo,0.5
"Free" Innovation Environments: Lessons learned from the Software Factory Initiatives

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Free University of Bozen-Bolzano, Italy, University of Helsinki, University of Oulu, Technical University of Madrid, University of Cagliari, University of Eastern Finland
Authors: Taibi, D., Lenarduzzi, V., Fagerholm, F., Münch, J., Ovais Ahmad, M., Liukkunen, K., Pietinen, S., Tukiainen, M., Lunesu, I., Matta, M., Fernández-Sánchez, C., Garbajosa, J., Systä, K.
Number of pages: 6
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Integrating UX Work in Agile Enterprise Software Development
Agile development methodologies have become the norm in software development. Simultaneously, user experience (UX) has become an increasingly important factor in the success or failure of software systems. However, agile methodologies do not give guidance on how to conduct UX work. Companies encounter challenges in UX work despite the previous academic research activities in order to integrate UX work with agile development practices.

This doctoral thesis investigates how to integrate UX work as part of agile development of enterprise software, where other factors such as business benefits often overrule end user needs. The thesis studies tasks and goals of which agile UX work consists of, challenges companies encounter while integrating UX work with agile development, and actions that support the integration. This thesis consists of nine publications and an introductory part. The research has been conducted in seven Finland-based international large- and middle-sized companies over the years 2011 to 2014. The research approach of the thesis is inductive, aiming at explaining and structuring the studied phenomena based on empirical findings. The research consists of three rounds of studies utilizing both qualitative and quantitative methods. The main data gathering methods include surveys and interviews. Most of the study participants were agile projects’ team members, but also end users and other roles significant to research and development activities in companies.

The main contributions of this thesis address the research questions of challenging issues in the integration of agile development and UX, tasks and goals related to UX, and activities that support the integration. We present a framework called BoB (Best of Both Worlds) for integrating UX work in agile enterprise software development. While most of the previous models for agile UX concentrate on integrating the role of UX specialist responsible for the UX work, BoB approaches the integration via UX tasks and shared ownership of the cross-functional team including software developers and UX specialists.

The results convey the conclusion that agile UX work should be collaborative effort with several contributing roles. BoB structures UX work via UX tasks unlike the previous models for agile UX work and partially merges upfront design work with development iterations.

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Kuusinen, K.
Number of pages: 296
Publication date: 6 Nov 2015

Publication information
Publisher: Tampere University of Technology
Original language: English

Publication series
Name: Tampere University of Technology. Publication
Publisher: Tampere University of Technology
Volume: 1339
Electromagnetic 3D subsurface imaging with source sparsity for a synthetic object

This paper concerns electromagnetic 3D subsurface imaging in connection with sparsity of signal sources. We explored an imaging approach that can be implemented in situations that allow one to obtain a large amount of data over a surface or a set of orbits but at the same time require sparsity of the signal sources. Characteristic to such a tomography scenario is that it necessitates the inversion technique to be genuinely three-dimensional; for example, slicing is not possible due to the low number of sources. Here, we primarily focused on astrophysical subsurface exploration purposes. As an example target of our numerical experiments we used a synthetic small planetary object containing three inclusions, e.g. voids, of the size of the wavelength. A tetrahedral arrangement of source positions was used, it being the simplest symmetric point configuration in 3D. Our results suggest that somewhat reliable inversion results can be produced within the present a priori assumptions, if the data can be recorded at a specific resolution. This is valuable early-stage knowledge especially for the design of future planetary missions in which the payload needs to be minimized, and potentially also for the development of other lightweight subsurface inspection systems.

General information
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Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact)
Authors: Pursiainen, S., Kaasalainen, M.
Number of pages: 17
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Scopus rating (2015): SJR 1.389 SNIP 1.411 CiteScore 1.82
Scopus rating (2014): SJR 1.257 SNIP 1.346 CiteScore 1.63
Scopus rating (2013): SJR 1.19 SNIP 1.566 CiteScore 2.13
Scopus rating (2012): SJR 1.239 SNIP 1.838 CiteScore 2.15
Scopus rating (2011): SJR 1.127 SNIP 1.6 CiteScore 1.9
Scopus rating (2010): SJR 1.365 SNIP 1.587
Scopus rating (2009): SJR 1.33 SNIP 1.759
Scopus rating (2008): SJR 1.211 SNIP 1.884
Scopus rating (2007): SJR 1 SNIP 1.984
Scopus rating (2006): SJR 0.893 SNIP 1.763
Scopus rating (2005): SJR 1.129 SNIP 1.954
Scopus rating (2004): SJR 0.795 SNIP 1.615
Scopus rating (2003): SJR 0.723 SNIP 1.389
Scopus rating (2002): SJR 1.114 SNIP 1.457
Scopus rating (2001): SJR 0.987 SNIP 1.502
Scopus rating (2000): SJR 0.896 SNIP 1.52
Scopus rating (1999): SJR 0.815 SNIP 1.347
Original language: English
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Links:
https://iopscience.iop.org/article/10.1088/0266-5611/31/12/125004
Research output: Scientific › peer-review › Article

MergeTree: a HLBVH Constructor for Mobile Systems

Powerful hardware accelerators have been recently developed that put interactive ray-tracing even in the reach of mobile devices. However, supplying the rendering unit with up-to date acceleration trees remains difficult, so the rendered scenes
are mostly static. The restricted memory bandwidth of a mobile device is a challenge with applying GPU-based tree construction algorithms. This paper describes MergeTree, a BVH tree constructor architecture based on the HLBVH algorithm, whose main features of interest are a streaming hierarchy emitter, an external sorting algorithm with provably minimal memory usage, and a hardware priority queue used to accelerate the external sort. In simulations, the resulting unit is faster by a factor of three than the state-of-the-art hardware builder based on the binned SAH sweep algorithm.

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Organisations: Department of Pervasive Computing, Research area: Computer engineering, Signal Processing Research Community (SPRC)
Authors: Viitanen, T., Koskela, M., Jääskeläinen, P., Kultala, H., Takala, J.
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Research output: Scientific - peer-review » Conference contribution

Coupled dictionaries for exemplar-based speech enhancement and automatic speech recognition
Exemplar-based speech enhancement systems work by decomposing the noisy speech as a weighted sum of speech and noise exemplars stored in a dictionary and use the resulting speech and noise estimates to obtain a time-varying filter in the full-resolution frequency domain to enhance the noisy speech. To obtain the decomposition, exemplars sampled in lower dimensional spaces are preferred over the full-resolution frequency domain for their reduced computational complexity and the ability to better generalize to unseen cases. But the resulting filter may be sub-optimal as the mapping of the obtained speech and noise estimates to the full-resolution frequency domain yields a low-rank approximation. This paper proposes an efficient way to directly compute the full-resolution frequency estimates of speech and noise using coupled dictionaries: an input dictionary containing atoms from the desired exemplar space to obtain the decomposition and a coupled output dictionary containing exemplars from the full-resolution frequency domain. We also introduce modulation spectrogram features for the exemplar-based tasks using this approach. The proposed system was evaluated for various choices of input exemplars and yielded improved speech enhancement performances on the AURORA-2 and AURORA-4 databases. We further show that the proposed approach also results in improved word error rates (WERs) for the speech recognition tasks using HMM-GMM and deep-neural network (DNN) based systems.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Audio research group, Research Community on Data-to-Decision (D2D), Signal Processing Research Community (SPRC), Speech Processing Research Group, Electrical Engineering Department (ESAT), KU Leuven
Authors: Baby, D., Virtanen, T., Gemmeke, J. F., Van hamme, H.
Number of pages: 12
Pages: 1788-1799
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Publication information
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Volume: 23
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ISSN (Print): 2329-9290
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Scopus rating (2016): CiteScore 3.5 SJR 0.813 SNIP 3.143
This paper presents an analysis of the recently proposed sparse extreme learning machine (S-ELM) classifier and describes an optimization scheme that can be used to calculate the network output weights. This optimization scheme exploits intrinsic graph structures in order to describe geometric data relationships in the so-called ELM space. Kernel formulations of the approach operating in ELM spaces of arbitrary dimensions are also provided. It is shown that the application of the optimization scheme exploiting geometric data relationships in the original ELM space is equivalent to the application of the original S-ELM to a transformed ELM space. The experimental results show that the incorporation of geometric data relationships in S-ELM can lead to enhanced performance.
A managerial view of the knowledge flows of a health-care system

A health system has various knowledge structures enabling its knowledge resources to be efficiently applied. The literature has covered the management of clinical health information fairly extensively, but less is known about managerial knowledge flows. To address this knowledge gap, a regional health system in Finland is studied and managerial knowledge flows categorized in order to provide a better understanding of the inter-organizational knowledge networks of a health system. The paper contributes by illustrating and concretizing the knowledge dynamics of a health system. The empirical examination reveals the complexity of managerial knowledge flows and identifies three main categories of these: (1) national information steering, (2) regional information steering, and (3) internal control information. These categories are further elaborated with the data gathered through observation, interviews, and process modelling. A better understanding and management of knowledge flows is expected to have a positive effect on the performance of the health system.

Model selection for linear classifiers using Bayesian error estimation

Regularized linear models are important classification methods for high dimensional problems, where regularized linear classifiers are often preferred due to their ability to avoid overfitting. The degree of freedom of the model is determined by a regularization parameter, which is typically selected using counting based approaches, such as K-fold cross-validation. For large data, this can be very time consuming, and, for small sample sizes, the accuracy of the model selection is limited by the large variance of CV error estimates. In this paper, we study the applicability of a recently proposed Bayesian error estimator for the selection of the best model along the regularization path. We also propose an extension of the estimator that allows model selection in multiclass cases and study its efficiency with L-1 regularized logistic regression and L-2 regularized linear support vector machine. The model selection by the new Bayesian error estimator is experimentally shown to improve the classification accuracy, especially in small sample-size situations, and is able to avoid the excess variability inherent to traditional cross-validation approaches. Moreover, the method has significantly smaller
computational complexity than cross-validation. (C) 2015 Elsevier Ltd. All rights reserved.

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Organisations: Department of Signal Processing, Research group: Vision, Research Community on Data-to-Decision (D2D), Universidad Carlos III de Madrid
Authors: Huttunen, H., Tohka, J.
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Scopus rating (2016): CiteScore 5.36 SJR 1.699 SNIP 2.988
Scopus rating (2015): SJR 1.671 SNIP 3.155 CiteScore 4.83
Scopus rating (2014): SJR 1.436 SNIP 3.522 CiteScore 4.68
Scopus rating (2013): SJR 1.407 SNIP 3.477 CiteScore 4.52
Scopus rating (2012): SJR 1.376 SNIP 3.683 CiteScore 4.37
Scopus rating (2011): SJR 1.346 SNIP 3.362 CiteScore 4.09
Scopus rating (2010): SJR 1.317 SNIP 2.952
Scopus rating (2009): SJR 1.322 SNIP 2.968
Scopus rating (2008): SJR 1.318 SNIP 2.261
Scopus rating (2007): SJR 1.428 SNIP 2.676
Scopus rating (2006): SJR 1.341 SNIP 2.778
Scopus rating (2005): SJR 1.245 SNIP 3.144
Scopus rating (2004): SJR 0.873 SNIP 2.569
Scopus rating (2003): SJR 0.959 SNIP 1.926
Scopus rating (2002): SJR 0.933 SNIP 1.724
Scopus rating (2001): SJR 1.342 SNIP 2.091
Scopus rating (2000): SJR 0.795 SNIP 1.578
Scopus rating (1999): SJR 0.982 SNIP 1.367
Original language: English
Keywords: Logistic regression, Support vector machine, Regularization, Bayesian error estimator, Linear classifier, MULTINOMIAL LOGISTIC-REGRESSION, SUPPORT VECTOR MACHINES, CLASSIFICATION, PERFORMANCE, BOUNDS
ASJC Scopus subject areas: Software, Artificial Intelligence, Computer Vision and Pattern Recognition, Signal Processing
DOIs: 10.1016/j.patcog.2015.05.005
Source: Scopus
Source-ID: 84937812363
Research output: Scientific - peer-review › Article

Refactoring - a Shot in the Dark?
A study performed semistructured interviews of 12 seasoned software architects and developers at nine Finnish companies. Its main goals were to find out how the practitioners viewed the role and importance of refactoring, and how and when they refactored. Another goal was to see whether shortened cycle times and, especially, continuous-deployment practices affected how and when refactoring was done. The results paint a multifaceted picture with some common patterns. The respondents considered refactoring to be valuable but had difficulty explaining and justifying it to management and customers. Refactoring often occurred in conjunction with the development of new features because it seemed to require a clear business need. The respondents didn't use measurements to quantify the need for or impact of refactoring. This article is part of a special issue on Refactoring.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Background: Orientation and the degree of isotropy are important in many biological systems such as the sarcomeres of cardiomyocytes and other fibrillar structures of the cytoskeleton. Image based analysis of such structures is often limited to qualitative evaluation by human experts, hampering the throughput, repeatability and reliability of the analyses. Software tools are not readily available for this purpose and the existing methods typically rely at least partly on manual operation.

Results: We developed CytoSpectre, an automated tool based on spectral analysis, allowing the quantification of orientation and also size distributions of structures in microscopy images. CytoSpectre utilizes the Fourier transform to estimate the power spectrum of an image and based on the spectrum, computes parameter values describing, among others, the mean orientation, isotropy and size of target structures. The analysis can be further tuned to focus on targets of particular size at cellular or subcellular scales. The software can be operated via a graphical user interface without any programming expertise. We analyzed the performance of CytoSpectre by extensive simulations using artificial images, by benchmarking against FibrilTool and by comparisons with manual measurements performed for real images by a panel of human experts. The software was found to be tolerant against noise and blurring and superior to FibrilTool when analyzing realistic targets with degraded image quality. The analysis of real images indicated general good agreement between computational and manual results while also revealing notable expert-to-expert variation. Moreover, the experiment showed that CytoSpectre can handle images obtained of different cell types using different microscopy techniques. Finally, we studied the effect of mechanical stretching on cardiomyocytes to demonstrate the software in an actual experiment and observed changes in cellular orientation in response to stretching.

Conclusions: CytoSpectre, a versatile, easy-to-use software tool for spectral analysis of microscopy images was developed. The tool is compatible with most 2D images and can be used to analyze targets at different scales. We expect the tool to be useful in diverse applications dealing with structures whose orientation and size distributions are of interest. While designed for the biological field, the software could also be useful in non-biological applications.
Changes in global gene expression of Vibrio parahaemolyticus induced by cold- and heat-stress

Background: Vibrio (V.) parahaemolyticus causes seafood-borne gastro-intestinal bacterial infections in humans worldwide. It is widely found in marine environments and is isolated frequently from seawater, estuarine waters, sediments and raw or insufficiently cooked seafood. Throughout the food chain, V. parahaemolyticus encounters different temperature conditions that might alter metabolism and pathogenicity of the bacterium. In this study, we performed gene expression profiling of V. parahaemolyticus RIMD 2210633 after exposure to 4, 15, 20, 37 and 42°C to describe the cold and heat shock response. Methods: Gene expression profiles of V. parahaemolyticus RIMD 2210633 after exposure to 4, 15, 20, 37 and 42°C were investigated via microarray. Gene expression values and RT-qPCR experiments were compared by plotting the log2 values. Moreover, volcano plots of microarray data were calculated to visualize the distribution of differentially expressed genes at individual temperatures and to assess hybridization qualities and
comparability of data. Finally, enriched terms were searched in annotations as well as functional-related gene categories using the Database for Annotation, Visualization and Integrated Discovery. Results: Analysis of 37°C normalised transcriptomics data resulted in differential expression of 19 genes at 20°C, 193 genes at 4°C, 625 genes at 42°C and 638 genes at 15°C. Thus, the largest number of significantly expressed genes was observed at 15 and 42°C with 13.3 and 13 %, respectively. Genes of many functional categories were highly regulated even at lower temperatures. Virulence associated genes (tdh1, tdh2, toxR, toxS, vopC, T6SS-1, T6SS-2) remained mostly unaffected by heat or cold stress. Conclusion: Along with folding and temperature shock depending systems, an overall temperature-dependent regulation of expression could be shown. Particularly the energy metabolism was affected by changed temperatures. Whole-genome gene expression studies of food related pathogens such as V. parahaemolyticus reveal how these pathogens react to stress impacts to predict its behaviour under conditions like storage and transport.

General information
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Organisations: Department of Chemistry and Bioengineering, Department of Signal Processing, Freie Universität Berlin, University of Tampere
Authors: Urmersbach, S., Aho, T., Alter, T., Hassan, S. S., Autio, R., Huehn, S.
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Peer-reviewed: Yes

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Scopus rating (2015): SJR 1.401 SNIP 0.998 CiteScore 2.93
Scopus rating (2014): SJR 1.472 SNIP 1.039 CiteScore 2.95
Scopus rating (2013): SJR 1.527 SNIP 1.143 CiteScore 3.32
Scopus rating (2012): SJR 1.454 SNIP 1.12 CiteScore 3.38
Scopus rating (2011): SJR 1.472 SNIP 1.116 CiteScore 3.4
Scopus rating (2010): SJR 1.405 SNIP 1.03
Scopus rating (2009): SJR 1.438 SNIP 0.964
Scopus rating (2008): SJR 1.432 SNIP 0.99
Scopus rating (2007): SJR 1.354 SNIP 0.949
Scopus rating (2006): SJR 1.261 SNIP 0.827
Scopus rating (2005): SJR 0.734 SNIP 0.548
Scopus rating (2004): SJR 0.668 SNIP 0.544
Scopus rating (2003): SJR 0.661 SNIP 0.535
Scopus rating (2002): SJR 0.69 SNIP 0.511
Original language: English
Keywords: Gene expression, Thermal shock, Vibrio parahaemolyticus
ASJC Scopus subject areas: Microbiology, Microbiology (medical)
DOIs:
10.1186/s12866-015-0565-7
Links:
http://www.scopus.com/inward/record.url?scp=84944883751&partnerID=8YFLogxK (Link to publication in Scopus)

Bibliographical note
ORG=keb,0.5
ORG=sgn,0.5
Source: Scopus
Source-ID: 84944883751
Research output: Scientific - peer-review › Article

A General Definition of the O-notation for Algorithm Analysis
We provide an extensive list of desirable properties for an O-notation — as used in algorithm analysis — and reduce them to 8 primitive properties. We prove that the primitive properties are equivalent to the definition of the O-notation as linear dominance.
Exercise apps cure the sitting disease
A sedentary lifestyle is the bane of our modern society and affects both body and mind. But help may be closer than you think – in your pocket. Can a mobile application get us up from our office chairs and start exercising?

LOGDIG Log File Analyzer for Mining Expected Behavior from Log Files
Log files are often the only way to identify and locate errors in a deployed system. This paper presents a new log file analyzing framework, LOGDIG, for checking expected system behavior from log files. LOGDIG is a generic framework, but it is motivated by logs that include temporal data (timestamps) and system-specific data (e.g., spatial data with coordinates of moving objects), which are present e.g. in Real Time Passenger Information Systems (RTPIS). The behavior mining in LOGDIG is state-machine-based, where a search algorithm in states tries to find desired events (by certain accuracy) from log files. That is different from related work, in which transitions are directly connected to lines of log files. LOGDIG reads any log files and uses metadata to interpret input data. The output is static behavioral knowledge and human friendly composite log for reporting results in legacy tools. Field data from a commercial RTPIS called ELMI is used as a proof-of-concept case study. LOGDIG can also be configured to analyze other systems log files by its flexible metadata formats and a new behavior mining language.
Semantics analyzing expression editors in IP-XACT design tool Kactus2

This paper presents parameter and expression editors of the design tool Kactus2. It is aimed at digital System-on-Chip (SoC) designs based on IEEE 1685 IP-XACT XML metadata standard. SoC's are constructed by assembling parametrized components using generators for hardware language code and design configuration. The key challenges are the management of dependencies between thousands of parameters, as well as immediate validation and evaluation while editing. The expression editor in this paper has been designed to overcome these challenges. The editors include real-time syntax, semantic analysis and the use of UUIDs behind user displayed parameter names. The implementations for these have been published in Kactus2 v2.8 open source code, written in C++/Qt5, and consisting of 3000 LoC in the release. An independent industrial user on the SoC domain has verified the correctness, completeness and usability of the new solutions. The designed editors significantly improve the SoC parameter editing and design configuration.

Collecting issue management data for analysis with a unified model and API descriptions

This paper presents a unified model for issue management data and a set of API descriptions for interacting with the model. The proposed model is designed to support various issue management systems and can be used to analyze issue data from different sources. The API descriptions provide a set of operations for querying and manipulating the model, which can be used to integrate issue management data into other systems. The model and API descriptions are implemented in Java and Python, and have been used to collect and analyze issue data from various sources.
ICDO: Integrated Cloud-based Development Tool for DevOps

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Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Ahmadighohandizi, F., Systä, K.
Number of pages: 15
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Title of host publication: 14th Symposium on Programming Languages and Software Tools

Adipose Tissue Dysfunction and Altered Systemic Amino Acid Metabolism Are Associated with Non-Alcoholic Fatty Liver Disease

Background
Fatty liver is a major cause of obesity-related morbidity and mortality. The aim of this study was to identify early metabolic alterations associated with liver fat accumulation in 50- to 55-year-old men (n = 49) and women (n = 52) with and without NAFLD.

Methods
Hepatic fat content was measured using proton magnetic resonance spectroscopy (H-1 MRS). Serum samples were analyzed using a nuclear magnetic resonance (NMR) metabolomics platform. Global gene expression profiles of adipose tissues and skeletal muscle were analyzed using Affymetrix microarrays and quantitative PCR. Muscle protein expression was analyzed by Western blot.

Results
Increased branched-chain amino acid (BCAA), aromatic amino acid (AAA) and orosomucoid were associated with liver fat accumulation already in its early stage, independent of sex, obesity or insulin resistance (p

Conclusions
Liver fat accumulation, already in its early stage, is associated with increased serum branched-chain and aromatic amino acids. The observed associations of decreased BCAA catabolism activity, mitochondrial energy metabolism and serum BCAA concentration with liver fat content suggest that adipose tissue dysfunction may have a key role in the systemic nature of NAFLD pathogenesis.
Decision-Making Framework for Refactoring

Refactoring has been defined as improving code quality without affecting its functionality. When refactoring is overlooked in daily development, the likelihood of larger refactorings increases with time. Disadvantages of larger refactorings include that they disrupt the daily work, require additional planning effort, and often they need to be justified to stakeholders. In this paper, we investigate with interviews how professionals make refactoring decisions. As a result, we present a framework for decision making for larger refactoring operations describing the key stages in a refactoring workflow. Furthermore, one actual industry case of refactoring decision making is presented in detail.

General information

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Research area: User experience, Solita Oy, Lappeenranta University of Technology
Authors: Leppänen, M., Lahtinen, S., Kuusinen, K., Mäkinen, S., Männistö, T., Itkonen, J., Yli-Huumo, J., Lehtonen, T.
Number of pages: 8
Pages: 61-68
Publication date: 2 Oct 2015

Host publication information
Title of host publication: 2015 IEEE 7th International Workshop on Managing Technical Debt (MTD)
Publisher: IEEE
ISBN (Electronic): 978-1-4673-7378-4
DOIs:
10.1109/MTD.2015.7332627
Research output: Scientific - peer-review › Conference contribution

Mobile Applications to Support Physical Exercise - Motivational Factors and Design Strategies

The growing incidence of health problems attributed to contemporary lifestyles, and the limited resources of healthcare, has led several stakeholders to look for alternative preventive healthcare methods. Physical exercise has many good effects for health, but people often lack motivation towards it. Smartphone applications can act as motivational tools, as they are accessible, mobile, and have suitable technological abilities. During past 10 years, a large number of mobile exercise applications have been launched and, increasingly, wellness technologies have been researched in the field of human-computer interaction (HCI). However, the field lacks a comprehensive overview of the design strategies related to motivational exercise applications. Additionally, research in the field has mostly been conducted in western cultures, and perspectives from the developing world are missing.

This thesis explores the design space of mobile applications that aim to motivate the users to engage in physical exercise. The main foci of the research were to identify the motivational factors towards the use of mobile exercise applications and to formulate a comprehensive overview of design strategies for motivational, mobile exercise applications. The results were gained from a constructive design research process that included user studies, concepting and evaluation of motivational exercise applications, a cross study analysis of motivational factors, and formulating design strategies. The
User studies were conducted in Finland and India with working-age participants.

Based on a rich set of empirical studies, this research produces insights for a wide set of motivational factors towards the use of mobile exercise applications. It points out differences in motivational factors between Finnish and Indian participants. For example, the use of surprising elements and certain playful elements as sources of motivation appealed to Indian participants more than Finns, who, in general, had a more pragmatic perspective towards the exercise applications. Finns were motivated by viewing their goals and progress by numbers and graphs, while Indians did not adopt the numerical approaches. The second outcome of the research is a comprehensive, structured and focused model of design strategies for motivational, mobile exercise applications. The model includes 34 design strategies divided into six dimensions. Nine of the strategies are India specific. The design strategies can be utilised in the design work of future exercise applications.

Transcriptome sequencing reveals PCAT5 as a Novel ERG-Regulated long Noncoding RNA in prostate cancer

Castration-resistant prostate cancers (CRPC) that arise after the failure of androgen-blocking therapies cause most of the deaths from prostate cancer, intensifying the need to fully understand CRPC pathophysiology. In this study, we characterized the transcriptomic differences between untreated prostate cancer and locally recurrent CRPC. Here, we report the identification of 145 previously unannotated intergenic long noncoding RNA transcripts (lncRNA) or isoforms that are associated with prostate cancer or CRPC. Of the one third of these transcripts that were specific for CRPC, we defined a novel lncRNA termed PCAT5 as a regulatory target for the transcription factor ERG, which is activated in approximately 50% of human prostate cancer. Genome-wide expression analysis of a PCAT5-positive prostate cancer after PCAT5 silencing highlighted alterations in cell proliferation pathways. Strikingly, an in vitro validation of these alterations revealed a complex integrated phenotype affecting cell growth, migration, invasion, colony-forming potential, and apoptosis. Our findings reveal a key molecular determinant of differences between prostate cancer and CRPC at the level of the transcriptome. Furthermore, they establish PCAT5 as a novel oncogenic lncRNA in ERGpositive prostate cancers, with implications for defining CRPC biomarkers and new therapeutic interventions.
Visualizing Big Data with Augmented and Virtual Reality: Challenges and Research Agenda

This paper provides a multi-disciplinary overview of the research issues and achievements in the field of Big Data and its visualization techniques and tools. The main aim is to summarize challenges in visualization methods for existing Big Data, as well as to offer novel solutions for issues related to the current state of Big Data Visualization. This paper provides a classification of existing data types, analytical methods, visualization techniques and tools, with a particular emphasis placed on surveying the evolution of visualization methodology over the past years. Based on the results, we reveal disadvantages of existing visualization methods. Despite the technological development of the modern world, human involvement (interaction), judgment and logical thinking are necessary while working with Big Data. Therefore, the role of human perceptual limitations involving large amounts of information is evaluated. Based on the results, a non-traditional approach is proposed: we discuss how the capabilities of Augmented Reality and Virtual Reality could be applied to the field of Big Data Visualization. We discuss the promising utility of Mixed Reality technology integration with applications in Big Data Visualization. Placing the most essential data in the central area of the human visual field in Mixed Reality would allow one to obtain the presented information in a short period of time without significant data losses due to human perceptual issues. Furthermore, we discuss the impacts of new technologies, such as Virtual Reality displays and Augmented Reality helmets on the Big Data visualization as well as to the classification of the main challenges of integrating the technology.

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Authors: Olshannikova, E., Ometov, A., Koucheryavy, Y., Olsson, T.
Publication date: 1 Oct 2015
Exploring co-learning behavior of conference participants with visual network analysis of Twitter data

Knowledge management has acknowledged organizational learning as a key factor for creating competitive advantage for companies already from early 1990. However, the studies of co-learning in this connection are in their infancy. This article contributes to an emerging field of 'smart data' research on Twitter by presenting a case study of how community managers in Finland used this social media platform to construct a co-learning environment around an annually organized conference. In this empirical study we explore the co-learning behavior in project contexts especially by analyzing and visualizing co-learning behavior from conference participants Twitter data.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Pori Department, Research group: Business Ecosystems, Networks and Innovations, Department of Information Management and Logistics, Research group: Novi, Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Managing digital industrial transformation (mDIT)
Authors: Aramo-Immonen, H., Jussila, J., Huhtamäki, J.
Number of pages: 9
Pages: 1154–1162
Publication date: Oct 2015
Peer-reviewed: Yes

Publication information
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Scopus rating (2016): CiteScore 4.54 SJR 1.595 SNIP 2.137
Scopus rating (2015): SJR 1.556 SNIP 2.123 CiteScore 4.22
Scopus rating (2014): SJR 1.519 SNIP 2.327 CiteScore 4.16
Scopus rating (2013): SJR 1.727 SNIP 2.531 CiteScore 4.16
Scopus rating (2012): SJR 1.528 SNIP 2.099 CiteScore 3.47
Scopus rating (2011): SJR 1.492 SNIP 2.083 CiteScore 3.67
Scopus rating (2010): SJR 1.2 SNIP 1.695
Scopus rating (2009): SJR 0.881 SNIP 1.533
Scopus rating (2008): SJR 1.016 SNIP 1.837
Scopus rating (2007): SJR 1.016 SNIP 2.321
Scopus rating (2006): SJR 0.715 SNIP 1.604
Scopus rating (2005): SJR 0.731 SNIP 1.574
Scopus rating (2004): SJR 0.56 SNIP 1.371
Scopus rating (2003): SJR 0.505 SNIP 1.437
Scopus rating (2002): SJR 0.675 SNIP 1.352
Scopus rating (2001): SJR 0.638 SNIP 0.998
Scopus rating (2000): SJR 0.503 SNIP 1.133
Global vs. Local - Experiences from a Distributed Software Project Course Using Agile Methodologies

Global software engineering (GSE) has become common in the software industry. Distributed development work comes with many challenges, especially related to communication and coordination. Thus, it is essential to also teach and prepare the new population of software engineers to be aware of – and familiar with – these hurdles. We addressed this need by arranging a joint (agile) software project course between universities in Finland and Norway. We had three teams – one with students from both countries and two with students from the Norwegian university only. The students were given a teacher mentor, a handbook on agile practices and state-of-the-art tools for project management and software development. Apart from monitoring the teams' progress, we also collected data from emails, questionnaires, student reports and interviews during and after the project. The main lesson learned is that the global and local teams are mostly facing the same challenges - especially when it comes to team building, clear project roles, and communication and management issues. Ultimately, our results show that the challenges were harder to solve by the global team and that not solving challenges in a timely manner had more serious consequences.
Image Based Rendering Technique via Sparse Representation in Shearlet Domain

Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC)
Authors: Vagharshakyan, S., Bregovic, R., Gotchev, A.
Number of pages: 5
Pages: 1379-1383
Publication date: 27 Sep 2015

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Publisher: The Institute of Electrical and Electronics Engineers, Inc.
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Electronic versions:
Vagharshakyan_ICIP2015
DOIs:
10.1109/ICIP.2015.7351026
Links:
Research output: Scientific - peer-review › Conference contribution

The MVC+D extension of the Advanced Video Coding (H.264/AVC) standard enables multiview-and-depth 3D video coding but specifies that all views are coded at equal spatial resolution. In mixed resolution 3D video coding some of the views are coded at reduced resolution. This paper proposes an improvement for the mode decisions in depth encoding in the mixed resolution scenario. We modify the distortion calculation for rate-distortion optimized depth coding. The proposed solution optimizes the depth data compression with assumption that it will be used not only for view synthesis but also for depth-based super resolution in the post-processing stage. The algorithm is implemented on top of the mixed resolution 3D video encoder based on the 3DV-ATM reference software. Evaluation of the proposed solution, tested under the JCT-3V common test conditions, is done against the mixed resolution MVC+D coding with the view synthesis distortion enabled. The results show 2.64%dBR gain for coded views and 0.64% gain for synthesized views.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Nokia
Authors: Joachimiak, M., Hannuksela, M., Aflaki Beni, P., Gabbouj, M.
Number of pages: 5
Pages: 1056-1060
Publication date: 27 Sep 2015
Building new computational models to support health behavior change and maintenance: new opportunities in behavioral research

Adverse and suboptimal health behaviors and habits are responsible for approximately 40% of preventable deaths, in addition to their unfavorable effects on quality of life and economics. Our current understanding of human behavior is largely based on static "snapshots" of human behavior, rather than ongoing, dynamic feedback loops of behavior in response to ever-changing biological, social, personal, and environmental states. This paper first discusses how new technologies (i.e., mobile sensors, smartphones, ubiquitous computing, and cloud-enabled processing/computing) and emerging systems modeling techniques enable the development of new, dynamic, and empirical models of human behavior that could facilitate just-in-time adaptive, scalable interventions. The paper then describes concrete steps to the creation of robust dynamic mathematical models of behavior including: (1) establishing "gold standard" measures, (2) the creation of a behavioral ontology for shared language and understanding tools that both enable dynamic theorizing across disciplines, (3) the development of data sharing resources, and (4) facilitating improved sharing of mathematical models and tools to support rapid aggregation of the models. We conclude with the discussion of what might be incorporated into a "knowledge commons," which could help to bring together these disparate activities into a unified system and structure for organizing knowledge about behavior.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI, Research Community on Data-to-Decision (D2D), University of Southern California, Arizona State University, Northeastern University, National Institutes of Health, Bethesda, Northwestern University, Wharton School, University of Pennsylvania, Scientific Institute Hospital San Raffaello, Valencia Polytechnical University, Columbia University in the City of New York, VTT Technical Research Centre of Finland
Number of pages: 12
Pages: 335-346
Publication date: 17 Sep 2015
Peer-reviewed: Yes
Performance of intensity-based non-normalized pointwise algorithms in dynamic speckle analysis

Intensity-based pointwise non-normalized algorithms for 2D evaluation of activity in optical metrology with dynamic speckle analysis are studied and compared. They are applied to a temporal sequence of correlated speckle patterns formed at laser illumination of the object surface. Performance of each algorithm is assessed through the histogram of estimates it produces. A new algorithm is proposed that provides the same quality of the 2D activity map for less computational effort. The algorithms are applied both to synthetic and experimental data.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Signal Processing Research Community (SPRC), Korea Electronics Technology Institute, Bulgarian Academy of Sciences
Authors: Stoykova, E., Nazarova, D., Berberova, N., Gotchev, A.
Number of pages: 15
Pages: 25128-25142
Publication date: 17 Sep 2015
Peer-reviewed: Yes

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Journal: Optics Express
Volume: 23
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ISSN (Print): 1094-4087
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Scopus rating (2015): SJR 1.976 SNIP 1.755 CiteScore 3.78
Scopus rating (2014): SJR 2.349 SNIP 2.166 CiteScore 4.18
Scopus rating (2013): SJR 2.358 SNIP 2.226 CiteScore 4.38
Scopus rating (2012): SJR 2.587 SNIP 2.145 CiteScore 3.85
Scopus rating (2011): SJR 2.579 SNIP 2.606 CiteScore 4.04
Scopus rating (2010): SJR 2.943 SNIP 2.466
Scopus rating (2009): SJR 3.092 SNIP 2.669
Scopus rating (2008): SJR 3.195 SNIP 2.393
Scopus rating (2007): SJR 3.27 SNIP 2.032
Scopus rating (2006): SJR 3.233 SNIP 2.326
Scopus rating (2005): SJR 3.334 SNIP 2.379
Scopus rating (2004): SJR 2.833 SNIP 2.499
Scopus rating (2003): SJR 2.688 SNIP 2.193
Scopus rating (2002): SJR 1.547 SNIP 1.673
Scopus rating (2001): SJR 1.442 SNIP 1.39
Scopus rating (2000): SJR 1.246 SNIP 0.714
Continuous User Experience Development
Continuous approaches for software engineering such as continuous planning, development, and operations are becoming increasingly popular in agile software companies. It means that also user-centered design practitioners and practices need to adapt to both possibilities and challenges the increasingly rapid and more tightly integrated software engineering environment induces. Such issues include planning continuously throughout the life cycle instead of upfront planning, delivering user value whenever something is ready instead of delivering working software at the end of time-boxed iterations, and experimenting with real users instead of conducting traditional user studies and tests. In this position paper we discuss how user experience work can be organized with continuous software development.

Task allocation between UX specialists and developers in agile software development projects
Synchronizing efforts between developers and user experience (UX) specialists is one of the major challenges in agile UX work. In this paper, we report results of a study conducted over a release cycle of six agile software development projects in five companies, considering the task allocation and cooperation in the team. Team members (N = 31), including product owners, UX specialists, and developers, reported weekly on the UX-related tasks they had contributed to and whether the UX specialist had participated. We identified three forms of cooperation: minimal, product owner–UX specialist, and developer–UX specialist. Our study suggests that for projects operating in the minimal cooperation mode, the collaboration concentrates on the user interface (UI) design, while other aspects of UX work are downplayed. At the same time, many UX-related tasks were successfully handled by developers alone. Therefore, to support UX work integration, we suggest a task-oriented integration approach for projects with minimal UX resources.
Methods and Systems for Suppressing Atmospheric Turbulence in Images

Various techniques are disclosed to suppress distortion in images (e.g., video or still images), such as distortion caused by atmospheric turbulence. For example, similar image blocks from a sequence of images may be identified and tracked along motion trajectories to construct spatiotemporal volumes. The motion trajectories are smoothed to estimate the true positions of the image blocks without random displacements/shifts due to the distortion, and the smoothed trajectories are used to aggregate the image blocks in their new estimated positions to reconstruct the sequence of images with the random displacements/shifts suppressed. Blurring that may remain within each image block of the spatiotemporal volumes may be suppressed by modifying the spatiotemporal volumes in a collaborative fashion. For example, a decorrelating transform may be applied to the spatiotemporal volumes to suppress the blurring in a transform domain, such as by alpha-rooting or other suitable operations on the coefficients of the spectral volumes.

Effects of subsampling on characteristics of RNA-seq data from triple-negative breast cancer patients

Background: Data from RNA-seq experiments provide a wealth of information about the transcriptome of an organism. However, the analysis of such data is very demanding. In this study, we aimed to establish robust analysis procedures that can be used in clinical practice. Methods: We studied RNA-seq data from triple-negative breast cancer patients. Specifically, we investigated the subsampling of RNA-seq data. Results: The main results of our investigations are as follows: (1) the subsampling of RNA-seq data gave biologically realistic simulations of sequencing experiments with smaller sequencing depth but not direct scaling of count matrices; (2) the saturation of results required an average sequencing depth larger than 32 million reads and an individual sequencing depth larger than 46 million reads; and (3) for an abrogated feature selection, higher moments of the distribution of all expressed genes had a higher sensitivity for signal detection than the corresponding mean values. Conclusions: Our results reveal important characteristics of RNA-seq data that must be understood before one can apply such an approach to translational medicine.
An estimation method of the kinetic rates of transcription initiation by Eσ70 and Eσ38 from measurements of individual RNA productions

One of the global regulators of transcription dynamics in Escherichia coli is the intracellular population of σ factors, due to their role in gene selection for transcription. It is unknown to which degree σ factors affect the dynamics of transcription initiation, following the binding between the RNAP holoenzyme (Eσ) and the promoter, and the closed complex formation. Proposed here is a new method to study the kinetics of the underlying steps in transcription initiation from time-lapse imaging of transcription events at the single RNA level in live cells. Namely, assuming a promoter that can be transcribed by Eσ70 or Eσ38, the researchers make use of in silico data from a stochastic model of transcription dynamics of that promoter, to show that the method estimates consistently and effectively the kinetics rates of closed and open complex formation by Eσ70 and Eσ38. In the end, the necessary measurement procedures for acquiring the data needed to apply this new methodology are described.

General information
State: Published
Ministry of Education publication type: A1 Journal article-referred
Organisations: Department of Signal Processing, Research group: Computational Systems Biology, Research group: Laboratory of Biosystem Dynamics-LBD
Authors: Tran, H., Ribeiro, A. S.
Number of pages: 7
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Peer-reviewed: Yes

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Journal: International Journal of Pharma Medicine and Biological Sciences
Volume: 4
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Scopus rating (2014): SJR 0.123 SNIP 0
Scopus rating (2013): SJR 0.122 SNIP 0
Original language: English
DOIs:
10.18178/ijpmbs.4.3.151-157
Research output: Scientific - peer-review › Article

The Next Level of User Experience of Cloud Storage Services: Supporting Collaboration with Social Features

Nowadays, individuals' personal data is at their disposal real-time from any device through cloud storage services (CSS). Such services enable new kinds of collaboration between individuals and have fundamental impact on how we organize and share our data. Nevertheless, only a few studies have been made on the user experience (UX) of such services. This paper reports the user experience of different CSSs (focusing on Drop box, Google Drive, One Drive, and iCloud) based on 19 interviews and 65 survey responses. The results include reasons for the most positive and negative experiences and descriptions of current habits and motivations of the CSS users. As the current use of CSSs is still mostly individual we investigate the potential of taking the UX of CSSs to the next level by integrating different social features to current CSSs. We conclude the paper by explaining the importance of different Cloud UX aspects in CSS context and suggesting design implications improving UX for CSSs.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Palviainen, J., Rezaei, P. P.
Number of pages: 10
Pages: 175-184
Publication date: 1 Sep 2015

Host publication Information
Title of host publication: 2015 24th Australasian Software Engineering Conference (ASWEC)
VLT/SPHERE- and ALMA-based shape reconstruction of asteroid (3) Juno

We use the recently released Atacama Large Millimeter Array (ALMA) and VLT/SPHERE science verification data, together with earlier adaptive-optics images, stellar occultation, and lightcurve data to model the 3D shape and spin of the large asteroid (3) Juno with the all-data asteroid modelling (ADAM) procedure. These data set limits on the plausible range of shape models, yielding reconstructions suggesting that, despite its large size, Juno has sizable unrounded features moulded by non-gravitational processes such as impacts.
Augmenting Technology Trees: Automation and Tool Support

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Computer Science and Applied Logics
Authors: Heinimäki, T. J., Elomaa, T.
Number of pages: 8
Pages: 68-75
Publication date: Sep 2015

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Title of host publication: Proceedings of the Seventh International Conference on Virtual Worlds and Games for Serious Applications (VS-Games 2015)
Publisher: IEEE
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ISBN (Electronic): 978-1-4799-8102-1
ASJC Scopus subject areas: Software
DOIs:
10.1109/VS-GAMES.2015.7295765
Research output: Scientific - peer-review › Conference contribution

Unified Model for Software Engineering Data
Software process data is available in several tools such as version control systems, issue trackers and test and build systems to name a few. Using the data gathered in these software engineering tools would be ideal for collecting different kinds of software processes and product metrics as the data is already automatically gathered by the tools. However, the tools present and store the data in various formats. The data collection methods and interfaces also vary between the tools. This closes the software engineering data into silos and makes it hard to build reusable analysis and visualizations for the data.

In this position paper we present a unified model for software engineering data and a framework for data collection, conversion and storing that utilizes our model. The aim of the model is to define a common format for software engineering data which is not dependent on specific software engineering tools or the software engineering process and thus can be used as a basis for building reusable visualization and analysis components. To demonstrate that we can build reusable visualization plugins on top of the framework, we created a timeline visualization plugin. The visualization plugin is used to visualize two data sets from industrial software projects that have different contexts and semantics.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Mattila, A., Luoto, A., Terho, H., Hylli, J., Sievi-Korte, O., Systä, K.
Number of pages: 5
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Publication date: Sep 2015

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Title of host publication: 2015 IEEE 3rd Working Conference on Software Visualization (VISSOFT)
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Publisher: IEEE
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10.1109/VISSOFT.2015.7332427
Sleep stage classification using sparse rational decomposition of single channel EEG records

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research group: Filterbanks, Research Community on Data-to-Decision (D2D), Eötvös Loránd University
Authors: Samiee, K., Kovacs, P., Kiranyaz, S., Gabbouj, M., Saramäki, T.
Number of pages: 5
Pages: 1905-1909
Publication date: 31 Aug 2015

Host publication information
Title of host publication: 2015 23rd European Signal Processing Conference (EUSIPCO)
Publisher: IEEE
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Links:
Research output: Scientific - peer-review › Conference contribution

The Class of Generalized Hampel Filters

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Signal Processing Research Community (SPRC)
Authors: Pearson, R. K., Neuvo, Y., Astola, J., Gabbouj, M.
Number of pages: 5
Pages: 2546-2550
Publication date: 31 Aug 2015

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Title of host publication: Proceedings of European Signal Processing Conference (EUSIPCO 2015), 31 August – 4 September 2015, Nice, France, 2015
ISBN (Print): 978-0-9928626-3-3
ISBN (Electronic): 978-0-9928626-4-0
Links:
Research output: Scientific - peer-review › Conference contribution

Improving reliability for classification of metallic objects using a WTMD portal
In this paper, a walk-through metal detection (WTMD) portal is used for classification of metallic objects. The classification is based on the inversion of the magnetic polarisability tensor (tensor) of the object. The nature of bias and noise components in the tensor are examined by using real walk-through data, and consequently, a novel classifier is introduced. Furthermore, a novel method for detecting poorly inverted tensors is presented, enabling self-diagnostics for the WTMD portal. Based on the results, the novel methods increase the accuracy of metal object classification and have the potential to improve the reliability of a WTMD system.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: MMDM, Signal Processing Research Community (SPRC), School of Electrical and Electronic Engineering, University of Manchester, Rapiscan Systems Oy
Publication date: 26 Aug 2015
Peer-reviewed: Yes

Publication information
Journal: Measurement Science and Technology
Volume: 26
Issue number: 10
Overcoming challenges in agile user experience work: Cross-case analysis of two large software organizations

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Kuusinen, K.
Publication date: 26 Aug 2015

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Publisher: IEEE Computer Society
ISBN (Print): 978-1-4673-7585-6
DOIs: 10.1109/SEAA.2015.38
Research output: Scientific - peer-review › Conference contribution

Surveys of daily information security of citizens in Finland

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Information security, Intelligent dexterity for secure networked infrastructure and applications (IDSNIA)
Authors: Koskinen, J. A.
Number of pages: 8
Pages: 326 - 333
Publication date: 20 Aug 2015

Host publication information
The Role of Customer Experience in Value Creation in Business-to-Business Context

General information
State: Unpublished
Ministry of Education publication type: D3 Professional conference proceedings
Organisations: Department of Information Management and Logistics, Research group: Novi, Tampere University of Technology, Tampere University of Applied Science
Authors: Väyrynen, H., Vasell, T., Helander, N., Boedeker, M., Andersson, T.
Number of pages: 1
Pages: 146
Publication date: 12 Aug 2015

Host publication information
Title of host publication: 23rd Nordic Academy of Management Conference : NFF 2015
Publisher: Nordic Academy of Management
Article number: 24.02
Links:

Bibliographical note
AUX=tlo,"Vasell, Tytti"
Research output: Professional › Conference contribution

Construction of therapeutically relevant human prostate epithelial fate map by utilising miRNA and mRNA microarray expression data

Background: Objective identification of key miRNAs from transcriptomic data is difficult owing to the inherent inconsistencies within miRNA target-prediction algorithms and the promiscuous nature of miRNA-mRNA target relationship. Methods: An integrated database of miRNAs and their 'relevant' mRNA targets was generated from validated miRNA and mRNA microarray data sets generated from patient-derived prostate epithelial normal and cancer stem-like cells (SCs) and committed basal (CB) cells. The effect of miR-542-5p inhibition was studied to provide proof-of-principle for database utility. Results: Integration of miRNA-mRNA databases showed that signalling pathways and processes can be regulated by a single or relatively few miRNAs, for example, DNA repair/Notch pathway by miR-542-5p, P=0.008. Inhibition of miR-542-5p in CB cells (thereby achieving miR-542-5p expression levels similar to SCs) promoted efficient DNA repair and activated expression of Notch reporters, HES1 and Survivin, without inducing dedifferentiation into SCs. Conclusions: Our novel framework impartially identifies therapeutically relevant miRNA candidates from transcriptomic data sets.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Computational Systems Biology, BioMediTech, Prostate cancer research center (PCRC), BioMediTech - Institute of Biosciences and Medical Technology, Hull York Medical School, Department of Urology, University of York, King's College London, University of Hull, Castle Hill Hospital
Authors: Rane, J. K., Ylipää, A., Adamson, R., Mann, V. M., Simms, M. S., Collins, A. T., Visakorpi, T., Nykter, M., Maitland, N. J.
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Peer-reviewed: Yes

Publication information
Journal: British Journal of Cancer
Volume: 113
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ISSN (Print): 0007-0920
Ratings:
Dynamics of Genetic Circuits with Molecule Partitioning Errors in Cell Division and RNA-RNA Interactions

Many signaling and regulatory molecules within cells exist in very few copies per cell. Any process affecting even limited numbers of these molecules therefore has the potential to affect the dynamics of the biochemical networks of which they are a part. This sensitivity to small copy-number changes is what allows stochasticity in gene expression to introduce a degree of randomness in what cells do. While this randomness can be suppressed, it does not appear to be so in many biological systems, at least not to the maximum degree possible. This suggests that this randomness is not necessarily detrimental to cell populations, as it can produce qualitatively new behaviours in genetic networks which may be utilized by cells.

In this thesis, two other mechanisms are investigated which, through their interaction with low copy-number molecules, are able to produce qualitatively different dynamics in genetic networks: the stochastic partitioning of molecules in cell division, and the direct interaction of two low copy-number molecules. For this, a novel simulator of chemical kinetics is first presented, designed to simulate the dynamics of genetic circuits inside growing populations of cells. It is then used to study a genetic switch where one repressive link is formed by direct interaction between RNA molecules. This arrangement was found to decouple the stability of the two noisy attractors of the network and the speeds of the state transitions. In other words, it allows the network to have two equally-stable noisy attractors, but differing state transition speeds.

Next, the cell-to-cell diversity in RNA numbers (as quantified by the normalized variance) of a single gene over time in a growing model cell population was studied as a function of the division synchrony. In the model, synchronous cell divisions introduce transient increases in the cell-to-cell diversity in RNA numbers of the population, a prediction which was verified using single-molecule measurements of RNA numbers. Finally, the effects of the stochastic partitioning of regulatory molecules in cell division on the dynamics of two genetic circuits, a switch and a clock, were studied. Of these two circuits, the switch has the most dramatic changes in its dynamics, brought on by the inevitable negative correlation in molecule numbers that sister cells inherit. This negative correlation can allow a cell population to partition the phenotypes of the individual cells with less variance than a binomial distribution.

These results advance our understanding of the different behaviours that can be produced in genetic circuits due to these two mechanisms. Since they produce unique behaviours, these mechanisms, and combinations thereof, are expected to be used for specialized purposes in natural genetic circuits. Further, since the downstream effects of these mechanisms may be more predictable than, e.g., modifying promoter sequences, they may also be useful in the design and implementation of future synthetic genetic circuits with specific behaviours.
Collaborative filtering based on group coordinates for smoothing and directional sharpening

Groups of mutually similar image blocks are the key element in nonlocal image processing. In this work, the spatial coordinates of grouped blocks are leveraged in two distinct parts of the transform-domain collaborative filtering within the BM3D algorithm. First, we introduce an adaptive 1-D transform for 3-D collaborative filtering based on sampling 2-D smooth functions at the positions of grouped blocks. This adaptive transform is applied for improved decorrelation of the 2-D spectra of the grouped blocks. Second, we propose a directional sharpening procedure whose strength varies adaptively according to the relative orientation of the transform basis functions with respect to the group coordinates. Experiments confirm the efficacy of the proposed adaptations, for denoising as well as for sharpening of noisy images.
**Exemplar-based speech enhancement for deep neural network based automatic speech recognition**

Deep neural network (DNN) based acoustic modeling has been successfully used for a variety of automatic speech recognition (ASR) tasks, thanks to its ability to learn higher-level information using multiple hidden layers. This paper investigates the recently proposed exemplar-based speech enhancement technique using coupled dictionaries as a pre-processing stage for DNN-based systems. In this setting, the noisy speech is decomposed as a weighted sum of atoms in an input dictionary containing exemplars sampled from a domain of choice, and the resulting weights are applied to a coupled output dictionary containing exemplars sampled in the short-time Fourier transform (STFT) domain to directly obtain the speech and noise estimates for speech enhancement. In this work, settings using input dictionary of exemplars sampled from the STFT, Mel-integrated magnitude STFT and modulation envelope spectra are evaluated. Experiments performed on the AURORA-4 database revealed that these pre-processing stages can improve the performance of the DNN-HMM-based ASR systems with both clean and multi-condition training.

**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.
Low-complexity robust DOA estimation

We propose a low complexity method for estimating direction of arrival (DOA) when the positions of the array sensors are affected by errors with known magnitude bound. This robust DOA method is based on solving an optimization problem whose solution is obtained in two stages. First, the problem is relaxed and the corresponding power estimation has an expression similar to that of standard beamforming. If the relaxed solution does not satisfy the magnitude bound, an approximation is made by projection. Unlike other robust DOA methods, no eigenvalue decomposition is necessary and the complexity is similar to that of MVDR. For low and medium SNR, the proposed method competes well with more complex methods and is clearly better than MVDR.

Low-Latency Sound-Source-Separation using Non-Negative Matrix Factorisation with Coupled Analysis and Synthesis Dictionaries

For real-time or close to real-time applications, sound source separation can be performed on-line, where new frames of incoming data for a mixture signal are processed as they arrive, at very low delay. We propose an approach which generates the separation filters for short synthesis frames to achieve low latency source separation, based on a compositional model mixture of the audio to be separated. Filter parameters are derived from a longer temporal context than the current processing frame through use of a longer analysis frame. A pair of dictionaries are used, one for analysis and one for reconstruction. With this approach we are able to increase separation performance at low latencies whilst retaining the low-latency provided by the use of short synthesis frames. The proposed data handling scheme and parameters can be adjusted to achieve real-time performance, given sufficient computational power. Low-latency output allows a human listener to use the results of such a separation scheme directly, without a perceptible delay. With the proposed method, separated source-to-distortion ratios (SDRs) can be improved by over 1 dB for latencies below 20 ms, without any affect on latency.
Similarity induced group sparsity for non-negative matrix factorisation

Non-negative matrix factorisations are used in several branches of signal processing and data analysis for separation and classification. Sparsity constraints are commonly set on the model to promote discovery of a small number of dominant patterns. In group sparse models, atoms considered to belong to a consistent group are permitted to activate together, while activations across groups are suppressed, reducing the number of simultaneously active sources or other structures. Whereas most group sparse models require explicit division of atoms into separate groups without addressing their mutual relations, we propose a constraint that permits dynamic relationships between atoms or groups, based on any defined distance measure. The resulting solutions promote approximation with components considered similar to each other. Evaluation results are shown for speech enhancement and noise robust speech and speaker recognition.
Adaptive Randomized Coordinate Descent for Sparse Systems: Lasso and Greedy Algorithms

Coordinate descent (CD) is a simple optimization technique suited to low complexity requirements and also for solving large problems. In randomized version, CD was recently shown as very effective for solving least-squares (LS) and other optimization problems. We propose here an adaptive version of randomized coordinate descent (RCD) for finding sparse LS solutions, from which we derive two algorithms, one based on the lasso criterion, the other using a greedy technique. Both algorithms employ a novel way of adapting the probabilities for choosing the coordinates, based on a matching pursuit criterion. Another new feature is that, in the lasso algorithm, the penalty term values are built without knowing the noise level or using other prior information. The proposed algorithms use efficient computations and have a tunable trade-off between complexity and performance through the number of CD steps per time instant. Besides a general theoretical convergence analysis, we present simulations that show good practical behavior, comparable to or better than that of state of the art methods.

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Scopus rating (2012): SJR 2.404 SNIP 3.552 CiteScore 4.81
Scopus rating (2011): SJR 1.957 SNIP 3.005 CiteScore 4.06
Scopus rating (2010): SJR 2.201 SNIP 2.925
Scopus rating (2009): SJR 2.034 SNIP 2.929
Scopus rating (2008): SJR 1.912 SNIP 2.751
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Analysing traffic fluency from bus data

The use of stored public transportation data facilitates the identification of potential issues with urban traffic flow. Focusing on buses, the authors proceed from a city-level delay distribution analysis to a detailed understanding of the factors that cause the delays on an example bus line. First, a database of bus data in Tampere was mined to detect any regular patterns in the distribution of delays in time, location or according to bus line throughout the city. The results allow the authors to focus on those areas and lines which are most prone to delays. In a case study, they illustrate that the most important reasons for tardy journeys are the long waiting times at traffic signals and bus stops, rather than slow driving speeds. The results are then further deepened to show spatially on a map which bus stops and intersections tend to be the ones where the time variances are high. The same methods can be applied to any other city for which the same kind of data are available.

Automatic image-based detection and inspection of paper fibres for grasping

An automatic computer vision algorithm that detects individual paper fibres from an image, assesses the possibility of grasping the detected fibres with microgrippers and detects the suitable grasping points is presented. The goal of the algorithm is to enable automatic fibre manipulation for mechanical characterisation, which has traditionally been slow manual work. The algorithm classifies the objects in images based on their morphology, and detects the proper grasp points from the individual fibres by applying given geometrical constraints. The authors test the ability of the algorithm to detect the individual fibres with 35 images containing more than 500 fibres in total, and also compare the graspability analysis and the calculated grasp points with the results of an experienced human operator with 15 images that contain a total of almost 200 fibres. The detection results are outstanding, with fewer than 1% of fibres missed. The graspability analysis gives sensitivity of 0.83 and specificity of 0.92, and the average distance between the grasp points of the human and the algorithm is 220 μm. Also, the choices made by the algorithm are much more consistent than the human choices.
Convolutional Neural Networks for patient-specific ECG classification

We propose a fast and accurate patient-specific electrocardiogram (ECG) classification and monitoring system using an adaptive implementation of 1D Convolutional Neural Networks (CNNs) that can fuse feature extraction and classification into a unified learner. In this way, a dedicated CNN will be trained for each patient by using relatively small common and patient-specific training data and thus it can also be used to classify long ECG records such as Holter registers in a fast and accurate manner. Alternatively, such a solution can conveniently be used for real-time ECG monitoring and early alert system on a light-weight wearable device. The experimental results demonstrate that the proposed system achieves a superior classification performance for the detection of ventricular ectopic beats (VEB) and supraventricular ectopic beats (SVEB).

General information

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Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Qatar University, Izmir University of Economics
Authors: Kiranyaz, S., Ince, T., Hamila, R., Gabbouj, M.
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Databases, Electrocardiography, Feature extraction, Neural networks, Neurons, Training

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Mapping dynamical states to structural classes for Boolean networks using a classification algorithm

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Authors: Sarbu, S., Shmulevich, I., Yli-Harja, O., Nykter, M., Kesseli, J.
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Single image super-resolution via BM3D sparse coding

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Towards visual words to words
We address the problem of text localization and retrieval in real world images. We are first to study the retrieval of text images, i.e. the selection of images containing text in large collections at high speed. We propose a novel representation, textual visual words, which describe text by generic visual words that geometrically consistently predict bottom and top lines of text. The visual words are discretized SIFT descriptors of Hessian features. The features may correspond to
various structures present in the text - character fragments, individual characters or their arrangements. The textual words representation is invariant to affine transformation of the image and local linear change of intensity. Experiments demonstrate that the proposed method outperforms the state-of-the-art on the MS dataset. The proposed method detects blurry, small font, low contrast, noisy text from real world images.

**General information**

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**Affective Audio Synthesis for Sound Experience Enhancement**

With the advances of technology, multimedia tend to be a recurring and prominent component in almost all forms of communication. Although their content spans in various categories, there are two protuberant channels that are used for information conveyance, i.e. audio and visual. The former can transfer numerous content, ranging from low-level characteristics (e.g. spatial location of source and type of sound producing mechanism) to high and contextual (e.g. emotion). Additionally, recent results of published works depict the possibility for automated synthesis of sounds, e.g. music and sound events. Based on the above, in this chapter the authors propose the integration of emotion recognition from sound with automated synthesis techniques. Such a task will enhance, on one hand, the process of computer driven creation of sound content by adding an anthropocentric factor (i.e. emotion) and, on the other, the experience of the multimedia user by offering an extra constituent that will intensify the immersion and the overall user experience level.

**General information**

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**Automatic recognition of environmental sound events using all-pole group delay features**

A feature based on the group delay function from all-pole models (APGD) is proposed for environmental sound event recognition. The commonly used spectral features take into account merely the magnitude information, whereas the phase is overlooked due to the complications related to its interpretation. Additional information concealed in the phase is hypothesised to be beneficial for sound event recognition. The APGD is an approach to inferring phase information, which has shown applicability for analysis of speech and music signals and is now studied in environmental audio. The evaluation is performed within a multi-label deep neural network (DNN) framework on a diverse real-life dataset of environmental sounds. It shows performance improvement compared to the baseline log mel-band energy case. In combination with the magnitude-based features, APGD demonstrates further improvement.
Context-aware knowledge-based middleware for selective information delivery in data-intensive monitoring systems

Multiple embedded devices in modern control and monitoring systems are able to sense different aspects of the current context such as environmental conditions, current processes in the system and user state. The number of captured situations in the environment and quantity and variety of devices in the system produce considerable amounts of data, which should be processed, understood and followed by corresponding actions. However, fully delivered to the user regardless of their role in the system and needs, data flows cause cognitive overload and thus may compromise the safety of the system depending on the timely response of the operators. This paper addresses the problem of selective information delivery with respect to the user's role in the system, his needs and responsibilities, by proposing context-aware information management middleware. The system utilizes Semantic Web technologies by capturing relevant information in the knowledge model of the system, which decouples data from the application logics. A clear division of data and application logics enables context-awareness and facilitates the reconfiguration process, when new information should be added into the system. The chosen approach is justified with an analysis of main trends in context-aware solutions. The engineering principles of the knowledge model are described and illustrated with simple scenarios from the building automation domain. The prototype developed proves the feasibility of the approach via performance evaluation and demonstrates the reconfiguration capabilities of information flows in the system. Further work assumes the extension of the knowledge model and integration of the system with adaptive human–machine interfaces for multi-role and multi-user environments.
Knowledge Management operationalization – how it differs in large enterprises and SMEs in Finland

Information and knowledge are essential resources for businesses to maintain their competitiveness and to constantly develop further. Knowledge Management (KM) enables companies to develop their activities by having the right information at the right time, as well as by offering the tools to manage the skills and knowledge of the personnel. The aim of this paper is to empirically analyze how KM is operationalized in large and small and medium sized companies in Finland, and furthermore, what kinds of challenges the companies face in KM operationalization. The empirical study was carried out in spring 2014 as a web-based questionnaire survey and structured interviews. Results of the study provide direction for the development directions of KM in Finnish companies.
Understanding the most influential user experiences in successful and unsuccessful technology adoptions

Abstract Understanding processes underlying technology adoption or non-adoption is an important research theme often addressed using the technology acceptance model (TAM) approach. The objective of this research was to investigate most influential user experiences in successful and unsuccessful technology adoptions using user experience related concepts and methods in conjunction with the TAM. Participants (N = 76) described their most influential user experiences related to one successful and one unsuccessful technology adoption process and evaluated both experiences using rating scales, including the central TAM related scales and user experience related scales probing emotions, psychological needs, user values, task load, and the impact of technology on the user's well-being. The results suggested that user experience and technology acceptance related viewpoints can complement each other in order to gain a more holistic understanding of the factors affecting the success or failure of technology adoptions, and the results showed how these variables typically behave in both contexts. The overall valence of user experience was significantly affected by perceived usefulness, the fulfillment of psychological needs, and the salience of negative emotions in the most influential user experiences of successful adoptions, and by perceived usefulness, output quality, and the salience of negative emotions in the unsuccessful adoptions.

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Scopus rating (2012): SJR 1.528 SNIP 2.099 CiteScore 3.47
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Scopus rating (2006): SJR 0.715 SNIP 1.604
Scopus rating (2005): SJR 0.731 SNIP 1.574
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Source-ID: 84937879051
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Mashing Up Software Issue Management, Development, and Usage Data

Modern software development approaches rely extensively on tools. Motivated by practices such as continuous integration, deployment, and delivery, these tools are used in a fashion where data are automatically accumulated in different databases as a side-effect of everyday development activities. In this paper we introduce an approach for software engineering data visualization as a mash up that combines data from issue management, software development and production use. The visualization can show to all stakeholders how well continuous delivery is realized in the project. The visualization clearly shows the time spent to specify and develop the features as well as the length of the delivery cycle. Furthermore, the visualization shows how much work is unfinished and waiting for delivery. This can help the development team to decrease the amount of unfinished work and by that help them to keep up in continuous delivery mindset. In addition to development data usage of the features is also visualized.

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Authors: Mattila, A., Lehtonen, T., Terho, H., Mikkonen, T., Systä, K.
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Kinetics of the cellular intake of a gene expression inducer at high concentrations

From in vivo single-event measurements of the transient and steady-state transcription activity of a single-copy lac-ara-1 promoter in Escherichia coli, we characterize the intake kinetics of its inducer (IPTG) from the media. We show that the empirical data are well-fit by a model of intake assuming a bilayer membrane, with the passage through the second layer being rate-limiting, coupled to a stochastic, sub-Poissonian, multi-step transcription process. Using this model, we show that for a wide range of extracellular inducer levels (up to 1.25 mM) the intake process is diffusive-like, suggesting unsaturated membrane permeability. Inducer molecules travel from the periplasm to the cytoplasm in, on average, 31.7 minutes, strongly affecting cells' response time. The novel methodology followed here should aid the study of cellular intake mechanisms at the single-event level.

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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.

An HMM-based spectrum access algorithm for cognitive radio systems

In this paper, we propose an improved spectrum access algorithm for cognitive radio applications using a Hidden Markov Model (HMM) for learning the primary user channel usage pattern. The proposed scheme maximizes the channel utilization without causing significant interference to the primary user. Simulation results show that the proposed algorithm provides about 3 times improvement in channel utilization compared to the system proposed in [1], with a slight degradation in collision probability. It is also observed that the proposed scheme performance is robust to variations in the
primary user behavior.

Detecting Anomalous Structures by Convolutional Sparse Models

Depth Map Compression Using Color-Driven Isotropic Segmentation and Regularised Reconstruction
low-resolution one and for splitting and predictive coding of segments with high reconstruction error. The scheme compares favorably with other methods for depth map compression.

**Adaptive sampling for compressed sensing based image compression**
The compressed sensing (CS) theory has been successfully applied to image compression in the past few years as most image signals are sparse in a certain domain. In this paper, we focus on how to improve the sampling efficiency for CS-based image compression by using our proposed adaptive sampling mechanism on the block-based CS (BCS), especially the reweighted one. To achieve this goal, two solutions are developed at the sampling side and reconstruction side, respectively. The proposed sampling mechanism allocates the CS-measurements to image blocks according to the statistical information of each block so as to sample the image more efficiently. A generic allocation algorithm is developed to help assign CS-measurements and several allocation factors derived in the transform domain are used to control the overall allocation in both solutions. Experimental results demonstrate that our adaptive sampling scheme offers a very significant quality improvement as compared with traditional non-adaptive ones.
A knowledge-based solution for automatic mapping in component based automation systems

Due to the current business requirements, the manufacturing industry is striving to reduce design, development and commissioning time of production systems to manufacture new products in a timely manner. The use of new technologies such as virtual engineering, automatic code generation and knowledge-based approaches is being extensively researched. This paper presents a framework that utilizes a knowledge-based approach to automate the component mapping in the code generation process. The raw data is taken from simulation models of manufacturing systems developed in 3D based virtual engineering tools. Moreover, a prototype implementation is presented and the results are discussed.

General information

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Keywords: ontologies (artificial intelligence), product design, product development, virtual manufacturing, 3D based virtual engineering tools, automatic code generation, automatic mapping, business requirements, component mapping, component-based automation systems, manufacturing industry, product manufacturing, production system commissioning time reduction, production system design time reduction, production system development time reduction, raw data, simulation models, virtual engineering, Actuators, Cognition, Data models, Engines, Manufacturing systems, OWL, Ontologies, SWRL, Virtual engineering, control systems, data mapping, knowledge representation, ontology
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Research output: Scientific - peer-review › Conference contribution

From artificial cognitive systems and open architectures to cognitive manufacturing systems

Considering constantly increasing demand for shift from mass production to mass customization and the need to maintain high level of automation despite permanent changes in manufacturing technologies and tools new approaches and solutions have to be provided in manufacturing. Cyber-Physical Systems and Industrial Internet of Things are enabling
smart manufacturing to tackle the challenge of data processing, integration and interpretation, but beyond uniformed data collection and visualization. The cognitive approach is argued to introduce brain and biologically-inspired algorithms capable to better adapt industrial systems for unforeseen conditions. Such approach should provide flexible and robust solution for manufacturing systems, enabling new level of adaptability and re-configurability in the system by self-X capabilities. In this paper contemporary solutions applicable for introduction of cognitive capabilities in manufacturing systems are studied and the architecture for cognitive manufacturing system employing benefits of Industrial Internet and Cognitive Control is proposed.

Knowledge-driven finite-state machines. Study case in monitoring industrial equipment

Traditionally state machines are implemented by coding the desired behavior of a given system. This work proposes the use of ontological models to describe and perform computations on state machines by using SPARQL queries. This approach represents a paradigm shift relating to the customary manner in which state machines are stored and computed. The main contribution of the work is an ontological model to represent state machines and a set of generic queries that can be used in any knowledge-driven state machine to compute valuable information. The approach was tested in a study case were the state machines of industrial robots in a manufacturing line were modeled as ontological models and used for monitoring the behavior of these devices on real time.
On the dynamics of a Recurrent Hopfield Network
In this research paper novel real/complex valued recurrent Hopfield Neural Network (RHNN) is proposed. The method of synthesizing the energy landscape of such a network and the experimental investigation of dynamics of Recurrent Hopfield Network is discussed. Parallel modes of operation (other than fully parallel mode) in layered RHNN is proposed. Also, certain potential applications are proposed.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D)
Authors: Garimella, R., Kicanaoglu, B., Gabbouj, M.
Number of pages: 8
Pages: 1-8
Publication date: 1 Jul 2015

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
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Video, Middle East Technical University, Electrical and Electronics Engineering Department
Authors: Aytekin, C., Rezaeitabar, Y., Dogru, S., Ulusoy, I.
Number of pages: 7
Pages: 1101-1107
Publication date: 1 Jul 2015
Peer-reviewed: Yes
Representation of manufacturing equipment and services for OKD-MES: From service descriptions to ontology

Demand for efficiency in the domain of manufacturing increases driven by competition for resources and customers. Adaptation of the modern concepts which have proven their benefits in other domains to the automation of manufacturing systems provides a field for innovation. Recent developments in Cyber-Physical Systems, Service-oriented Architecture and Knowledge-Driven Approach suggest an ecosystem for contemporary factory. Such set of concepts is applied in the eScop project for implementation of Open Knowledge-Driven Manufacturing Execution System (OKD-MES). The Knowledge-Driven approach introduces new possibilities for efficient operation of the system, but also requires significant effort to describe knowledge about the system. Significant part of this knowledge may be provided by the equipment in the factory shop floor. The approach which facilitates the process of population of knowledge base using the data from manufacturing equipment in automated manner should lower the cost and the organizational threshold for introduction of OKD-MES to the industry. This paper evaluates the possibilities for extraction of required semantic data from the descriptions provided by the smart service-oriented manufacturing equipment.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Faculty of Engineering Sciences, Research area: Manufacturing and Automation, Research group: Factory automation systems technology
Authors: Iarovyi, S., Ramis, B., Xu, X., Sampath, A., Lobov, A., Martinez Lastra, J. L.
Number of pages: 6
Pages: 1069-1074
Publication date: 1 Jul 2015

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Keywords: knowledge management, manufacturing systems, ontologies (artificial intelligence), organisational aspects, service-oriented architecture, OKD-MES, cyber-physical systems, eScop project, factory shop floor, knowledge base, knowledge-driven approach, manufacturing equipment representation, manufacturing service representation, ontology, open knowledge-driven manufacturing execution system, organizational threshold, semantic data extraction, service description, smart service-oriented manufacturing equipment, Automation, Manufacturing systems, OWL, Ontologies, Service-oriented architecture, CPS, Knowledge Driven systems, Linked Data, SOA, Web Services, industrial automation, ontologies
DOIs:
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Bibliographical note
AUX=orc,"Sampath, Anisa"
Source: Bibtex
Self-contained slices in H.264 for partial video decoding targeting 3D light-field displays

Some video applications work with parallel bitstreams however only parts of them are required. Decoding the streams entirely might be prohibitive due to high number of video streams and / or high resolution or bitrate of the streams. In such cases, a random access also referred as to partial decoding has to be supported. It can be achieved with a conforming decoder, if the video is separated into individual slices, and the unnecessary slices are dropped from the bit stream. Such a feature is essential in 3D lightfield displays in which partial decoding of bitstreams helps providing less complex and thus real-time decoding and processing. This paper studies the problem of creating self-contained (i.e., independently decodable) slices in an H.264 stream. The requirements that need to be fulfilled in order to build selfcontained slices are described, and an encoder-side solution is proposed. The advantages of self-contained slices are examined in the context of a light-field rendering application that relies on partial decoding.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: 3D MEDIA, Signal Processing Research Community (SPRC)
Authors: Zare, A., Kovacs, P., Gotchev, A.
Number of pages: 4
Pages: 1-4
Publication date: 1 Jul 2015

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Bibliographical note
AUX=sgn,"Zare, A."
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Source-ID: urn:ac791505d3e8a263cc2475f4b8b61a98
Research output: Scientific - peer-review » Conference contribution

Single-cell kinetics of a repressilator when implemented in a single-copy plasmid

Synthetic genetic clocks, such as the Elowitz-Leibler repressilator, will be key regulatory components of future synthetic circuits. We constructed a single-copy repressilator (SCR) by implementing the original repressilator circuit on a single-copy F-plasmid. After verifying its functionality, we studied its behaviour as a function of temperature and compared it with that of the original low-copy-number repressilator (LCR). Namely, we compared the period of oscillations, functionality (the fraction of cells exhibiting oscillations) and robustness to internal fluctuations (the fraction of expected oscillations that would occur). We found that, under optimal temperature conditions, the dynamics of the two systems differs significantly, although qualitatively they respond similarly to temperature changes. Exception to this is in the functionality, in which the SCR is higher at low temperatures but lower at high temperatures. Next, by adding IPTG to the medium at low and high concentrations during microscopy sessions, we showed that the functionality of the SCR is more robust to external perturbations, which indicates that the oscillatory behaviour of the LCR can be disrupted by affecting only a few of the copies in a cell. We conclude that the SCR, the first functional, synthetic, single-copy, ring-type genetic clock, is more robust to lower temperatures and to external perturbations than the original LCR. The SCR will be of use in future synthetic circuits, since it complements the array of tasks that the LCR can perform.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Speed-optimized free-viewpoint rendering based on depth layering

In this paper free-viewpoint rendering is addressed and a new fast approach for virtual views synthesis from view-plus-depth 3D representation is proposed. Depth layering in disparity domain is employed in order to optimally approximate the scene geometry by a set of constant depth layers. This approximation facilitates the use of connectivity information for segment-based forward warping of the reference layer map, producing a complete virtual view layer map containing no cracks or holes. The warped layer map is used to guide the disocclusions inpainting process of the synthesized texture map. For this purpose, a speed-optimized patch-based inpainting approach is proposed. In contrast to the existing methods, patch similarity function is based on local binary patterns descriptors. Such binary representation allows for efficient processing and comparison of patches, as well as compact storage and reuse of previously calculated binary descriptors. The experimental results demonstrate realtime capability of the proposed method even for CPU-based implementation, while the quality is comparable with other view synthesis approaches.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: 3D MEDIA, Department of Signal Processing, Signal Processing Research Community (SPRC)
Authors: Chuchvara, A., Suominen, O., Georgiev, M., Gotchev, A.
Number of pages: 4
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Publication date: 1 Jul 2015

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Keywords: image representation, image restoration, image segmentation, image texture, natural scenes, rendering (computer graphics), CPU-based implementation, binary representation, depth layering, local binary pattern descriptor, reference layer map segment-based forward warping, scene geometry, speed-optimized free-viewpoint rendering, speed-
Towards processing and reasoning streams of events in knowledge-driven manufacturing execution systems

The incessant need of the industry to optimize processes due to market demands derived in a huge investment on information communication technologies implementation during last decades, in the industrial automation domain. This caused the implementation of paradigms as service-oriented or event-driven architectures in factories, used for wide data integration. Moreover, the use of knowledge representation, within ontologies, permitted the description of system status in knowledge bases, which can be queried and updated at runtime. Due to the massive occurrence of events at any location of the enterprise, complex event processing (CEP) technologies can be used for anticipating facts that can compromise the production at shop floors. In fact, recent implementations on processing and reasoning streams of events in the Semantic Web can be applied also in the industrial automation domain because they combine CEP and SPARQL, which are technologies nowadays used by factory systems. This article describes how these technologies can support the study of the ontological system models evolution through time and an approach to bring predictability to current knowledge-based systems.

General information

State: Published

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Organisations: Department of Automation Science and Engineering, Research area: Manufacturing and Automation, Research group: Factory automation systems technology, Faculty of Engineering Sciences

Authors: Ferrer, B. R., Iarovyi, S., Lobov, A., Martinez Lastra, J. L.

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Keywords: SQL, factory automation, knowledge based systems, ontologies (artificial intelligence), production engineering computing, semantic Web, service-oriented architecture, CEP technologies, SPARQL, complex event processing, data integration, event processing stream, event reasoning stream, event-driven architectures, industrial automation domain, information communication technology implementation, investment, knowledge representation, knowledge-based systems, knowledge-driven manufacturing execution systems, market demands, ontological system model evolution, ontologies, service-oriented architectures, Automation, Cognition, Manufacturing, Monitoring, Ontologies, Production, Resource description framework, Complex Event Processing, industrial automation, knowledge-based systems

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Research output: Scientific - peer-review › Conference contribution

Accessible Games for Blind Children, Empowered by Binaural Sound

Accessible games have been researched and developed for many years, however, blind people still have very limited access and knowledge of them. This can pose a serious limitation, especially for blind children, since in recent years electronic games have become one of the most common and wide spread means of entertainment and socialization. For our implementation we use binaural technology which allows the player to hear and navigate the game space by adding localization information to the game sounds. With our implementation and user studies we provide insight on what constitutes an accessible game for blind people as well as a functional game engine for such games. The game engine developed allows the quick development of games for the visually impaired. Our work provides a good starting point for future developments on the field and, as the user studies show, was very well perceived by the visually impaired children that tried it.
General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Science For You, N.P.C. - SciFY, Ionian University
Authors: Drossos, K., Zormpas, N., Giannakopoulos, G., Floros, A.
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Pages: 5:1-5:8
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Research output: Scientific - peer-review › Conference contribution

Data Intensive Computing: From Modeling to Implementation

General information
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Organisations: Department of Pervasive Computing, Research area: Computer engineering, Univ Oulu, University of Oulu, Dept Med Technol, Inst Biomed
Authors: Jääskeläinen, P., Boutellier, J.
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Scopus rating (2014): SJR 0.292 SNIP 1 CiteScore 0.99
Scopus rating (2013): SJR 0.27 SNIP 0.858 CiteScore 0.97
Scopus rating (2012): SJR 0.281 SNIP 0.869 CiteScore 1.04
Scopus rating (2011): SJR 0.252 SNIP 0.717 CiteScore 0.92
Scopus rating (2010): SJR 0.288 SNIP 0.829
Scopus rating (2009): SJR 0.293 SNIP 0.849
Scopus rating (2008): SJR 0.314 SNIP 0.661
Scopus rating (2007): SJR 0.34 SNIP 1.021
Scopus rating (2006): SJR 0.261 SNIP 0.688
Scopus rating (2005): SJR 0.379 SNIP 0.914
Scopus rating (2004): SJR 0.384 SNIP 1.05
Scopus rating (2003): SJR 0.561 SNIP 1.024
Scopus rating (2002): SJR 0.475 SNIP 1.004
Scopus rating (2001): SJR 0.316 SNIP 0.752
Lossy-to-lossless progressive coding of depth-maps
A progressive coding method is proposed for depth-map images, where the bitstream is encoded so that one can generate many lossy versions of the original, encompassing a wide range, from very low resolution up to lossless reconstruction. The partitions into regions of the lossy versions are assumed to be nested, so that a higher resolution image is obtained by splitting some regions of a lower resolution image. The encoder transmits to the decoder information about which regions to split, the extra contour to be added for obtaining the shapes of the more refined regions, and the extra depth values needed inside each new region. The efficient encoding of the anchor points in the progressive scenario, relative to the contour points already encoded, and the depth information recovery, are the main contributions of this paper. The progressive bitstream produced by the proposed method scales well over the whole range of rates, from low rates to lossless, reaching a performance close to that of the non-progressive methods.

On the Design of Hopfield Neural Networks: Synthesis of Hopfield Type Associative Memories
We present efficient methods for parametrizing planar models, to be used for depth value reconstruction inside selected regions in a depth image. The optimal plane for each region is represented using its quantized heights at three pixel locations. The decoder uses the decoded quantized heights to approximately represent the optimal plane. The three pixel...
locations are selected so that the distortion due to the approximation of the plane over the region is minimized. The planar reconstructions are used in competition with the piecewise constant reconstruction at the regions obtained through a merging process, where the two regions to be merged are those ensuring the optimal slope in the rate-distortion curve. The lossy depth compression algorithm including the planar modeling obtains a significantly better rate-distortion performance than the algorithm that uses only constant regions, with improvements up to 8 dB.

Polyphonic Sound Event Detection Using Multi Label Deep Neural Networks
In this paper, the use of multi label neural networks are proposed for detection of temporally overlapping sound events in realistic environments. Real-life sound recordings typically have many overlapping sound events, making it hard to recognize each event with the standard sound event detection methods. Frame-wise spectral-domain features are used as inputs to train a deep neural network for multi label classification in this work. The model is evaluated with recordings from realistic everyday environments and the obtained overall accuracy is 63.8%. The method is compared against a state-of-the-art method using non-negative matrix factorization as a pre-processing stage and hidden Markov models as a classifier. The proposed method improves the accuracy by 19% percentage points overall.

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.
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
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Organisations: Department of Pervasive Computing, Research area: Information security, Tampere University of Technology
Authors: Silverajan, B., Luoma, J., Vajaranta, M., Itäpuro, R.
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Source: Scopus
Source-ID: 84942601939
Research output: Scientific - peer-review › Conference contribution
remains more in the background before the students start working with cases and hands-on experiments later. The
description covers four separate courses, forming a prerequisite chain. The first and last one are lecture-based and it
takes at least two years to pass them; 3–4 years is more normal. The academic units are not essential here. Instead, one
of the main points is the repeated exposure to the various ways of thinking. In the following summary of the succession the
numbers 1–4 refer to the courses, but they can be just thought of as time-separated occasions: Ethics: 1. Laws 2. Laws 3.
Ethical questions in one’s own environment – technology-related ethical questions for individuals – ethical questions for
organizations. 4. Interview a security professional, ethical point of view included. Awareness: 1 & 2. Policies, guidelines
and web-sites of security information. 3. Daily observations (own or from news) and actions regarding information security,
4. Campaigns etc. Hacking: 1. By-pass authentication by changing the source code of a web page. 2. -- 3. Carry out and
report an exercise found at one of listed sites. 4. Laboratory exercises in hacking. Research: 1. Fill in a questionnaire
resembling the one from 3rd stage. 2. -- 3. A questionnaire to five acquaintances, completed by interviewing them; deal
with the results. 4. Read research papers, interview a security professional trying to generalize together with peers. The
paper explains the rationale of these exposures and how they are delivered. It must be noted that not everything is
compulsory for passing the courses. The paper reports observations concerning the student choices and feedback. The
course #3 appears in its earlier form in [1]. The current version was updated to be two times larger and more
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.

Stop It, and Be Stubborn!
A system is always may-terminating, if and only if from every reachable state, a terminal state is reachable. This publication argues that it is beneficial for both catching non-progress errors and stubborn, ample, and persistent set state space reduction to try to make verification models always may-terminating. An incorrect mutual exclusion algorithm is used as an example. The error does not manifest itself, unless the first action of the customers is modelled differently from other actions. An appropriate method is to add an alternative first action that models the customer stopping for good. This method typically makes the model always may-terminating. If the model is always may-terminating, then the basic strong stubborn set method preserves safety and some progress properties without any additional condition for solving the ignoring problem. Furthermore, whether the model is always may-terminating can be checked efficiently from the reduced state space.
Graph distance measures based on topological indices revisited

Graph distance measures based on topological indices have been already explored by Dehmer et al. Also, inequalities for those graph distance measures have been proved. In this paper, we continue studying such comparative graph measures based on the well-known Wiener index, graph energy and Randić index, respectively. We prove extremal properties of the graph distance measures for some special classes of graphs. To demonstrate useful properties of the measures, we also discuss numerical results. To conclude the paper we state some open problems.
The effects of neuron morphology on graph theoretic measures of network connectivity: The analysis of a two-level statistical model

We developed a two-level statistical model that addresses the question of how properties of neurite morphology shape the large-scale network connectivity. We adopted a low-dimensional statistical description of neurites. From the neurite model description we derived the expected number of synapses, node degree, and the effective radius, the maximal distance between two neurons expected to form at least one synapse. We related these quantities to the network connectivity described using standard measures from graph theory, such as motif counts, clustering coefficient, minimal path length, and small-world coefficient. These measures are used in a neuroscience context to study phenomena from synaptic connectivity in the small neuronal networks to large scale functional connectivity in the cortex. For these measures we provide analytical solutions that clearly relate different model properties. Neurites that sparsely cover space lead to a small effective radius. If the effective radius is small compared to the overall neuron size the obtained networks share similarities with the uniform random networks as each neuron connects to a small number of distant neurons. Large neurites with densely packed branches lead to a large effective radius. If this effective radius is large compared to the neuron size, the obtained networks have many local connections. In between these extremes, the networks maximize the variability of connection repertoires. The presented approach connects the properties of neuron morphology with large scale network properties without requiring heavy simulations with many model parameters. The two-steps procedure provides an easier interpretation of the role of each modeled parameter. The model is flexible and each of its components can be further expanded. We identified a range of model parameters that maximizes variability in network connectivity, the property that might affect network capacity to exhibit different dynamical regimes.

General information
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Organisations: Department of Signal Processing, Research group: Computational Neuro Science-CNS, University of Oslo
Authors: Acimovic, J., Mäki-Marttunen, T., Linne, M.
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Scopus rating (2014): SJR 2.086 SNIP 1.015 CiteScore 3.06
Scopus rating (2013): SJR 2.609 SNIP 1.023 CiteScore 3.27
Scopus rating (2012): SJR 2.486 SNIP 1.124 CiteScore 3.62
Scopus rating (2011): SJR 2.134 SNIP 0.803 CiteScore 2
Scopus rating (2010): SJR 2.093 SNIP 0.985
Scopus rating (2009): SJR 1.816 SNIP 0.868
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ASJC Scopus subject areas: Anatomy, Neuroscience (miscellaneous), Cellular and Molecular Neuroscience
Keywords: Graph theory, Motifs, Network connectivity, Neurite density field, Neuron morphology, Theoretical model
DOIs: 10.3389/fnana.2015.00076
Source: Scopus
Source-ID: 84935865748
Research output: Scientific - peer-review › Article

Computer Vision for Head Pose Estimation: Review of a Competition
This paper studies the prediction of head pose from still images, and summarizes the outcome of a recently organized competition, where the task was to predict the yaw and pitch angles of an image dataset with 2790 samples with known angles. The competition received 292 entries from 52 participants, the best ones clearly exceeding the state-of-the-art accuracy. In this paper, we present the key methodologies behind selected top methods, summarize their prediction accuracy and compare with the current state of the art.
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.
Fluctuations of Hi-Hat Timing and Dynamics in a Virtuoso Drum Track of a Popular Music Recording

Long-range correlated temporal fluctuations in the beats of musical rhythms are an inevitable consequence of human action. According to recent studies, such fluctuations also lead to a favored listening experience. The scaling laws of amplitude variations in rhythms, however, are widely unknown. Here we use highly sensitive onset detection and time series analysis to study the amplitude and temporal fluctuations of Jeff Porcaro's one-handed hi-hat pattern in "I Keep Forgetting"—one of the most renowned 16th note patterns in modern drumming. We show that fluctuations of hi-hat amplitudes and interbeat intervals (times between hits) have clear long-range correlations and short-range anticorrelations separated by a characteristic time scale. In addition, we detect subtle features in Porcaro's drumming such as small drifts in the 16th note pulse and non-trivial periodic two-bar patterns in both hi-hat amplitudes and intervals. Through this investigation we introduce a step towards statistical studies of the 20th and 21st century music recordings in the framework of complex systems. Our analysis has direct applications to the development of drum machines and to drumming pedagogy.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: Quantum Control and Dynamics, Research area: Computational Physics, Department of Physics, Department of Signal Processing, Research group: Audio research group, Computational Science X (CompX), Signal Processing Research Community (SPRC), Regensburg Univ Appl Sci, University of Regensburg, Electroacoust
In this paper, we investigate treatment cycles inferred from diabetes data by means of graph theory. We define the term treatment cycles graph-theoretically and perform a descriptive as well as quantitative analysis thereof. Also, we interpret our findings in terms of nursing and clinical management.
Using shRNA experiments to validate gene regulatory networks

Quantitative validation of gene regulatory networks (GRNs) inferred from observational expression data is a difficult task usually involving time intensive and costly laboratory experiments. We were able to show that gene knock-down experiments can be used to quantitatively assess the quality of large-scale GRNs via a purely data-driven approach (Olsen et al. 2014). Our new validation framework also enables the statistical comparison of multiple network inference techniques, which was a long-standing challenge in the field. In this Data in Brief we detail the contents and quality controls for the gene expression data (available from NCBI Gene Expression Omnibus repository with accession number GSE53091) associated with our study published in Genomics (Olsen et al. 2014). We also provide R code to access the data and reproduce the analysis presented in this article.
Multimedia applications and embedded platforms are both becoming very complex in order to improve user experience. Thus, multimedia developers need high-level methods to automate time-consuming and error-prone tasks. Dynamic dataflow modeling is attractive to describe complex applications, such as video codecs, at a high level of abstraction. This paper presents a dataflow-based design approach to implement video codecs on embedded multi-core platforms. First, we introduce a custom architecture model to design low-power multi-core chips based on distributed memory and Transport-Triggered Architecture processor cores. Then, we describe software synthesis techniques to improve dynamic dataflow implementations. This methodology has been implemented into open-source tools and demonstrated on video decoders based on the MPEG-4 Visual standard and the new High Efficiency Video Coding standard. The simulations achieve real-time decoding (40 FPS) of high definition (720 P) MPEG-4 Visual video sequences on a custom multi-core platform clocked at 1 GHz, which is an improvement of more than 100% over previously proposed implementations.
Identifying Cover Songs Using Information-Theoretic Measures of Similarity
This paper investigates methods for quantifying similarity between audio signals, specifically for the task of cover song detection. We consider an information-theoretic approach, where we compute pairwise measures of predictability between time series. We compare discrete-valued approaches operating on quantized audio features, to continuous-valued approaches. In the discrete case, we propose a method for computing the normalized compression distance, where we account for correlation between time series. In the continuous case, we propose to compute information-based measures of similarity as statistics of the prediction error between time series. We evaluate our methods on two cover song identification tasks using a data set comprised of 300 Jazz standards and using the Million Song Dataset. For both datasets, we observe that continuous-valued approaches outperform discrete-valued approaches. We consider approaches to estimating the normalized compression distance (NCD) based on string compression and prediction, where we observe that our proposed normalized compression distance with alignment (NCDA) improves average performance over NCD, for sequential compression algorithms. Finally, we demonstrate that continuous-valued distances may be combined to improve performance with respect to baseline approaches. Using a large-scale filter-and-refine approach, we demonstrate state-of-the-art performance for cover song identification using the Million Song Dataset.

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Organisations: Department of Signal Processing, Queen Mary Univ London, Queen Mary University London, University of London, Sch Elect Engn & Comp Sci
Authors: Foster, P., Dixon, S., Klapuri, A.
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On the Socio-Technical Dependencies in Free/Libre/Open Source Software Projects
During the course of the past two decades, Open Source Software (OSS) development model has lead to a number of projects which have produced software that rivals and in some cases even exceeds the scale and quality of the traditional software projects. Among others, Eclipse, Apache, Linux, and BSD operating system are representative examples of such success stories.

However, OSS project like traditional in-house projects, often pose the potential for enormous problems, whose effects run the gamut from immense cumulative delay through complete breakdown and failure. This situation is evident, as OSS development is a socio-technical endeavor and is non-trivial. Such development occurs within an intensively collaborative process, in which technical prowess must go hand in hand with the efficient coordination and management of a large number of social, inter-personal interactions across the development organization. Furthermore, those social and technical dimensions are not orthogonal. It has been recognized that the structure of a software product and the layout of the development organization working on that product correlate.

Therefore this thesis argue that a comprehensive understanding on the sustainable evolution of OSS projects can be gained through the examination of the mutual influence of social and technical dimensions in OSS development. Thus, the goal of this thesis is the verification and reasoning of the following proposition,

*The evolution of the Open Source Software (OSS) project is constrained by the non-orthogonal evolution of Social and
Technical dimensions (often termed as Socio-Technical dependency) of such projects.

In concrete terms, this thesis investigates and measures empirically the extent to which the two dimensions of OSS projects, social and technical, approximate and influence each other during the evolution of the projects. Perceived insight is then used to build proposals that would provide empirical basis to frame theory around the affirmed proposition.

Moving towards this goal, this thesis proposes models, methods, frameworks and tool supports to measure, assess, and reason the socio-technical dependency within OSS project context. The starting point is to propose a data model to mimic the social and technical dimensions and their inter-relationships. This model is instantiated through the repository data of OSS projects that represent each of these dimensions. Then, methods and a mathematical model are proposed to derive dependency between the two dimensions, and to utilize them in measuring socio-technical dependency quantitatively. These proposals are then put into practice within distinct OSS project contexts to empirically measure and investigate socio-technical dependency. Along the process, frameworks, architectural design and corresponding tool implementations are provided to automate the analysis and visualization of such dependency.

Reported results suggest that high degree of socio-technical congruence can be considered as the implicit underlying principle for building team collaboration and coordination within the developer community of long lived OSS projects. Even being highly distributed community of developers, and mostly using passive communication channels, OSS communities are tied together by maintaining task dependent communication. Such communication is often ad-hoc, adaptive and situated as it cope with rapid and continuous changes in the underlying software.

Additionally, collaboration among projects are significantly influenced by the resembling properties among the projects. Resembling properties (e.g., project domain, size, and programming language) often form a favorable ground, thus creating a stimuli for developers to participate in those projects.

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Authors: Syeed, M. M. M.
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Efficient Use of Teaching Technologies with Programming Education
Learning and teaching programming are challenging tasks that can be facilitated by using different teaching technologies. Visualization systems are software systems that can be used to help students in forming proper mental models of executed program code. They provide different visual and textual cues that help student in abstracting the meaning of a program code or an algorithm. Students also need to constantly practice the skill of programming by implementing programming assignments. These can be automatically assessed by other computer programs but parts of the evaluation need to be assessed manually by teachers or teaching assistants.

There are a lot of existing tools that provide partial solutions to the practical problems of programming courses: visualizing program code, assessing student programming submissions automatically or rubrics that help keeping manual assessment consistent. Taking these tools into use is not straightforward. To succeed, the teacher needs to find the suitable tools and properly integrate them into the course infrastructure supporting the whole learning process. As many programming courses are mass courses, it is a constant struggle between providing sufficient personal guidance and
feedback while retaining a reasonable workload for the teacher.

This work answers to the question "How can the teaching of programming be effectively assisted using teaching technologies?" As a solution, different learning taxonomies are presented from Computer Science perspective and applied to visualization examples so the examples could be used to better support deeper knowledge and the whole learning process within a programming course. Then, different parts of the assessment process of programming assignments are studied to find the best practices in supporting the process, especially when multiple graders are being used, to maintain objectivity, consistency and reasonable workload in the grading.

The results of the work show that teaching technologies can be a valuable aid for the teacher to support the learning process of the students and to help in the practical organization of the course without hindering the learning results or personalized feedback the students receive from their assignments. This thesis presents new visualization categories that allow deeper cognitive development and examples on how to integrate them efficiently into the course infrastructure. This thesis also presents a survey of computer-assisted assessment tools and assessable features for teachers to use in their programming assignments. Finally, the concept of rubric-based assessment tools is introduced to facilitate the manual assessment part of programming assignments.

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**A method and an apparatus for processing an audio signal**

**General information**
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Organisations: Department of Signal Processing, Research group: 3D MEDIA
Authors: Niemistö, R., Bregovic, R., Dumitrescu, B., Myllylä, V.
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Research output: Scientific › Patent
Wavefront reconstruction in digital off-axis holography via sparse coding of amplitude and absolute phase

This work presents the new method for wavefront reconstruction from a digital hologram recorded in off-axis configuration. The main feature of the proposed algorithm is a good ability for noise filtration due to the original formulation of the problem taking into account the presence of noise in the recorded intensity distribution and the sparse phase and amplitude reconstruction approach with the data-adaptive block-matching 3D technique. Basically, the sparsity assumes that low dimensional models can be used for phase and amplitude approximations. This low dimensionality enables strong suppression of noisy components and accurate revealing of the main features of the signals of interest. The principal point is that dictionaries of these sparse models are not known in advance and reconstructed from given noisy observations in a multiobjective optimization procedure. We show experimental results demonstrating the effectiveness of our approach. (C) 2015 Optical Society of America

General information
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Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing
Research Community (SPRC), ITMO Univ, ITMO University, Dept Photon & Opt Informat Technol
Authors: Katkovnik, V., Shevkunov, I. A., Petrov, N. V., Egiazarian, K.
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Scopus rating (2013): SJR 2.458 SNIP 2.095 CiteScore 3.95
Scopus rating (2012): SJR 2.596 SNIP 1.95 CiteScore 3.52
Scopus rating (2011): SJR 2.518 SNIP 2.475 CiteScore 3.69
Scopus rating (2010): SJR 2.669 SNIP 2.293
Scopus rating (2009): SJR 3.167 SNIP 2.665
Scopus rating (2008): SJR 3.408 SNIP 2.378
Scopus rating (2007): SJR 3.489 SNIP 2.102
Scopus rating (2006): SJR 3.143 SNIP 2.334
Scopus rating (2005): SJR 3.251 SNIP 2.483
Scopus rating (2004): SJR 3.521 SNIP 2.718
Scopus rating (2003): SJR 3.708 SNIP 2.573
Scopus rating (2002): SJR 3.702 SNIP 2.39
Scopus rating (2001): SJR 3.62 SNIP 2.244
Scopus rating (2000): SJR 3.416 SNIP 1.705
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Source-ID: 000354708300067
Research output: Scientific - peer-review › Article

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...
We investigated the structural and functional properties of GRNs for the identification of molecular targets associated with 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., HIF1/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.
Experiments of the sonification of the sleep electroencephalogram

It is becoming possible to perform sleep recordings at home with equipment targeted for the regular consumers. This alleviates the pressures to increase capacity in sleep clinics. The interpretation of the sleep recordings is not very easy for the laymen and alternative assisting methods should be sought for this. Sonification is a method by which a phenomenon is converted to a sound for human listeners. This paper describes experiments made for the sonification of the electric activity of the brain, the electroencephalography (EEG) for the purpose of recognizing the presence and absence of the necessary refreshing components of sleep, deep sleep and rapid eye movement (REM) sleep. The methods are based on the calculation of features of the EEG signal which are characteristic to the deep and REM sleep as well as wakefulness. The features are converted to amplitude modulation functions of artificial and musical instrument sounds by using mathematical transforms such as Principal Component Analysis and Linear Discriminant Analysis. The results indicate that modulated sinusoidal signals are not appropriate for the sonification of sleep EEG but that modulating the sound of musical instruments could be a viable option for making the recognition of good and bad sleep possible.

General information

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Organisations: Department of Signal Processing, Research group: Sleep and Sensory Signal Analysis Group-SSSAG, Instituto Superior Tecnico, Lissabon, Portugal
Authors: Franco, P., Värri, A.
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Peer-reviewed: Yes

Techniques and Practices for Software Architecture Work in Agile Software Development

Since the publishing of Agile Manifesto in 2001, the agile software development has taken the world by storm. Agile software development does not emphasize the importance of software architecture, even though software architecture is often seen as a key factor for achieving the quality goals set for the software system. It has been even said that agile software development and software architecture are a clash of two cultures.

In many software projects there is no need to consider software architecture anymore. For example, when designing a mobile application, the ecosystem forces the developer to use certain architecture style provided by the platform. In web development ready-made frameworks and project templates are available offering complete software architecture designs for the application developer.

There are still domains and systems where careful architecture design is needed. When developing complex systems or systems with a long lifecycle, diligent software architecture design is a key to avoid massive rework during the development. It cannot be a coincidence that companies developing these kinds of systems struggle with agile software development the most.

On the one hand, the goal of this thesis was to study software architecture practices used in agile software development in the industry. On the other hand, the goal was to develop new methods and techniques to support incremental software
architecture working practices which can be aligned with agile methods such as Scrum. The study applied case study, interviews and design science as the main research methods.

The results show that there are four main ways to carry out software architecture work while using agile methods. Basing on this result, models for aligning software architecture knowledge management were developed. These models can be used as guidelines for selecting the appropriate software architecture practices in an organization.

As a part of the research work, an architecture knowledge repository was developed for sharing the knowledge in agile projects and for automatic software architecture document generation. Additionally, the results of this study show that by taking a decision-centric approach to software architecture evaluation, the evaluation method can be lightweight enough to make incremental evaluation a viable option. Similarly, existing software architecture evaluation methods can be boosted to fit agile software development by utilizing domain knowledge.

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Research output: Collection of articles › Doctoral Thesis

Microarray analysis of differentially expressed genes in ovarian and fallopian tube epithelium from risk-reducing salpingo-oophorectomies
Mutations in the BRCA1 and BRCA2 genes confer an increased lifetime risk for breast and ovarian cancer. Ovarian cancer risk can be decreased by risk-reducing salpingo-oophorectomy (RRSO). Studies on RRSO material have altered the paradigm of serous ovarian cancer pathogenesis. The purpose of this study was to identify candidate genes possibly involved in the pathogenesis of serous ovarian cancer by carrying out a microarray analysis of differentially expressed genes in BRCA1/2- mutation positive ovarian and fallopian tube epithelium derived from RRSO surgery. Freshly frozen ovarian and fallopian tube samples from nine BRCA1/2 mutation carriers scheduled for RRSO were prospectively collected together with five mutation-negative control patients undergoing salpingo-oophorectomy for benign indications. Microarray analysis of genome-wide gene expression was performed on ovarian and fallopian tube samples from the BRCA1/2 and control patients. The validation of microarray data was performed by quantitative real-time polymerase chain reaction (qRT-PCR) in selected cases of RRSO samples and also in high grade serous carcinoma samples collected from patients with a BRCA phenotype. From 22,733 genes, 454 transcripts were identified that were differentially expressed in BRCA1/2 mutation carriers when compared with controls, pooling all ovarian and fallopian tube samples together. Of these, 299 genes were statistically significantly downregulated and 155 genes upregulated. Differentially expressed genes in BRCA1/2 samples reported here might be involved in serous ovarian carcinogenesis and provide interesting targets for further studies.

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Algorithms for computer-aided diagnosis of dementia based on structural MRI have demonstrated high performance in the literature, but are difficult to compare as different data sets and methodology were used for evaluation. In addition, it is unclear how the algorithms would perform on previously unseen data, and thus, how they would perform in clinical practice when there is no real opportunity to adapt the algorithm to the data at hand. To address these comparability, generalizability and clinical applicability issues, we organized a grand challenge that aimed to objectively compare algorithms based on a clinically representative multi-center data set. Using clinical practice as the starting point, the goal was to reproduce the clinical diagnosis. Therefore, we evaluated algorithms for multi-class classification of three diagnostic groups: patients with probable Alzheimer's disease, patients with mild cognitive impairment and healthy controls. The diagnosis based on clinical criteria was used as reference standard, as it was the best available reference despite its known limitations. For evaluation, a previously unseen test set was used consisting of 354 T1-weighted MRI scans with the diagnoses blinded. Fifteen research teams participated with a total of 29 algorithms. The algorithms were trained on a small training set (n = 30) and optionally on data from other sources (e.g., the Alzheimer's Disease Neuroimaging Initiative, the Australian Imaging Biomarkers and Lifestyle flagship study of aging). The best performing algorithm yielded an accuracy of 63.0% and an area under the receiver-operating-characteristic curve (AUC) of 78.8%. In general, the best performances were achieved using feature extraction based on voxel-based morphometry or a combination of features that included volume, cortical thickness, shape and intensity. The challenge is open for new submissions via the web-based framework: http://caddementia.grand-challenge.org. (C) 2015 Elsevier Inc. All rights reserved.
Understanding business ecosystem dynamics: A data-driven approach

Business ecosystems consist of a heterogeneous and continuously evolving set of entities that are interconnected through a complex, global network of relationships. However, there is no well-established methodology to study the dynamics of this network. Traditional approaches have primarily utilized a single source of data of relatively established firms; however, these approaches ignore the vast number of relevant activities that often occur at the individual and entrepreneurial levels.
We argue that a data-driven visualization approach, using both institutionally and socially curated datasets, can provide important complementary, triangulated explanatory insights into the dynamics of interorganizational networks in general and business ecosystems in particular. We develop novel visualization layouts to help decision makers systemically identify and compare ecosystems. Using traditionally disconnected data sources on deals and alliance relationships (DARs), executive and funding relationships (EFRs), and public opinion and discourse (POD), we empirically illustrate our data-driven method of data triangulation and visualization techniques through three cases in the mobile industry Google’s acquisition of Motorola Mobility, the coopetitive relation between Apple and Samsung, and the strategic partnership between Nokia and Microsoft. The article concludes with implications and future research opportunities.

General information

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Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, School of Interacting, Computing and Tennenbaum Institute, Georgia Institute of Technology, MediaX, Stanford University, Graduate School of Information Systems, University of Electro-Communications, VTT Technical Research Centre of Finland, School of Industrial and Systems Engineering, Tennenbaum Institute
Authors: Basole, R. C., Russell, M. G., Huhtamäki, J., Rubens, N., Still, K., Park, H.
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Scopus rating (2013): SJR 0.879 SNIP 1.445 CiteScore 2.31
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Research output: Scientific - peer-review > Article

Interferometric Phase Image Estimation via Sparse Coding in the Complex Domain

This paper addresses interferometric phase image estimation, i.e., the estimation of phase modulo-2 pi images from sinusoidal 2 pi-periodic and noisy observations. These degradation mechanisms make interferometric phase image estimation a quite challenging problem. We tackle this challenge by reformulating the true estimation problem as a sparse regression, often termed sparse coding, in the complex domain. Following the standard procedure in patch-based image restoration, the image is partitioned into small overlapping square patches, and the vector corresponding to each patch is modeled as a sparse linear combination of vectors, termed the atoms, taken from a set called dictionary. Aiming at optimal sparse representations, and thus at optimal noise removing capabilities, the dictionary is learned from the data that it represents via matrix factorization with sparsity constraints on the code (i.e., the regression coefficients) enforced by the l(1) norm. The effectiveness of the new sparse-coding-based approach to interferometric phase estimation, termed the SpInPHASE, is illustrated in a series of experiments with simulated and real data where it outperforms the state-of-the-art.

General information

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Organisations: Department of Signal Processing, Signal Processing Research Community (SPRC), Natl Univ Def Technol, National University of Defence Technology - China, Coll Informat Syst & Management, Univ Lisbon, Instituto Superior Tecnico, Universidade de Lisboa, Instituto de Telecomunicacoes, Inst Super Tecn, Inst Telecomunicacoes
Authors: Hongxing, H., Bioucas-Dias, J. M., Katkovnik, V.
Number of pages: 16
IGFBP2 potentiates nuclear EGFR-STAT3 signaling

Insulin-like growth factor binding protein 2 (IGFBP2) is a pleiotropic oncogenic protein that has both extracellular and intracellular functions. Despite a clear causal role in cancer development, the tumor-promoting mechanisms of IGFBP2 are poorly understood. The contributions of intracellular IGFBP2 to tumor development and progression are also unclear.
Here we present evidence that both exogenous IGFBP2 treatment and cellular IGFBP2 overexpression lead to aberrant activation of epidermal growth factor receptor (EGFR), which subsequently activates signal transducer and activator of transcription factor 3 (STAT3) signaling. Furthermore, we demonstrate that IGFBP2 augments the nuclear accumulation of EGFR to potentiate STAT3 transactivation activities, via activation of the nuclear EGFR signaling pathway. Nuclear IGFBP2 directly influences the invasive and migratory capacities of human glioblastoma cells, providing a direct link between intracellular (and particularly nuclear) IGFBP2 and cancer hallmarks. These activities are also consistent with the strong association between IGFBP2 and STAT3-activated genes derived from The Cancer Genome Atlas database for human glioma. A high level of all three proteins (IGFBP2, EGFR and STAT3) was strongly correlated with poorer survival in an independent patient data set. These results identify a novel tumor-promoting function for IGFBP2 of activating EGFR/STAT3 signaling and facilitating EGFR accumulation in the nucleus, thereby deregulating EGFR signaling by two distinct mechanisms. As targeting EGFR in glioma has been relatively unsuccessful, this study suggests that IGFBP2 may be a novel therapeutic target.

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Scopus rating (2014): SJR 4.371 SNIP 1.691 CiteScore 6.83
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Scopus rating (2012): SJR 4.436 SNIP 1.658 CiteScore 7.04
Scopus rating (2011): SJR 4.779 SNIP 1.639 CiteScore 7.04
Scopus rating (2010): SJR 5.219 SNIP 1.676
Scopus rating (2009): SJR 5.236 SNIP 1.64
Scopus rating (2008): SJR 4.921 SNIP 1.61
Scopus rating (2006): SJR 4.147 SNIP 1.455
Scopus rating (2005): SJR 4.186 SNIP 1.447
Scopus rating (2004): SJR 3.897 SNIP 1.343
Scopus rating (2003): SJR 4.115 SNIP 1.295
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'miSimBa' - A simulator of synthetic time-lapsed microscopy images of bacterial cells
Escherichia coli is a model organism for the study of multiple biological processes, including gene expression and cellular aging. Recently, these studies started to rely on temporal single cell imaging. To support these efforts, available automated image analysis methods should be improved. One important step is their validation. Ideally, the 'ground truth' of the images should be known, which is possible only in synthetic images. To simulate artificial images of E. coli cells, we are developing the 'miSimBa' tool (Microscopy Image Simulator of Bacterial Cells). 'miSimBa' simulates images that reproduce the spatial and temporal bacterial organization by modelling realistically cell morphology (shape, size and spatial arrangement), cell growth and division, cell motility and some internal functions and intracellular structures, namely,
the nucleoid. This tool also incorporates image acquisition parameters that simulate illumination and the primary sources of noise.

SmartWoW – constructing a tool for knowledge work performance analysis

Purpose – New Ways of Working (NewWoW) refers to a novel approach for improving the performance of knowledge work. The purpose of this paper is to seek innovative solutions concerning facilities, information technology tools and work practices in order to be able to “work smarter, not harder.” In order to develop work practices toward the NewWoW mode there is a need for an analytical management tool that would help assess the status of the organization’s current work practices and demonstrate the impacts of development initiatives. This paper introduces such a tool.

Design/methodology/approach – Constructive research approach was chosen to guide the development of the Smart ways of working (SmartWoW) tool. The tool was designed on the basis of previous knowledge work performance literature as well as on interviews in two knowledge-intensive organizations. The usefulness of the tool was verified by applying it in four organizations. Findings – SmartWoW is a compact questionnaire tool for analyzing and measuring knowledge work at the individual level. The questionnaire consists of four areas: work environment, personal work practices, well-being at work and productivity. As SmartWoW is a standardized tool its results are comparable between organizations. Research limitations/implications – SmartWoW was designed a pragmatic managerial tool. It is considered possible that it can be valuable as a research instrument as well but the current limited amount of collected data does not yet facilitate determining its usefulness from that perspective. Originality/value – This paper makes a contribution to the existing literature on knowledge work measurement and management by introducing an analytical tool which takes into account the NewWoW perspective.
Cancer research in the era of next-generation sequencing and big data calls for intelligent modeling
We examine the role of big data and machine learning in cancer research. We describe an example in cancer research where gene-level data from The Cancer Genome Atlas (TCGA) consortium is interpreted using a pathway-level model. As the complexity of computational models increases, their sample requirements grow exponentially. This growth stems from the fact that the number of combinations of variables grows exponentially as the number of variables increases. Thus, a large sample size is needed. The number of variables in a computational model can be reduced by incorporating biological knowledge. One particularly successful way of doing this is by using available gene regulatory, signaling, metabolic, or context-specific pathway information. We conclude that the incorporation of existing biological knowledge is essential for the progress in using big data for cancer research.

Calibration method for improving the autofocusing speed in digital cameras

General information
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Organisations: Department of Signal Processing, Research group: Computational Systems Biology
Authors: Yli-Hietanen, J., Ylipää, A., Yli-Harja, O.
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Source: WOS
Source-ID: 000360225300001
Research output: Scientific - peer-review › Article
A Bayesian approach for suppression of limited angular sampling artifacts in single particle 3D reconstruction

In the single particle reconstruction, the initial 3D structure often suffers from the limited angular sampling artifact. Selecting 2D class averages of particle images generally improves the accuracy and efficiency of the reference-free 3D angle estimation, but causes an insufficient angular sampling to fill the information of the target object in the 3D frequency space. Similarly, the initial 3D structure by the random-conical tilt reconstruction has the well-known "missing cone" artifact. Here, we attempted to solve the limited angular sampling problem by sequentially applying maximum a posteriori estimate with expectation maximization algorithm (sMAP-EM). Using both simulated and experimental cryo-electron microscope images, the sMAP-EM was compared to the direct Fourier method on the basis of reconstruction error and resolution. To establish selection criteria of the final regularization weight for the sMAP-EM, the effects of noise level and sampling sparseness on the reconstructions were examined with evenly distributed sampling simulations. The frequency information filled in the missing cone of the conical tilt sampling simulations was assessed by developing new quantitative measurements. All the results of visual and numerical evaluations showed the sMAP-EM performed better than the direct Fourier method, regardless of the sampling method, noise level, and sampling sparseness. Furthermore, the frequency domain analysis demonstrated that the sMAP-EM can fill the meaningful information in the unmeasured angular space without detailed a priori knowledge of the objects. The current research demonstrated that the sMAP-EM has a high potential to facilitate the determination of 3D protein structures at near atomic-resolution.
Sparse logistic regression and polynomial modelling for detection of artificial drainage networks

Mire ditching changes dramatically mire biodiversity. Thus, drainage network detection is an important factor when analysing the natural state of a mire. In this article, we propose a method for automated drainage network detection from raster digital terrain model created from high-resolution laser scanning data. Sparse logistic regression classifier with a large generic feature set and automated feature selection is used for classification. Broken segments are connected with polynomial modelling. The results showed that our method can accurately detect artificial drainage networks.

ADAM: A general method for using various data types in asteroid reconstruction

We introduce ADAM, the All-Data Asteroid Modelling algorithm. ADAM is simple and universal since it handles all disk-resolved data types (adaptive optics or other images, interferometry, and range-Doppler radar data) in a uniform manner via the 2D Fourier transform, enabling fast convergence in model optimization. The resolved data can be combined with disk-integrated data (photometry). In the reconstruction process, the difference between each data type is only a few code lines defining the particular generalized projection from 3D onto a 2D image plane. Occultation timings can be included as
sparse silhouettes, and thermal infrared data are efficiently handled with an approximate algorithm that is sufficient in practice because of the dominance of the high-contrast (boundary) pixels over the low-contrast (interior) pixels. This is of particular importance to the raw ALMA data that can be directly handled by ADAM without having to construct the standard image. We study the reliability of the inversion, using the independent shape supports of function series and control-point surfaces. When other data are lacking, one can carry out fast non-convex lightcurve-only inversions, but any shape models resulting from it should only be taken as illustrative large-scale models.

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Mathematics, Research group: MAT Inverse Problems, Mathematical modelling with wide societal impact (MathImpact), Astronomical Institute, Faculty of Mathematics and Physics, Charles University in Prague
Authors: Viikinkoski, M., Kaasalainen, M., Durech, J.
Number of pages: 11
Publication date: 1 Apr 2015
Peer-reviewed: Yes

Publication information
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Scopus rating (2014): SJR 2.823 SNIP 1.219 CiteScore 2.82
Scopus rating (2013): SJR 2.544 SNIP 1.058 CiteScore 2.01
Scopus rating (2012): SJR 2.585 SNIP 1.295 CiteScore 3.14
Scopus rating (2011): SJR 2.373 SNIP 1.231 CiteScore 3.42
Scopus rating (2010): SJR 2.74 SNIP 1.444
Scopus rating (2009): SJR 2.879 SNIP 1.404
Scopus rating (2008): SJR 2.923 SNIP 1.297
Scopus rating (2007): SJR 2.816 SNIP 1.34
Scopus rating (2006): SJR 3.224 SNIP 1.349
Scopus rating (2005): SJR 2.891 SNIP 1.355
Scopus rating (2004): SJR 2.633 SNIP 1.462
Scopus rating (2003): SJR 1.967 SNIP 1.373
Scopus rating (2002): SJR 1.742 SNIP 1.346
Scopus rating (2001): SJR 1.555 SNIP 0.727
Scopus rating (2000): SJR 2.178 SNIP 1.039
Scopus rating (1999): SJR 2.489 SNIP 1.076
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ASJC Scopus subject areas: Astronomy and Astrophysics, Space and Planetary Science
Keywords: Methods: analytical, Methods: numerical, Minor planets, asteroids: general, Minor planets, asteroids: individual: 2000 ET70, Minor planets, asteroids: individual: Daphne
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10.1051/0004-6361/201425259
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http://URN.fi/URN:NBN:fi tty-201603083624
Links:
http://www.scopus.com/inward/record.url?scp=84925251323&partnerID=8YFLLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84925251323
Research output: Scientific - peer-review › Article

Image Processing: Algorithms and Systems XIII

General information
Computational Methods for Modelling and Analysing Biological Networks

The main theme of this thesis is modelling and analysis of biological networks. Measurement data from biological systems is being produced at such a pace that it is impossible to make use of it without computational models and inference algorithms. The methods and models presented here aim at allowing to extract relevant relationships from the masses of data and formulating complex biological hypotheses that can be studied via simulation. The problem of learning the structure of a popular method class, Bayesian networks, from measurement data is investigated in this thesis, and an improvement to the standard method is presented that facilitates finding the correct network structure. Furthermore, this thesis studies active learning, where the structure inference algorithm can itself suggest measurements to be made. Active learning is applied to realistic scenarios with measured datasets and an active learning method that can deal with heterogeneous data types is presented. Another focus of this thesis is on analysing networks whose structure is known. The utility of a standard method for selecting beneficial mutations in metabolic networks is evaluated in the context of engineering the network to produce a desired substance at a higher rate than normally. Metabolic network modelling is also used in conjunction with a simulation of a biochemical network controlling bacterial movement in a state-based and executable framework that can integrate different submodels. This combined model is then used to simulate the behaviour of a population of bacteria. In summary, this thesis presents improvements on methods for learning network structures, evaluates the utility of an analysis method for identifying suitable mutations for producing a substance of interest, and introduces a state-based modelling framework capable of integrating several submodels.
"They do not get along without us and we do not get along without them...": Uncertainty in information system development

This paper discusses about issues related to uncertainties when developing information system in inter-organizational relationships (IORs). The study is a part of longitudinal grounded theory study where a business critical information system development (ISD) project is retrospectively followed over a time period of a one and half year. The main actors are two private sector organizations that share a long common ISD history and mutual trust. In the course of the project, prevailing optimism among actors generated uncertainties about the outcome and overall success of the project. The paper presents sources and consequences of those uncertainties from the IOR viewpoint. The findings provide new insights on the earlier studies of a dynamic nature of trust and uncertainties in ISD cooperation.

Sharpening the linear programming bound for linear Lee codes

Finding the largest code with a given minimum distance is one of the most basic problems in coding theory. A sharpening to the linear programming bound for linear codes in the Lee metric is introduced, which is based on an invariance-type property of Lee compositions of a linear code. Using this property, additional equality constraints are introduced into the linear programming problem, which give a tighter bound for linear Lee codes.
Genomically amplified Akt3 activates DNA repair pathway and promotes glioma progression

Akt is a robust oncogene that plays key roles in the development and progression of many cancers, including glioma. We evaluated the differential propensities of the Akt isoforms toward progression in the well-characterized RCAS/Ntv-a mouse model of PDGFB-driven low grade glioma. A constitutively active myristoylated form of Akt1 did not induce high-grade glioma (HGG). In stark contrast, Akt2 and Akt3 showed strong progression potential with 78% and 97% of tumors diagnosed as HGG, respectively. We further revealed that significant variations in polarity and hydropathy values among the Akt isoforms in both the pleckstrin homology domain (P domain) and regulatory domain (R domain) were critical in mediating glioma progression. Gene expression profiles from representative Akt-derived tumors indicated dominant and distinct roles for Akt3, consisting primarily of DNA repair pathways. TCGA data from human GBM closely reflected the DNA repair function, as Akt3 was significantly correlated with a 76-gene signature DNA repair panel. Consistently, compared with Akt1 and Akt2 overexpression models, Akt3-expressing human GBM cells had enhanced activation of DNA repair proteins, leading to increased DNA repair and subsequent resistance to radiation and temozolomide. Given the wide range of Akt3-amplified cancers, Akt3 may represent a key resistance factor.

General information

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Organisations: Department of Signal Processing, Research group: Computational Systems Biology, BioMediTech, Multiscaled biodata analysis and modelling (MultiBAM), Prostate cancer research center (PCRC), University of Texas, M. D. Anderson Cancer Center, Cancer Genomics Laboratory, Houston, TX, USA, Department of Pathology and Neuro-Oncology, Department of Neuro-Oncology
Number of pages: 6
Pages: 3421-3426
Publication date: 17 Mar 2015
Peer-reviewed: Yes
From the Internet of Things to the Internet of People

There's growing interest in developing applications for the Internet of Things. Such applications’ main objective is to integrate technology into people’s everyday lives, to be of service to them en masse. The form in which this integration is implemented, however, still leaves much room for improvement. Usually, the user must set parameters within the application. When the person’s context changes, they have to manually reconfigure the parameters. What was meant to be a commodity in an unforeseen situation then becomes extra noise. This article describes a reference architecture that improves how people are integrated with the IoT, with smartphones doing the connecting. The resulting integration opens the way to new IoT scenarios supporting evolution towards the Internet of People.

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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Software engineering, University of Extremadura, University of Malaga, Spain, Gloin
Authors: Miranda, J., Mäkitalo, N., Garcia-Alonso, J., Berrocal, J., Mikkonen, T., Canal, C., Murillo, J. M.
Number of pages: 8
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ISSN (Print): 1089-7801
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Scopus rating (2015): SJR 0.683 SNIP 2.125 CiteScore 2.81
The highways and country roads to continuous deployment

As part of a Finnish research program, researchers interviewed 15 information and communications technology companies to determine the extent to which the companies adopted continuous deployment. They also aimed to find out why continuous deployment is considered beneficial and what the obstacles are to its full adoption. The benefits mentioned the most often were the ability to get faster feedback, the ability to deploy more often to keep customers satisfied, and improved quality and productivity. Despite understanding the benefits, none of the companies adopted a fully automatic deployment pipeline. The companies also had higher continuous-deployment capability than what they practiced. In many cases, they consciously chose not to aim for full continuous deployment. Obstacles to full adoption included domain-imposed restrictions, resistance to change, customer desires, and developers' skill and confidence.
Improved weighted prediction based color gamut scalability in SHVC

One use case that the scalable extension (SHVC) of the state-of-the-art High Efficiency Video Coding (HEVC) standard aims for is to support Ultra High Definition (UHD) TV broadcast in a backwards compatible way with the existing High Definition (HD) TV broadcast. However, since UHD content typically has higher bit-depth and wider color gamut in addition to increased spatial resolution, the compression efficiency is highly affected by the inter-layer processing applied on the base layer picture. This paper proposes an improvement for the weighted prediction based color gamut scalability to have a better mapping between the color gamuts of the base and enhancement layers. The proposed method aims at capturing the nonlinear characteristics of the color gamut mapping using a piecewise linear model, whose parameters are signaled through weighted prediction mechanism and multiple inter-layer reference pictures. Compared to other existing methods for color gamut mapping in SHVC, such as the 3D Look Up Table (LUT) method, the proposed weighted prediction based approach is less complex, as it does not require any changes to the decoder. The simulation results show up to 3.8%...
Bjontegaard delta bitrate gain in luma for all intra and 3.0% for random access configurations compared to the existing weighted prediction based scalability method in SHVC.

**General information**

State: Published

Ministry of Education publication type: A4 Article in a conference publication

Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Åbo Akademi, Department of Information Technologies, Nokia, AVCR Information Technologies

Authors: Bugdayci Sansli, D., Aminlou, A., Ugur, K., Hannuksela, M. M., Gabbouj, M.

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DOIs: 10.1109/VCIP.2014.7051539

Source: Scopus

Source-ID: 84925424736

Research output: Scientific - peer-review » Conference contribution

**An Energy-efficient Live Video Coding and Communication over Unreliable Channels**

In the field of multimedia communications there exist many important applications where live or real-time video data is captured by a camera, compressed and transmitted over the channel which can be very unreliable and, at the same time, computational resources or battery capacity of the transmission device are very limited. For example, such scenario holds for video transmission for space missions, vehicle-to-infrastructure video delivery, multimedia wireless sensor networks, wireless endoscopy, video coding on mobile phones, high definition wireless video surveillance and so on. Taking into account such restrictions, a development of efficient video coding techniques for these applications is a challenging problem. The most popular video compression standards, such as H.264/AVC, are based on the hybrid video coding concept, which is very efficient when video encoding is performed off-line or non real-time and the pre-encoded video is played back. However, the high computational complexity of the encoding and the high sensitivity of the hybrid video bit stream to losses in the communication channel constitute a significant barrier of using these standards for the applications mentioned above. In this thesis, as an alternative to the standards, a video coding based on three-dimensional discrete wavelet transform (3-D DWT) is considered as a candidate to provide a good trade-off between encoding efficiency, computational complexity and robustness to channel losses. Efficient tools are proposed to reduce the computational complexity of the 3-D DWT codec. These tools cover all levels of the codec’s development such as adaptive binary arithmetic coding, bit-plane entropy coding, wavelet transform, packet loss protection based on error-correction codes and bit rate control. These tools can be implemented as end-to-end solution and directly used in real-life scenarios. The thesis provides theoretical, simulation and real-world results which show that the proposed 3-D DWT codec can be more preferable than the standards for live video coding and communication over highly unreliable channels and or in systems where the video encoding computational complexity or power consumption plays a critical role.

**General information**

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Ministry of Education publication type: G5 Doctoral dissertation (article)

Organisations: Department of Signal Processing, Research group: Video

Authors: Belyaev, E.

Number of pages: 61

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Original language: English

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Riding for a fall in outsourced ISD: Transferring knowledge between onshore vendor and offshored unit

General information
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Organisations: Department of Information Management and Logistics, Research group: Novi
Authors: Alanne, A., Pekkola, S.
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http://www.globalsourcing.org.uk/2013/05/the-8th-global-sourcing-workshop-23-26-of-march-2014-call-for-papers-released/
Research output: Professional › Conference contribution

Adaptive spatial resolution selection for stereoscopic video compression with MV-HEVC: A frequency based approach
One approach for stereoscopic video compression is to down sample the content prior to encoding and up sample it to the original spatial resolution after decoding. In this study it is shown that the ratio by which the content should be rescaled is sequence dependent. Hence, a frequency based method is introduced enabling fast and accurate estimation of the best down sampling ratio for different stereoscopic video clips. It is shown that exploiting this approach can bring 3.38% delta bitrate reduction over five camera-captured sequences.

General information
State: Published
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Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Nokia
Authors: Aflaki, P., Hannuksela, M. M., Gabbouj, M.
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Keywords: frequency power spectrum, MVC, objective quality metrics, resolution adjustment
DOIs: 10.1109/ISM.2014.11
Source: Scopus
Source-ID: 84930427463
Research output: Scientific - peer-review › Conference contribution
Asymmetric luminance based filtering for stereoscopic video compression

Asymmetric stereo video coding is a well-known enhancement technique for efficient 3D video rate scaling, taking advantage from the binocular suppression theory. Usually in asymmetric video coding one view is encoded in a higher spatial/temporal resolution or quality, while the auxiliary view is encoded with a lower resolution or quality. In this paper a novel asymmetric video coding approach is proposed to enhance the stereoscopic video compression efficiency. A regionally adaptive smoothing filter is applied to dark pixels of one view while the same filter is only applied to the light pixels of the other view. The location and the strength of the smoothing filters are determined according to the texture characteristics and the degree of the brightness of each individual pixel within the image. A series of systematic subjective tests were conducted, confirming that no quality degradation is perceptible by application of such filters. This is while the objective measurements show a Bjontegaard delta bitrate reduction of up to 26.6% and with an average of 16.8%.

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State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Nokia
Authors: Homayouni, M., Aflaki, P., Hannuksela, M. M., Gabbouj, M.
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Source: Scopus
Source-ID: 84930446866
Research output: Scientific - peer-review › Conference contribution

Salient event detection in basketball mobile videos

Modern smartphones have become the most popular means for recording videos. In fact, thanks to their portability, smartphones allow for recording anything and at any moment of our everyday life. One common occasion is represented by sport happenings, where people often record their favourite team or players. Automatic analysis of such videos is important for enabling applications such as automatic organization, browsing and summarization of the content. This paper proposes novel algorithms for the detection of salient events in videos recorded at basketball games. The novel approach consists of jointly analyzing visual data and magnetometer data. The proposed joint analysis allows for a reduced number of false positives and for a reduced computational complexity. The algorithms are tested on data captured during real basketball games. The experimental results clearly show the advantages of the proposed approach.

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Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Nokia Technologies
Authors: Cricri, F., Mate, S., Curcio, I. D. D., Gabbouj, M.
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DOIs: 10.1109/ISM.2014.67
Modeling and Experimental Characterization of Pressure Drop in Gravity-Driven Microfluidic Systems

Passive pumping using gravity-driven flow is a fascinating approach for microfluidic systems. When designing a passive pumping system, generated flow rates should be known precisely. While reported models used to estimate the flow rates do not usually consider capillary forces, this paper shows that their exclusion is unrealistic in typical gravity-driven systems. Therefore, we propose a new analytical model to estimate the generated flow rates. An extensive set of measurements is used to verify that the proposed model provides a remarkably more precise approximation of the real flow rates compared to the previous models. It is suggested that the developed model should be used when designing a gravity-driven pumping system.

General information

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Organisations: Department of Electronics and Communications Engineering, Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Mäki, A., Hemmilä, S., Hirvonen, J., Narra Girish, N., Kreutzer, J., Hyttinen, J., Kallio, P.
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Scopus rating (2014): SJR 0.629 SNIP 1.355 CiteScore 1.32
Scopus rating (2013): SJR 0.678 SNIP 1.295 CiteScore 1.21
Scopus rating (2012): SJR 0.586 SNIP 1.271 CiteScore 0.95
Scopus rating (2011): SJR 0.553 SNIP 1.088 CiteScore 0.89
Scopus rating (2010): SJR 0.538 SNIP 1.127
Scopus rating (2009): SJR 0.543 SNIP 1.048
Scopus rating (2008): SJR 0.656 SNIP 1.386
Scopus rating (2007): SJR 0.656 SNIP 1.054
Scopus rating (2006): SJR 0.893 SNIP 1.304
Scopus rating (2005): SJR 1.105 SNIP 1.421
Scopus rating (2004): SJR 1.086 SNIP 1.543
Scopus rating (2003): SJR 1.183 SNIP 1.427
Scopus rating (2002): SJR 0.983 SNIP 1.569
Scopus rating (2001): SJR 1.204 SNIP 1.523
Scopus rating (2000): SJR 1.436 SNIP 1.586
Scopus rating (1999): SJR 1.069 SNIP 1.22
Original language: English
ASJC Scopus subject areas: Control and Systems Engineering, Biomedical Engineering
Keywords: analytical, gravity-driven, microfluidic, modeling, passive pump
DOIs:
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Antimicrobial activity and molecular analysis of azoderivatives of β-diketones

The emergence and increase in the number of multidrug resistant microorganisms have highly increased the need of therapeutic trials, necessitating a deep exploration on novel antimicrobial response tactics. This study is intended to screen and analyze the activity of a novel set of azoderivatives of β-diketones and their known analogs for antimicrobial properties. The compounds were analyzed to determine their minimum inhibitory concentration. Hit compounds 5-(2-(2-hydroxyphenyl)hydrazono)pyrimidine-2,4,6(1H,3H,5H)-trione (C5), 5-chloro-3-(2-(4,4-dimethyl-2,6-dioxocyclohexylidene)hydrazinyl)-2-hydroxybenzenesulfonic acid (C8), 2-(2-carboxyphenylhydrazo)malononitrile (C11) were then considered in evaluating their effect on transcription, translation and cellular oxidation impact. All three compounds were found to have in vitro inhibitory action on E. coli cell growth. The study also revealed that those compounds have a notable impact on cellular activities. It is determined that the newly synthesized azoderivative of barbituric acid (C8) have maximum growth inhibitory activity among the three compounds considered, characterized by a MIC50 of 0.42 mg/ml. The MS2 reporter system was used to detect the transcriptional response of the bacteria to the treatment with the selected drugs. All three compounds are found to down regulate the transcriptional pathway. The novel compound, C8, showed maximum inhibition of transcription mechanism, followed by C5 and C11. The effect of the compounds on translation was analyzed using a Yellow Fluorescent protein reporter system. All the compounds displayed reductive impact on translation of which C8 was found to the best, exhibiting 8.5-fold repression followed by C5 and C11, respectively. Fluctuations of the Reactive Oxygen Species (ROS) concentrations were investigated upon incubation in hit compounds using ROS sensor protein. All the three compounds were found to contribute to oxidative pathway. C8 is found to have the best oxidative effect than C5 and C11. All experiments were repeated at least twice, the results being verified to be significant using statistical analysis.

General information
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Organisations: Department of Signal Processing, Research group: Computational Systems Biology, Research group: Molecular Signaling Lab, Prostate cancer research center (PCRC), Institute for Systems Biology, Seattle, Washington, USA
Authors: Viswanathan, A., Sala, A., Yli-Harja, O., Kandhavelu, M.
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Scopus rating (2014): SJR 0.994 SNIP 1.247 CiteScore 3.48
Scopus rating (2013): SJR 1.038 SNIP 1.287 CiteScore 3.47
Scopus rating (2012): SJR 1.254 SNIP 1.425 CiteScore 3.6
Scopus rating (2011): SJR 1.236 SNIP 1.428 CiteScore 3.57
Scopus rating (2010): SJR 1.289 SNIP 1.283
Scopus rating (2009): SJR 1.169 SNIP 1.465
Scopus rating (2008): SJR 1.015 SNIP 1.265
Scopus rating (2007): SJR 0.927 SNIP 1.137
Scopus rating (2006): SJR 0.775 SNIP 1.039
Scopus rating (2005): SJR 0.93 SNIP 1.409
Scopus rating (2004): SJR 0.873 SNIP 1.367
Scopus rating (2003): SJR 0.964 SNIP 1.4
Scopus rating (2002): SJR 0.791 SNIP 1.167
Scopus rating (2001): SJR 0.694 SNIP 0.969
Scopus rating (2000): SJR 0.445 SNIP 0.901
Scopus rating (1999): SJR 0.388 SNIP 0.79
Original language: English
Lossless compression of regions-of-interest from retinal images

This paper presents a lossless compression method performing separately the compression of the vessels and of the remaining part of eye fundus in retinal images. Retinal images contain valuable information sources for several distinct medical diagnosis tasks, where the features of interest can be e.g. the cotton wool spots in the eye fundus, or the volume of the vessels over concentric circular regions. It is assumed that one of the existent segmentation methods provided the segmentation of the vessels. The proposed compression method transmits losslessly the segmentation image, and then transmits the eye fundus part, or the vessels image, or both, conditional on the vessels segmentation. The independent compression of the two color image segments is performed using a sparse predictive method. Experiments are provided over a database of retinal images containing manual and estimated segmentations. The codelength of encoding the overall image, including the segmentation and the image segments, proves to be better than the codelength for the entire image obtained by JPEG2000 and other publicly available compressors.

Object-based Modeling of Audio for Coding and Source Separation

This thesis studies several data decomposition algorithms for obtaining an object-based representation of an audio signal. The estimation of the representation parameters are coupled with audio-specific criteria, such as the spectral redundancy, sparsity, perceptual relevance and spatial position of sounds. The objective is to obtain an audio signal representation that is composed of meaningful entities called audio objects that reflect the properties of real-world sound objects and events. The estimation of the object-based model is based on magnitude spectrogram redundancy using non-negative matrix factorization with extensions to multichannel and complex-valued data. The benefits of working with object-based audio representations over the conventional time-frequency bin-wise processing are studied. The two main applications of the object-based audio representations proposed in this thesis are spatial audio coding and sound source separation from multichannel microphone array recordings. In the proposed spatial audio coding algorithm, the audio objects are estimated from the multichannel magnitude spectrogram. The audio objects are used for recovering the content of each original channel from a single downmixed signal, using time-frequency filtering. The perceptual relevance of modeling the audio signal is considered in the estimation of the parameters of the object-based model, and the sparsity of the model is utilized in encoding its parameters. Additionally, a quantization of the model parameters is proposed that reflects the perceptual relevance of each quantized element. The proposed object-based spatial audio coding algorithm is evaluated via listening tests and comparing the overall perceptual quality to conventional time-frequency block-wise methods at the same bitrates. The proposed approach is found to produce comparable coding efficiency while providing additional functionality via the object-based coding domain representation, such as the blind separation of the mixture of sound sources in the encoded channels. For the sound source separation from multichannel audio recorded by a microphone array, a method combining an object-based magnitude model and spatial covariance matrix estimation is considered. A direction of arrival-based model for the spatial covariance matrices of the sound sources is proposed. Unlike the conventional approaches, the estimation of the parameters of the proposed spatial covariance matrix model ensures a spatially coherent solution for the spatial parameterization of the sound sources. The separation quality is measured with objective criteria and the proposed method is shown to improve over the state-of-the-art sound source separation methods, with recordings done using a small microphone array.
Designing a performance measurement system to support outsourcing decisions in a Finnish university

In recent years, the role and importance of performance measurement in public organisations has been much emphasised. However, the discussion on the issue so far has been on a rather general level. This paper aims to understand the challenges faced by public organisations in developing performance measurement systems (PMSs) for a specific managerial purpose, to support outsourcing decisions. The objective of the paper is approached with a literature review and a single qualitative case study carried out as an action research. The case study introduces a detailed description of a PMS development project carried out in the support services of a Finnish university. A framework developed in prior research is utilised to analyse the impacts of two typical characteristics (conflicting stakeholder needs and undefined objectives) of public organisations in a PMS design project. The contribution of the paper is to extend the existing understanding about public sector PMS especially regarding two key points: 1) to understand the impact of different purposes for measurement (in this case the outsourcing context) on the PMS development process; 2) to understand the need to align the PMS system with the organisational culture and other managerial control systems in order to achieve desired performance outcomes.

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State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Industrial Management, Research group: Center for Research on Operations Projects and Services, Department of Information Management and Logistics, Managing digital industrial transformation (mDIT), Lappeenranta University of Technology
Authors: Jääskeläinen, A., Lönnqvist, A., Kulmala, H. I.
Number of pages: 16
Pages: 237-252
Publication date: 3 Jan 2015
Peer-reviewed: Yes

Publication information
This paper describes a recently created image database, TID2013, intended for evaluation of full-reference visual quality assessment metrics. With respect to TID2008, the new database contains a larger number (3000) of test images obtained from 25 reference images, 24 types of distortions for each reference image, and 5 levels for each type of distortion. Motivations for introducing 7 new types of distortions and one additional level of distortions are given; examples of distorted images are presented. Mean opinion scores (MOS) for the new database have been collected by performing 985 subjective experiments with volunteers (observers) from five countries (Finland, France, Italy, Ukraine, and USA). The availability of MOS allows the use of the designed database as a fundamental tool for assessing the effectiveness of visual quality. Furthermore, existing visual quality metrics have been tested with the proposed database and the collected results have been analyzed using rank order correlation coefficients between MOS and considered metrics. These correlation indices have been obtained both considering the full set of distorted images and specific image subsets, for highlighting advantages and drawbacks of existing, state of the art, quality metrics. Approaches to thorough performance analysis for a given metric are presented to detect practical situations or distortion types for which this metric is not adequate enough to human perception. The created image database and the collected MOS values are freely available for downloading and utilization for scientific purposes.

**General information**

**State:** Published

**Ministry of Education publication type:** A1 Journal article-refereed

**Organisations:**
- Department of Signal Processing, Research group: Computational Imaging-CI, Research group: Algebraic and Algorithmic Methods in Signal Processing AAMSP, Signal Processing Research Community (SPRC), National Aerospace University, Dept of Transmitters, Receivers and Signal Processing, University of Rennes 1 - IETR, Media Communications Lab, USC Viterbi School of Engineering

**Authors:** Ponomarenko, N., Jin, L., Ieremeiev, O., Lukin, V., Egiazarian, K., Astola, J., Vozel, B., Chehdi, K., Carli, M., Battisti, F., Jay Kuo, C. C.

**Number of pages:** 21

**Pages:** 57-77

**Publication date:** 1 Jan 2015

**Peer-reviewed:** Yes

**Journal:** Signal Processing: Image Communication

**Volume:** 30
Investigating the Impact of Sound Angular Position on the Listener Affective State

Emotion recognition from sound signals represents an emerging field of recent research. Although many existing works focus on emotion recognition from music, there seems to be a relative scarcity of research on emotion recognition from general sounds. One of the key characteristics of sound events is the sound source spatial position, i.e. the location of the source relatively to the acoustic receiver. Existing studies that aim to investigate the relation of the latter source placement and the elicited emotions are limited to distance, front and back spatial localization and/or specific emotional categories. In this paper we analytically investigate the effect of the source angular position on the listener's emotional state, modeled in the well-established valence/arousal affective space. Towards this aim, we have developed an annotated sound events dataset using binaural processed versions of the available International Affective Digitized Sound (IADS) sound events library. All subjective affective annotations were obtained using the Self Assessment Manikin (SAM) approach. Preliminary results obtained by processing these annotation scores are likely to indicate a systematic change in the listener affective state as the sound source angular position changes. This trend is more obvious when the sound source is located outside of the visible field of the listener.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Ionian University
Authors: Drossos, K., Floros, A., Giannakouloupolos, A., Kanellopoulos, N.
Number of pages: 16
Pages: 27-42
Publication date: 1 Jan 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Affective Computing
Volume: 6
Issue number: 1
ISSN (Print): 1949-3045
MicroRNA expression profile of primary prostate cancer stem cells as a source of biomarkers and therapeutic targets

MicroRNA (miRNA) expression profiles were generated from prostate epithelial subpopulations enriched from patient-derived benign prostatic hyperplasia (n = 5), Gleason 7 treatment-naive prostate cancer (PCa) (n = 5), and castration-resistant PCa (CRPC) (n = 3). Microarray expression was validated in an independent patient cohort (n = 10). Principal component analysis showed that miRNA expression is clustered by epithelial cell phenotype, regardless of pathologic status. We also discovered concordance between the miRNA expression profiles of unfractionated epithelial cells from CRPCs, human embryonic stem cells (SCs), and prostate epithelial SCs (both benign and malignant). MiR-548c-3p was chosen as a candidate miRNA from this group to explore its usefulness as a CRPC biomarker and/or therapeutic target. Overexpression of miR-548c-3p was confirmed in SCs (5-fold, p < 0.05) and in unfractionated CRPCs (1.8-fold, p < 0.05). Enforced overexpression of miR-548c-3p in differentiated cells induced stemlike properties (p < 0.01) and radioresistance (p < 0.01). Reanalyses of published studies further revealed that miR-548c-3p is significantly overexpressed in CRPC (p < 0.05) and is associated with poor recurrence-free survival (p < 0.05), suggesting that miR-548c-3p is a functional biomarker for PCa aggressiveness. Our results validate the prognostic and therapeutic relevance of miRNAs for PCa management while demonstrating that resolving cell-type and differentiation-specific differences is essential to obtain clinically relevant miRNA expression profiles. Patient summary We report microRNA (miRNA) expression profiles of epithelial cell fractions from the human prostate, including stem cells. miR-548c-3p was revealed as a functional biomarker for prostate cancer progression. The evaluation of miR-548c-3p in a larger patient cohort should yield information on its clinical usefulness.

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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Computational Systems Biology, BioMediTech, Prostate cancer research center (PCRC), Tampere University Hospital, University of York, Molecular Biology of Prostate Cancer Group, Terry Fox Laboratory, Eaves Lab, BC Cancer Research Centre, Hull York Medical School, University of Hull, Department of Urology, Castle Hill Hospital
Authors: Rane, J. K., Scaravilli, M., Ylipää, A., Pellacani, D., Mann, V. M., Simms, M. S., Nykter, M., Collins, A. T., Visakorpi, T., Maitland, N. J.
Number of pages: 4
Pages: 7-10
Publication date: 1 Jan 2015
Peer-reviewed: Yes
Scalable bit allocation between texture and depth views for 3-D video streaming over heterogeneous networks

In the multiview video plus depth (MVD) coding format, both texture and depth views are jointly compressed to represent the 3-D video content. The MVD format enables synthesis of virtual views through depth-image-based rendering; hence, distortion in the texture and depth views affects the quality of the synthesized virtual views. Bit allocation between texture and depth views has been studied with some promising results. However, to the best of our knowledge, most of the existing bit-allocation methods attempt to allocate a fixed amount of total bit rate between texture and depth views; that is, to select appropriate pair of quantization parameters for texture and depth views to maximize the synthesized view quality subject to a fixed total bit rate. In this paper we propose a scalable bit-allocation scheme, where a single ordering of texture and depth packets is derived and used to obtain optimal bit allocation between texture and depth views for any total target rates. In the proposed scheme, both texture and depth views are encoded using the quality scalable coding method; that is, medium grain scalable (MGS) coding of the Scalable Video Coding (SVC) extension of the Advanced Video Coding (H.264/AVC) standard. For varying target total bit rates, optimal bit truncation points for both texture and depth views can be obtained using the proposed scheme. Moreover, we propose to order the enhancement layer packets of the H.264/SVC MGS encoded depth view according to their contribution to the reduction of the synthesized view distortion. On one hand, this improves the depth view packet ordering when considered the rate-distortion performance of synthesized views, which is demonstrated by the experimental results. On the other hand, the information obtained in this step is used to facilitate optimal bit allocation between texture and depth views. Experimental results demonstrate the effectiveness of the proposed scalable bit-allocation scheme for texture and depth views.
The connection between cycling safety and volume

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Information Management and Logistics, Research group: Transport Research Centre Verne
Authors: Luukkonen, T., Vaismaa, K.
Number of pages: 26
Pages: 71-96
Publication date: 1 Jan 2015

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http://www.scopus.com/inward/record.url?scp=84946920192&partnerID=8YFLogxK (Link to publication in Scopus)
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Source-ID: 84946920192
Research output: Scientific - peer-review › Chapter

Winner-Does-Not-Take-All: Selective Attention and Local Bias in Platform-Based Markets
We examine competition between platforms in platform-based markets with agent-based modeling. In our proposed model, a consumer adopts a platform that offers the most relative utility of competing platforms. More specifically, the utility is derived from the local direct network effects arising from the social network of the consumer and the indirect network effects arising from complementary products of the platform. We portray the consumer as selectively attentive and locally biased. We contrast the proposed model to several alternative models with empirical data from the competition between Sony’s PlayStation 3 and Microsoft’s Xbox 360 and show that the proposed model, where the aforementioned consumer characteristics, and platform pricing, explain the adoption decisions of consumers and thus the division of the market between platforms. We offer important insights on how the dynamics of competition on the macro-level emerge from micro-level interactions between consumers.
A Bayesian Approach for Extreme Learning Machine-based Subspace Learning

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Lappeenranta University of Technology, Hanken School of Economics
Authors: Huotari, P., Järvi, K., Kortelainen, S., Huhtamäki, J.
Publication date: Jan 2015

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Links:
http://proceedings.aom.org/content/2015/1/16901.short
Research output: Scientific - peer-review › Conference contribution

Accuracy evaluation of a linear positioning system for light field capture
In this paper a method has been proposed for estimating the positions of a moving camera attached to a linear positioning system (LPS). By comparing the estimated camera positions with the expected positions, which were calculated based on the LPS specifications, the manufacturer specified accuracy of the system, can be verified. Having this data, one can more accurately model the light field sampling process. The overall approach is illustrated on an inhouse assembled LPS.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D)
Authors: Iosifidis, A., Gabbouj, M.
Number of pages: 5
Pages: 2401-2405
Publication date: 2015

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Research output: Scientific - peer-review › Conference contribution

Accuracy evaluation of a linear positioning system for light field capture
In this paper a method has been proposed for estimating the positions of a moving camera attached to a linear positioning system (LPS). By comparing the estimated camera positions with the expected positions, which were calculated based on the LPS specifications, the manufacturer specified accuracy of the system, can be verified. Having this data, one can more accurately model the light field sampling process. The overall approach is illustrated on an inhouse assembled LPS.

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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: 3D MEDIA, Tampere University of Technology, Signal Processing Research Community (SPRC)
Authors: Vagharshakyan, S., Durmush, A., Suominen, O., Bregovic, R., Gotchev, A.
Number of pages: 10
Pages: 388-397
Publication date: 2015

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Name: Lecture Notes in Computer Science
Volume: 9012
ISSN (Print): 0302-9743
A Comparison of Methods to Move Visual Objects Between Personal Mobile Devices in Different Contexts of Use

As people increasingly own multiple mobile and portable devices (such as smartphones, tablets, and laptops), situations where several devices are used together have become more common. A frequent problem in such situations is how to move virtual visual objects (such as content items or application windows) between device displays. We present a comparative evaluation of three methods for moving objects between personal mobile devices: Tray, Transfer Mode, and Device Touch. The participants' preferences of the methods in different real-life scenarios were found to strongly depend on the task and the context of use, making the design of a single optimal cross-display object movement method a challenging task. We identify several clusters of contextual factors that influenced the users' preferences. We also report more detailed differences in efficiency, novelty, learnability, physical device handling, and task completion strategies between the three methods included in the evaluation.

General information

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience, Augmented Human Activities (AHA)
Authors: Jokela, T., Ojala, J., Grassel, G., Piippo, P., Olsson, T.
Number of pages: 10
Pages: 172-181
Publication date: 2015

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DOIs: 10.1145/2785830.2785841
Research output: Scientific - peer-review » Conference contribution

A computationally feasible optimization approach to inverse SAR translational motion compensation

The traditional approach to inverse synthetic aperture radar translational motion compensation is to solve the problem in the two distinct parts of range alignment and autofocus. In this paper, we follow this practice and propose an approach based on the global range alignment and contrast optimization autofocus methods. The proposed range alignment procedure parametrizes the track as a spline polynomial and minimizes the loss function determined by the sum of the squared envelope differences. The necessary numerical global optimization is performed with the differential evolution algorithm. The solution of the autofocus problem is produced with first order numerical optimization, as we solve it by using an expression derived for the gradient of the loss function. In this paper, we consider the back-projection case but the proposed approach is easily extended to other reconstruction techniques. We use simulated inverse synthetic aperture radar data to demonstrate the proposed approach and to illustrate its computational efficiency.

General information

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: MMDM, Finnish Defence Research Agency
Authors: Vehmas, R., Jylhä, J., Väilä, M., Kylmälä, J.
Number of pages: 4
Pages: 17-20
A conceptual model towards the scaffolding of learning experience

The challenge of delivering personalized learning experiences is amplified by the size of classrooms and of online learning communities. In turn, serious games are increasingly recognized for their potential to improve education, but a typical requirement from instructors is to gain insight into how the students are playing. When we bring games into the rapidly growing online learning communities, the challenges multiply and hinder the potential effectiveness of serious games. There is a need to deliver a comprehensive, flexible and intelligent learning framework that facilitates better understanding of learners’ knowledge, effective assessment of their progress and continuous evaluation and optimization of the environments in which they learn. This paper aims to explore the potential in the use of games and learning analytics towards scaffolding and supporting teaching and learning experience. The conceptual model discussed aims to highlight key considerations that may advance the current state of learning analytics, adaptive learning and serious games, by leveraging serious games as an ideal medium for gathering data and performing adaptations. This opportunity has the potential to affect the design and deployment of education and training in the future.
A Cross-Cultural and Gender-Based Perspective for Online Security: Exploring Knowledge, Skills and Attitudes of Higher Education Students.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Information security
Authors: Chaudhary, S., Zhao, Y., Berki, E., Valtanen, J., Li, L., Helenius, M., Mystakidis, S.
Pages: 57-71
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: IADIS International Journal on WWW/Internet
Volume: 13
Issue number: 1
ISSN (Print): 1645-7641
Original language: English
Research output: Scientific - peer-review › Article

A Design Framework Enhancing Developer Experience in Collaborative Coding Environment

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Palviainen, J., Kilamo, T., Koskinen, J., Lautamäki, J. T., Mikkonen, T., Nieminen, A.
Number of pages: 8
Pages: 149-156
Publication date: 2015

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Title of host publication: Proceedings of the 30th Annual ACM Symposium on Applied Computing
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Research output: Scientific - peer-review › Conference contribution

A Diary Study on Combining Multiple Information Devices in Everyday Activities and Tasks
As people possess increasing numbers of information devices, situations where several devices are combined and used together have become more common. We present a user study on people's current practices in combining multiple information devices in their everyday lives, ranging from pragmatic tasks to leisure activities. Based on diaries and interviews of 14 participants, we characterize the usage practices of the most common devices, including smartphones, computers, tablets, and home media centers. We analyze 123 real-life multi-device use cases and identify the main usage patterns, including Sequential Use, Resource Lending, Related Parallel Use, and Unrelated Parallel Use. We discuss the practical challenges of using several information devices together. Finally, we identify three levels of decisions that determine which devices are used in a particular situation, including acquiring, making available, and selecting the devices for use.

General information
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.

A lumped element model was used to predict the measurement results of an inductively coupled resonance sensor. Errors related to the inductive coupling and the reader coil self-resonance were studied. The model was compared with measurements made with a physical circuit.
Analysis of dct spectrum statistics for image processing applications

Statistical characteristics of coefficients of discrete cosine transform (DCT) in 8x8 pixel blocks of grayscale images are analyzed. Robust estimators of distribution scale and tail heaviness are used in analysis since it is shown that the considered distributions are essentially non-Gaussian and they are better described by generalized Gaussian distribution (GGD) with variable parameters. Parameters of these distributions are determined for noise-free images and the same images corrupted by additive white Gaussian noise. It is demonstrated that the noise presence considerably changes distribution that approaches to Gaussian for high frequency DCT coefficients. Parameters of GGD model depend on both image properties and noise variance. The usefulness of the obtained results for two operations of image processing (variance estimation and filtering) is shown.
Analysis of HVS-metrics' properties using color image database TID2013

Various full-reference (FR) image quality metrics (indices) that take into account peculiarities of human vision system (HVS) have been proposed during last decade. Most of them have been already tested on several image databases including TID2013, a recently proposed database of distorted color images. Metrics performance is usually characterized by the rank order correlation coefficients of the considered metric and a mean opinion score (MOS). In this paper, we characterize HVS-metrics from another practically important viewpoint. We determine and analyze image statistics such as mean and standard deviation for several state of the art quality metrics on classes of images with multiple or particular types of distortions. This allows setting threshold value(s) for a given metric and application.

Analysis on bus travel time through traffic light intersection

As the number of vehicles grows, cities around the world face serious road traffic congestion problems. One solution is the introduction of bus traffic with intelligent traffic light control. Travel time in an urban area consists of driving time and dwelling time. To analyze the effect of traffic light, data was collected from two sources: GPS bus locations and traffic light system. Travel time in an intersection depends on the arrival time on the traffic light sequence and other traffic. The traffic light on the selected segment utilizes bus priority. Comparisons with bus priority and without were carried out. Bus priority in the intersection causes a slight decrease on travel time and removes some of the larger waiting times. Bus arrival time on the traffic light sequence is random. In this paper travel time of buses through an intersection with bus priority is analyzed.
Analytical model in discrete time for cross-layer video communication over LTE

Since video traffic is resource intensive, it is a challenging issue to stream video over low bandwidth networks, whereas video communication over LTE becomes an open research topic nowadays due to LTE’s high throughput capabilities. Indeed, video transmission requires low delay, and wireless channel is time-varying, which result in a scenario when a layer-separated design is replaced by a Cross-Layer Adaptation (CLA) principle. In this paper an efficient analytical model that evaluates the behavior of the downlink LTE channel with CLA is presented. To the best of our knowledge, this is the first time an analytical model using CLA principle has been devised that covers both the transmission process from the eNB to the User Equipment (UE) at the first phase and video decoding process at the UE at the second phase. In order to ensure the cross-layer adaptation in the model, the arrival rate varies based on the received video request, whereas the service probability changes according to the channel quality indicator sent from the UE. In the experimental part the analysis of the main performance measures found from the stationary distribution is conducted.
An efficient adaptive binary range coder and its VLSI architecture

In this paper, we propose a new hardware-efficient adaptive binary range coder (ABRC) and its very-large-scale integration (VLSI) architecture. To achieve this, we follow an approach that allows to reduce the bit capacity of the multiplication needed in the interval division part and shows how to avoid the need to use a loop in the renormalization part of ABRC. The probability estimation in the proposed ABRC is based on a lookup table free virtual sliding window. To obtain a higher compression performance, we propose a new adaptive window size selection algorithm. In comparison with an ABRC with a single window, the proposed system provides a faster probability adaptation at the initial encoding/decoding stage, and more accurate probability estimation for very low entropy binary sources. We show that the VLSI architecture of the proposed ABRC attains a throughput of 105.92 MSymbols/s on the FPGA platform, and consumes 18.15 mW for the dynamic part power. In comparison with the state-of-the-art MQ-coder (used in JPEG2000 standard) and the M-coder (used in H.264/Advanced Video Coding and H.265/High Efficiency Video Coding standards), the proposed ABRC architecture provides comparable throughput, reduced memory, and power consumption.

Experimental results obtained for a wavelet video codec with JPEG2000-like bit-plane entropy coder show that the proposed ABRC allows to reduce the bit rate by 0.8%-8% in comparison with the MQ-coder and from 1.0%-24.2% in comparison with the M-coder.

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Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D)
Authors: Belyaev, E., Liu, K., Gabbouj, M., Li, Y.
Number of pages: 12
Pages: 1435-1446
Publication date: 2015
Peer-reviewed: Yes

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Scopus rating (2008): SJR 1.587 SNIP 3.587
Scopus rating (2007): SJR 1.849 SNIP 3.697
Scopus rating (2006): SJR 2.244 SNIP 5.368
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Scopus rating (2002): SJR 2.817 SNIP 4.448
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A new method for automatic marking epileptic spike-wave discharges in local field potential signals

This work proposes a new method for automatic marking epileptic spike-wave discharges in local field potential (LFP) signals. The method is based on empirical modelling using radial basis functions to approximate dependency of a further state on the current one. Number and type of radial basis functions used are adjusted to data based on statistical criteria. Due to this the method needs only a few manual efforts for its application to new data. The time resolution of the method is close to the sampling interval of the original data, and real time detection is possible. Detection accuracy of the proposed approach is validated analysing the LFP signals obtained using WAG/Rij rats.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Computational Systems Biology, Research group: MMDM, Research group: Laboratory of Biosystem Dynamics-LBD, Saratov NG Chernyshevskii State Univ, Saratov State University, Dept Nano & Biomed Technol, Radboud Univ Nijmegen, Radboud University Nijmegen, Donders Ctr Cognit, Univ Munster, University of Munster, Inst Physiol
Authors: Startceva, S., Lüttjohann, A., Sysoev, I. V., van Luijtelaar, G.
Number of pages: 8
Publication date: 2015

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Keywords: local field potentials, epilepsy, signal processing, radial-basis functions, SEIZURES, MODELS, EEG
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Research output: Scientific - peer-review › Conference contribution

A New R-D Optimization Criterion for Fast Mode Decision Algorithms in Video Coding and Transrating

Mode decision has a significant effect on the quality and complexity of video coding. It is even more challenging when generating multiple bitstreams with different bitrates in, for example, Dynamic Adaptive Streaming for HTTP (DASH) or transrating systems. Full search and simplified fast search mode decision methods either suffer from a high computational complexity or have a negative impact on quality. Furthermore, mode selection in conventional approaches strongly depends on the quantization parameter. Hence, modes that have been selected for high bitrate compression may not be suitable for low bitrate when transrating a bitstream. In this paper, we propose a Rate-Distortion (R-D) optimized criterion for fast mode decision algorithms. The proposed cost function when adopted in different fast mode decision algorithms, not only improves the R-D performance by up to 6.6% in terms of Bjøntegaard delta rate, but also reduces the execution time of the encoder by up to 6.8%. We also show that modes selected by the proposed criterion are less sensitive to changes in bitrate or quantization parameter. As a result, the same modes in an encoded bitstream may be used even after transrating using re-quantization, resulting in a significant R-D performance improvement of up to 33.3%.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Video
Authors: Aminlou, A., Hashemi, M. R., Gabbouj, M., Zeng, B., Fatemi, O.
Pages: 696-710
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Circuits and Systems for Video Technology
Animal Welfare as a Design Goal in Technology Mediated Human-Animal Interaction
Designing technology mediated human-animal interaction with the animal welfare as a design goal calls for understanding of animal welfare issues. This paper discusses the notion of animal welfare and specifically focuses on domestic dogs (Canis familiaris) as an example case. Strategies for mediating relatedness are discussed and an initial framework to support designing tactile interactions for human-animal interaction is presented. Paper builds its reasoning upon scientific research on human-animal interaction and welfare, and identifies issues for future work in this area.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience, Augmented Human Activities (AHA)
Authors: Väätäjä, H.
Number of pages: 8
Publication date: 2015

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Place of publication: New York, NY
Publisher: ACM
Article number: 6
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Publication series
Name: International conference on advances in computer entertainment technology
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Electronic versions:
Vaataja-Animal Welfare as a Design Goal-ACI-ACE WS-2014
DOIs: 10.1145/2693787.2693797
An Initial Homophily Indicator to Reinforce Context-Aware Semantic Computing

The vast increase of personal sensor information is driving the rise in popularity of context-aware applications. Users crave and very often expect tailored services that are based on the users' context or personal preferences. The users themselves, using forms, often provide such information. An inference solution typically addresses this problem. In this paper, we present and show by way of a real-world example, the first step towards incorporating information of the user's social networking behavior in the inference task. We define an initial indicator of a particular social phenomenon, called Homophily, and describe how the indicator measures the presence of homophily at certain moments, also capturing the degree to which it is present. Different from existing indicators, ours lends itself to indicating the presence of homophily in a way that is easier to comprehend, so that it may be easily integrated into and reinforce context-aware semantic computing.

General information

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory
Authors: Rivero-Rodriguez, A., Pileggi, P., Nykänen, O.
Number of pages: 5
Pages: 89-93
Publication date: 2015

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Title of host publication: 7th International Conference on Computational Intelligence, Communication Systems and Networks (CICSyN)
Place of publication: Riga
Publisher: IEEE
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Name: International Conference on Computational Intelligence, Communications and Networks
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Homophily_indicator
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10.1109/CICSyN.2015.26
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http://www.mendeley.com/research/initial-homophily-indicator-reinforce-context-aware-semantic-computing
Source: Mendeley
Source-ID: 6f091d3c-7f8d-366f-ac71-f59b685f9ff9
Research output: Scientific - peer-review › Conference contribution

A Paradigm for Dynamic Adaptive Streaming over HTTP for Multi-view Video

HTTP-based delivery for Video on Demand (VoD) has been gaining popularity within recent years. With the recently proposed Dynamic Adaptive Streaming over HTTP (DASH), video clients may dynamically adapt the requested video quality and bitrate to match their current download rate. To avoid playback interruption, DASH clients attempt to keep the buffer occupancy above a certain minimum level. This mechanism works well for the single view video streaming. For multi-view video streaming application over DASH, the user originates view switching and that only one view of multi-view content is played by a DASH client at a given time. For such applications, it is an open problem how to exploit the buffered video data during the view switching process. In this paper, we propose two fast and efficient view switching approaches in the paradigm of DASH systems, which fully exploit the already buffered video data. The advantages of the proposed approaches are twofold. One is that the view switching delay will be short. The second advantage is that the rate-distortion performance during the view switching period will be high, i.e., using less request data to achieve comparable video playback quality. The experimental results demonstrate the effectiveness of the proposed method.

General information
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.
Applying finite state process algebra to formally specify a computational model of security requirements in the Key2phone-mobile access solution

Key2phone is a mobile access solution which turns mobile phone into a key for electronic locks, doors and gates. In this paper, we elicit and analyse the essential and necessary safety and security requirements that need to be considered for the Key2phone interaction system. The paper elaborates on suggestions/solutions for the realisation of safety and security concerns considering the Internet of Things (IoT) infrastructure. The authors structure these requirements and illustrate particular computational solutions by deploying the Labelled Transition System Analyser (LTSA), a modelling tool that supports a process algebra notation called Finite State Process (FSP). While determining an integrated solution for this research study, the authors point to key quality factors for successful system functionality.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Information security, Intelligent dexterity for secure networked infrastructure and applications (IDSNIA), Augmented Human Activities (AHA), University of Tampere, Department of Computer Engineering and Information Technology of College of Information and Communication Technology at the University of Dar Es Salaam, University of Jyväskylä, Beijing Institute of Petrochemical Technology, Department of Computer Science and Information Systems, Finwe Ltd
Authors: Chaudhary, S., Li, L., Berki, E., Helenius, M., Kela, J., Turunen, M.
Number of pages: 18
Pages: 128-145
Publication date: 2015

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ISBN (Print): 9783319194578

Publication series
Name: Lecture Notes in Computer Science
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ISSN (Electronic): 1611-3349
ASJC Scopus subject areas: Computer Science(all), Theoretical Computer Science
DOIs: 10.1007/978-3-319-19458-5_9
Source: Scopus
Source-ID: 84931036213
Research output: Scientific - peer-review › Conference contribution

Approach for Investigating Crowdfunding Campaigns with Platform Data: Case Indiegogo
Crowdfunding via the internet is a relatively new phenomenon in research and gaining momentum currently. While taking a data-driven approach into investigating the properties and dynamics of crowdfunding campaigns would allow the use of computational social science in investigations on crowdfunding, existing data-driven research on crowdfunding remains very limited. This is particularly true on the level of individual funder data. In this study, we contribute to the empirical body of knowledge on crowdfunding by introducing Indiegogo as a data source and, more specifically, the development and implementation of a crawler and scraper for accessing Indiegogo campaign data, and sharing this openly for other researchers. Due to the extremely dynamic and rapidly increasing amount of crowdfunding data in terms of the number of crowdfunding campaigns and the available investment and individual investor data, we believe our approach is useful for supporting public and open data-driven research, instead of providing merely a static data set.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT), Copenhagen Business School
Authors: Huhtamäki, J., Lasrado, L., Menon, K., Kärkkäinen, H., Jussila, J.
Archetypal analysis for audio dictionary learning

This paper proposes dictionary learning with archetypes for audio processing. Archetypes refer to so-called pure types, which are a combination of a few data points and which can be combined to obtain a data point. The concept has been found useful in various problems, but it has not yet been applied for audio analysis. The algorithm performs archetypal analysis that minimises the generalised Kullback-Leibler divergence, shown suitable for audio, between an observation and the model. The methodology is evaluated in a source separation scenario (mixtures of speech) and shows results, which are comparable to the state-of-the-art, with perceptual measures indicating its superiority over all of the competing methods in the case of medium-size dictionaries.

Architecture for Open, Knowledge-Driven Manufacturing Execution System

This paper proposes dictionary learning with archetypes for audio processing. Archetypes refer to so-called pure types, which are a combination of a few data points and which can be combined to obtain a data point. The concept has been found useful in various problems, but it has not yet been applied for audio analysis. The algorithm performs archetypal analysis that minimises the generalised Kullback-Leibler divergence, shown suitable for audio, between an observation and the model. The methodology is evaluated in a source separation scenario (mixtures of speech) and shows results, which are comparable to the state-of-the-art, with perceptual measures indicating its superiority over all of the competing methods in the case of medium-size dictionaries.
Assessment of social media skills among vocational teachers in Finland

In this explorative case study we planned, tested and verified an assessment tool for evaluating Social Media (SOME) skills among vocational teachers. We also planned and trained vocational teachers in the use of social media tools. The case study was automotive and transport engineering upper secondary vocational teacher training. According Huhtala [1], based on a large national inquiry of the automotive sector, there has arisen the need to develop the skills of the student in many ways. They require paying attention to coming trends of the teaching methods and the technology [2]. With the help of this training we wanted to provide teachers a better understanding of ideology of SOME and realize its pedagogical possibilities and benefits. In the case study training we introduced theories and examples about SOME and its potential to solve future challenges in the automotive sector. But there are multiple barriers in utilizing social software [3]. We explored an answer to the research question: How to assess utilization of social media tools in teaching among vocational Teachers? We discovered that utilizing an assessment survey questionnaire before a training course was very beneficial. In this case study we found out that the ability to utilize SOME tools among automotive vocational teachers was poor. Our earlier studies among adult SOME users support these findings [4],[5],[6],[7]. Our notion was that the automotive and transport engineering genre was very traditional and surprisingly conservative towards new technology like SOME for example. Limitations in the research process were typical for the case study [8],[9].

References:

Keywords: Social media, vocational teaching, SOME, SOME assessment, automotive, case study.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Pori Department, Research group: Business Ecosystems, Networks and Innovations, Research group: Data-analytics and Optimization, Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mIDIT), Winnova Länsirannikon koulutus Oy, University of Exeter Business School
Authors: Linna, P., Aramo-Immonen, H., Saari, M., Turunen, J., Jussila, J., Joel-Edgar, S., Huhtala, M.
Number of pages: 8
Pages: 4574-4581
Publication date: 2015

Host publication information
Title of host publication: 7th International Conference on Education and New Learning Technologies, Barcelona, Spain, 6-8 July, 2015
ISBN (Electronic): 978-84-606-8243-1

Bibliographical note
ORG=pla,0.5
ORG=ito,0.5
Research output: Scientific - peer-review Conference contribution

Associating Event Logs with Ontologies for Semantic Process Mining and Analysis

Process mining uses various forms of event logs to extract process-related information, in order to discover, analyze conformance, or to enhance (business) processes. The vast majority of process mining applications are based on event logs with flat, keyword-based activity and resource descriptions. Many human-designed processes, however, are based on explicit workflow or lifecycle models with associated product models, both of which can be described using taxonomies or more complicated ontologies. This additional information can be used to analyze and visualize the processes with better insight of and improved formal access to the data. In this paper, we introduce a generic approach for enriching process mining using events logs with associated ontology structures. The main contribution and benefit of this approach lies in the ability to analyze the models in different abstraction levels, which greatly helps understanding complicated processes. Our main application areas are related to engineering and documentation processes.
Augmenting food with information
Eating is not only one of the most fundamental human needs but also among the most regular activities. Acquiring food, preparing meals, and socializing around food are deeply rooted in all human cultures. In this paper we show how food can not only serve to satisfy hunger but also become a new display technology. Through food augmentation, a dinner could communicate its ingredients, convey messages, or provide instructions such as the recipe of a meal. We show how to augment a large range of food with laser. We conducted a series of focus groups to gather people's first impressions and derive a broad range of meaningful augmentation scenarios. We discuss the perceived benefits, opportunities, and concerns. Additionally, we evaluated a number of scenarios through an online survey. The most readily accepted augmentation scenarios include adding practical information, increasing awareness about the food, and augmenting food items with a natural skin.

Automated Super-Voxel Based Features Classification of Urban Environments by Integrating 3D Point Cloud and Image Content
In this paper we present a novel street scene semantic recognition framework, which takes advantage of 3D point cloud captured by a high definition LiDAR laser scanner. An important problem in object recognition is the need for sufficient labeled training data to learn robust classifiers. We show how to significantly reduce the need for manually labeled training data by reduction of scene complexity using non-supervised ground and building segmentation. Our system first automatically segments grounds point cloud. Then, using binary range image processing building facades will be detected.
Remained point cloud will be grouped into voxels which are then transformed to super voxels. Local 3D features extracted from super voxels are classified by trained boosted decision trees and labeled with semantic classes such as tree, pedestrian, and car. Given labeled 3D point cloud and 2D image with known viewing camera pose, the proposed association module aligns collections of 3D points to the groups of 2D image pixel to parsing 2D cubic images.

**Automatic quantification of mitochondrial fragmentation from two-photon microscope images of mouse brain tissue**

The morphology of mitochondria can inform about their functional state and, thus, about cell vitality. For example, fragmentation of the mitochondrial network is associated with many diseases. Recent advances in neuronal imaging have enabled the observation of mitochondria in live brains for long periods of time, enabling the study of their dynamics in animal models of diseases. To aid these studies, we developed an automatic method, based on supervised learning, for quantifying the degree of mitochondrial fragmentation in tissue images acquired via two-photon microscopy from transgenic mice, which exclusively express Enhanced cyan fluorescent protein (ECFP) under Thy1 promoter, targeted to the mitochondrial matrix in subpopulations of neurons. We tested the method on images prior to and after cardiac arrest, and found it to be sensitive to significant changes in mitochondrial morphology because of the arrest. We conclude that the method is useful in detecting morphological abnormalities in mitochondria and, likely, in other subcellular structures as well.
Benefits for supplier and customer with the help of logged usage data

Visual analytics of logged usage data based on end-user interactions can increase understanding of user experience and system use. This in turn can support continuous development, technology renewal and service development that enhances the end-user's experience, as well as create competitive advantage.

General information
State: Published
Ministry of Education publication type: D2 Article in professional manuals or guides or professional information systems or text book material
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Väätäjä, H., Heimonen, T., Tiitinen, K., Hakulinen, J., Turunen, M.
Pages: 110-112
Publication date: 2015

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Title of host publication: User Experience and Usability in Complex Systems - UXUS : FIMECC Publications Series No. 8, 2010-2015
ISBN (Print): 978-952-238-146-0
ISBN (Electronic): 978-952-238-147-7

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Publisher: FIMECC Oy
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ISSN (Print): 2342-2688
ISSN (Electronic): 2342-2696
Keywords: user experience, Usability, complex systems, human-computer interaction, human-centered design, logging
ASJC Scopus subject areas: Management of Technology and Innovation, Human-Computer Interaction

Biological networks: the microscope of the twenty-first century?

General information
State: Published
Ministry of Education publication type: B1 Article in a scientific magazine
Organisations: Department of Signal Processing, BioMediTech
Authors: Emmert-Streib, F., Dehmer, M.
Publication date: 2015
Peer-reviewed: No

Publication information
Journal: Frontiers in Genetics
Volume: 6
ISSN (Print): 1664-8021

Ratings:
Scopus rating (2016): CiteScore 3.44 SJR 1.99 SNIP 0.888
Scopus rating (2015): SJR 2.001 SNIP 0.847 CiteScore 3.38
Characterizing Context of Use in Mobile Work

The context of use has been widely acknowledged as important when designing and evaluating systems for work related activities. This paper describes in case of mobile news making the synthesized findings on the context of use. Findings are categorized to five components and nineteen subcomponents and characterized with examples from our studies. The presented findings validate a previously presented model for context of use in mobile HCI, extend it, and elaborate the definitions for the components. The presented elaborated model can be applied by academics and practitioners in development, research and evaluation activities from identifying requirements to evaluating systems for mobile work. Findings support understanding what circumstances and how they can contribute to user experience and acceptance of designed systems.

Characterizing the Context of Use in Mobile Work

The context of use has been widely acknowledged as important when designing and evaluating systems for work related activities. This paper describes in case of mobile news making the synthesized findings on the context of use. Findings are categorized to five components and nineteen subcomponents and characterized with examples from our studies. The presented findings validate a previously presented model for context of use in mobile HCI, extend it, and elaborate the definitions for the components. The presented elaborated model can be applied by academics and practitioners in development, research and evaluation activities from identifying requirements to evaluating systems for mobile work. Findings support understanding what circumstances and how they can contribute to user experience and acceptance of designed systems.
CIP2A is a candidate therapeutic target in clinically challenging prostate cancer cell populations

Residual androgen receptor (AR)-signaling and presence of cancer stem-like cells (SCs) are the two emerging paradigms for clinically challenging castration-resistant prostate cancer (CRPC). Therefore, identification of AR-target proteins that are also overexpressed in the cancer SC population would be an attractive therapeutic approach. Our analysis of over three hundred clinical samples and patient-derived prostate epithelial cultures (PPECs), revealed Cancerous inhibitor of protein phosphatase 2A (CIP2A) as one such target. CIP2A is significantly overexpressed in both hormonenaïve prostate cancer (HN-PC) and CRPC patients. CIP2A is also overexpressed, by 3- and 30-fold, in HN-PC and CRPC SCs respectively. In vivo binding of the AR to the intronic region of CIP2A and its functionality in the AR-moderate and AR-high expressing LNCaP cell-model systems is also demonstrated. Further, we show that AR positively regulates CIP2A expression, both at the mRNA and protein level. Finally, CIP2A depletion reduced cell viability and colony forming efficiency of AR-independent PPECs as well as AR-responsive LNCaP cells, in which anchorage-independent growth is also impaired. These findings identify CIP2A as a common denominator for AR-signaling and cancer SC functionality, highlighting its potential therapeutic significance in the most clinically challenging prostate pathology: castration-resistant prostate cancer.

Keywords: Androgen receptor, Cancer stem-like cells, Castration-resistant prostate cancer, CIP2A

Original language: English
ASJC Scopus subject areas: Oncology

Publication information
Journal: Oncotarget
Volume: 6
Issue number: 23
ISSN (Print): 1949-2553
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Scopus rating (2016): SJR 1.927 SNIP 1.056 CiteScore 4.73
Scopus rating (2015): SJR 2.262 SNIP 1.113 CiteScore 4.91
Scopus rating (2014): SJR 2.521 SNIP 1.277 CiteScore 4.96
Scopus rating (2013): SJR 3.041 SNIP 1.268 CiteScore 5.26
Scopus rating (2012): SJR 2.474 SNIP 1.096 CiteScore 6.54
Scopus rating (2011): SJR 1.481 SNIP 0.494 CiteScore 3.38

Research output: Scientific - peer-review › Article
Classification of moving ground radar objects by using bispectrum-based features

In this paper, a novel bispectrum-based strategy applied for moving object classification by using the Doppler radar surveillance systems is proposed. Time-frequency distributions (TFDs) computed by bispectrum-based processing of signals backscattered by moving objects are used for extraction of classification features. Phase coupling contributions extracted from radar backscattering serve as the classification features contained in bispectrum-based TFDs. Coherent and homodyne Doppler radar operating at frequency of 33 GHz and continuous mode is exploited in experimental measurements. Experimental data are collected for five target classes: a single walking human, a group of walking humans, a bicyclist, a vehicle, and vegetation clutter. Classification performance of the proposed bispectrum-based automatic target recognition (ATR) radar system is examined by comparing it to the ATR systems using common energy-based TFDs. The benefits of the bispectrum-based approach are demonstrated and studied.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), National Aerospace University
Authors: Molchanov, P. O., Astola, J. T., Egiazarian, K. O., Totsky, A. V.
Number of pages: 19
Pages: 527-545
Publication date: 2015
Peer-reviewed: Yes

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Journal: Telecommunications and Radio Engineering
Volume: 74
Issue number: 6
ISSN (Print): 0040-2508
Ratings:
Scopus rating (2016): CiteScore 0.31 SJR 0.211 SNIP 0.59
Scopus rating (2015): SJR 0.192 SNIP 0.546 CiteScore 0.17
Scopus rating (2014): SJR 0.21 SNIP 0.391 CiteScore 0.15
Scopus rating (2013): SJR 0.193 SNIP 0.629 CiteScore 0.17
Scopus rating (2012): SJR 0.191 SNIP 0.537 CiteScore 0.12
Scopus rating (2011): SJR 0.192 SNIP 0.657 CiteScore 0.13
Scopus rating (2010): SJR 0.195 SNIP 0.072
Scopus rating (2009): SJR 0.189 SNIP 0.074
Scopus rating (2008): SJR 0.151 SNIP 0.068
Scopus rating (2007): SJR 0.133 SNIP 0.024
Scopus rating (2006): SJR 0.124 SNIP 0.09
Scopus rating (2005): SJR 0.143 SNIP 0.025
Scopus rating (2004): SJR 0.125 SNIP 0.017
Scopus rating (2003): SJR 0.194 SNIP 0.285
Scopus rating (2002): SJR 0.191 SNIP 0.092
Scopus rating (2001): SJR 0.143 SNIP 0.01
Scopus rating (2000): SJR 0.1 SNIP 0
Scopus rating (1999): SJR 0.123 SNIP 0
Original language: English
ASJC Scopus subject areas: Electrical and Electronic Engineering
Keywords: Automatic target recognition radar system, Bispectrum estimate, Ground moving object, Instantaneous frequency, Phase coupling, The ground surveillance doppler radar, Time-frequency distribution
DOIs:
10.1615/TelecomRadEng.v74.i6.50
Source: Scopus
Source-ID: 84941616153
Research output: Scientific - peer-review » Article

Class-specific nonlinear projections using class-specific kernel spaces

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Cloud Technologies for the Internet of Things: Defining a Research Agenda Beyond the Expected Topics

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Nokia Technologies
Authors: Taivalsaari, A., Mikkonen, T.
Pages: 484-488
Publication date: 2015

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Publisher: IEEE
ISBN (Print): 978-1-4673-7585-6
DOIs: 10.1109/SEAA.2015.12
Research output: Scientific - peer-review › Conference contribution

Code Density and Energy Efficiency of Exposed Datapath Architectures
Exposing details of the processor datapath to the programmer is motivated by improvements in the energy efficiency and the simplification of the microarchitecture. However, an instruction format that can control the data path in a more explicit manner requires more expressiveness when compared to an instruction format that implements more of the control logic in the processor hardware and presents conventional general purpose register based instructions to the programmer. That is, programs for exposed datapath processors might require additional instruction memory bits to be fetched, which consumes additional energy. With the interest in energy and power efficiency rising in the past decade, exposed datapath architectures have received renewed attention. Several variations of the additional details to expose to the programmer have been proposed in the academy, and some exposed datapath features have also appeared in commercial architectures. The different variations of proposed exposed datapath architectures and their effects to the energy efficiency, however, have not so far been analyzed in a systematic manner in public. This article provides a review of exposed datapath approaches and highlights their differences. In addition, a set of interesting exposed datapath design choices is evaluated in a closer study. Due to the fact that memories constitute a major component of power consumption in contemporary processors, we analyze instruction encodings for different exposed datapath variations and consider the energy required to fetch the additional instruction bits in comparison to the register file access savings achieved with the exposed datapath.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Signal Processing Research Community (SPRC)
Authors: Jääskeläinen, P., Kultala, H., Viitanen, T., Takala, J.
Number of pages: 16
Pages: 49-64
Publication date: 2015
Peer-reviewed: Yes
Early online date: 1 Jan 2014

Publication information
Journal: Journal of Signal Processing Systems
Volume: 80
Issue number: 1
Collaboration, distribution and culture - challenges for communication

This paper describes a case study for collecting digital footprint data for the purpose of health data mining. The case study involved 20 subjects residing in Finland who were instructed to collect data from registries which they evaluated to be...
useful for understanding their health or health behaviour, current or past. 11 subjects were active, sending 100 data requests to 49 distinct organizations in total. Our results indicate that there are still practical challenges in collecting actionable digital footprint data. Our subjects received a total of 75 replies (reply rate of 75.0%) and 61 datasets (reception rate of 61%). Out of the received data, 44 datasets (72.1%) were delivered in paper format, 4 (6.6%) in portable document format and 13 (21.3%) in structured digital form. The time duration between the sending of the information requests and reception of a reply was 26.4 days on the average.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI, Research Community on Data-to-Decision (D2D)
Authors: Gencoglu, O., Similä, H., Honko, H., Isomursu, M.
Number of pages: 4
Pages: 7626-7629
Publication date: 2015

Host publication information
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ISBN (Print): 978-1-4244-9270-1
Keywords: Banking, Data mining, Education, Insurance, Medical services, Organizations, Portable document format
DOIs:
10.1109/EMBC.2015.7320158
Source: RIS
Source-ID: urn:FA0B37F7B248AFC77D58A5E4F14665C0
Research output: Scientific - peer-review › Conference contribution

Comparison of Functional, Structural, and Dynamic Business-IT Alignment Models: A Case Study

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT)
Authors: Pekkola, S., Nieminen, N.
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the 21st Americas Conference on Information Systems (AMCIS) 2015
Publisher: Association for Information Systems
ISBN (Electronic): 978-0-9966831-0-4
Links:
http://aisel.aisnet.org/amcis2015/StrategicUse/GeneralPresentations/13/
http://aisel.aisnet.org/amcis2015/
Research output: Scientific - peer-review › Conference contribution

Compositional Models for Audio Processing: Uncovering the structure of sound mixtures

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Audio research group, Research Community on Data-to-Decision (D2D)
Authors: Virtanen, T., Gemmeke, J. F., Raj, B., Smaragdis, P.
Number of pages: 20
Pages: 125 - 144
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: IEEE Signal Processing Magazine
Volume: 32
Issue number: 2
Constrained Directed Graph Clustering and Segmentation Propagation for Multiple Foregrounds Cosegmentation

This paper proposes a new constrained directed graph clustering (DGC) method and segmentation propagation method for the multiple foreground cosegmentation. We solve the multiple object cosegmentation with the perspective of classification and propagation, where the classification is used to obtain the object prior of each class and the propagation is used to propagate the prior to all images. In our method, the DGC method is designed for the classification step, which adds clustering constraints in cosegmentation to prevent the clustering of the noise data. A new clustering criterion such as the strongly connected component search on the graph is introduced. Moreover, a linear time strongly connected component search algorithm is proposed for the fast clustering performance. Then, we extract the object priors from the clusters, and propagate these priors to all the images to obtain the foreground maps, which are used to achieve the final multiple objects extraction. We verify our method on both the cosegmentation and clustering tasks. The experimental
results show that the proposed method can achieve larger accuracy compared with both the existing cosegmentation methods and clustering methods.

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Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D)
Authors: Meng, F., Li, H., Zhu, S., Luo, B., Zeng, B., Gabbouj, M.
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Scopus rating (2015): SJR 1.253 SNIP 3.384 CiteScore 5.49
Scopus rating (2014): SJR 1.071 SNIP 3.365 CiteScore 4.43
Scopus rating (2013): SJR 1.158 SNIP 3.139 CiteScore 4.54
Scopus rating (2012): SJR 1.073 SNIP 3.051 CiteScore 3.64
Scopus rating (2011): SJR 1.101 SNIP 2.771 CiteScore 3.56
Scopus rating (2010): SJR 1.279 SNIP 3.284
Scopus rating (2009): SJR 1.61 SNIP 3.89
Scopus rating (2008): SJR 1.587 SNIP 3.587
Scopus rating (2007): SJR 1.849 SNIP 3.697
Scopus rating (2006): SJR 2.244 SNIP 5.368
Scopus rating (2005): SJR 2.139 SNIP 6.847
Scopus rating (2004): SJR 1.477 SNIP 5.829
Scopus rating (2003): SJR 2.222 SNIP 4.323
Scopus rating (2002): SJR 2.817 SNIP 4.448
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Original language: English
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10.1109/TCSVT.2015.2402891
Research output: Scientific - peer-review › Article

**Content Sharing Building Social User Experiences**
People are increasingly interested in personally creating content, such as images, audio and videos, as well as sharing them in social networking services. Creating content has become increasingly common with state-of-art devices and technology. Sharing such content mediates rich social interactions between the users in social media services. This research aims to gain deeper understanding of personal content management from the user experience viewpoint. This research studies the design solutions supporting and motivating users in management and sharing of their personal content. Contribution of this work is to identify the motivations and needs that occur in media content sharing regardless of the content type and as a theoretical outcome Content Sharing Social User Experience framework is constructed.

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Ojala, J.
Number of pages: 3
Pages: 903-905
Publication date: 2015
Cross-Cultural Design of Mobile Mathematics Learning Service for South African Schools

In the era of mobile devices and services, researchers in the educational domain have been interested in how to support learning with mobile technology in both local and global contexts. Recent human-computer interaction (HCI) research in the educational domain has particularly focused on how to develop mobile learning services and how to evaluate the learning outcomes. However, learning occurs in a local cultural context and the impact of culturally sensitive issues of the design of mobile learning needs more attention. We studied mobile mathematics learning-service in a longitudinal research with over 30 South African schools during three years. Our aim was to understand culturally dependent issues which need to be taken into consideration in the design of mobile learning services. We found subjective and objective culturally dependent issues in the content, context, infrastructure and technology of mobile learning and therefore, subjects to cross-cultural research. In conclusion, we argue that localization enhances the user experience and therefore support learning.
Cross-cultural issues in working with users in the design of interactive systems

Globalization of markets means that interactive systems need to be usable and provide positive user experience (UX) to users in many different cultures. There is an increasing realization that systems may need to be localized to different cultures, but less realization that methods used to work with users also need to be localized. We present two case studies which investigate cultural differences in users’ interpretation of and reactions to methods used to elicit usability and UX information. The first case study investigated the use of photos and sketches with Nigerian and Anglo-Celtic participants, the second investigated the use of three different question types, Likert items, sentence completion questions and open-ended questions with Chinese and British participants. Conclusions are drawn for conducting cross-cultural user research.

CueSense: a Wearable Proximity-Aware Display Enhancing Encounters

Wearable technology has been envisioned, amongst other things, to enhance face-to-face social interaction. For example, the visibility of wearable devices to other people (e.g. a wearable display) could augment the wearer’s appearance by displaying public and socially relevant information about them. Such information could increase nearby people’s awareness of the wearer, thus serve as tickets-to-talk and, ideally, enhance their first encounters. We present the design of CueSense, a wearable displays that shows textual content from the wearer’s social media profiles, determined by the level of proximity to another user and match-making between their contents. We report the findings from a preliminary user
Cultural influence on online community use: A cross-cultural study on online exercise diary users of three nationalities

This study investigates the influence of culture on the use of a website intended for tracking exercise activities. The data was collected using an online survey with 258 respondents from three national backgrounds: Germany, the USA and Spain. In the analysis, the focus was on determining whether users' cultural background impacts their use and perception of the site, especially as concerns social networking and the sharing of content. The Spanish were most interested in social networking, collaboration and sharing content with others, whereas the German participants were the least interested in these activities. The applicability of Hofstede's cultural theory in the explanation of differences between national cultures in online community use is discussed.
In this paper, a data collector service has been developed based on embedded Linux, which operates as a key element in a larger intelligent alarm system. The target of this study was to test out how well a cost-efficient single-board computer could be used to gather sensory data, and how this data can be provided for the client over the public Internet. The paper describes the data collector service currently in use and its functionality and also gives a concrete example of how to utilize a microcontroller with an embedded Linux distribution. The paper presents one solution on how to utilize embedded systems for managing and controlling conditions in buildings and also environmental conditions in a smart and cost-effective way.

Using an activity tracker for measuring activity-related parameters, e.g. steps and energy expenditure (EE), can be very helpful in assisting a person’s fitness improvement. Unlike the measuring of number of steps, an accurate EE estimation requires additional personal information as well as accurate velocity of movement which is hard to achieve due to
inaccuracy of sensors. In this paper, we have evaluated regression-based models to improve the precision for both steps and EE estimation. For this purpose, data of seven activity trackers and two reference devices was collected from 20 young adult volunteers wearing all devices at once in three different tests, namely 60-minute office work, 6-hour overall activity and 60-minute walking. Reference data is used to create regression models for each device and relative percentage errors of adjusted values are then statistically compared to that of original values. The effectiveness of regression models are determined based on the result of a statistical test. During a walking period, EE measurement was improved in all devices. The step measurement was also improved in five of them. The results show that improvement of EE estimation is possible only with low-cost implementation of fitting model over the collected data e.g. in the app or in corresponding service back-end.

**General information**

State: Published  
Ministry of Education publication type: A4 Article in a conference publication  
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Authors: Andalibi, V., Honko, H., Christophe, F., Viik, J.  
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ORG=tie,0.3  
ORG=sgn,0.35  
ORG=elt,0.35  
Research output: Scientific - peer-review › Conference contribution

**Data driven ecosystem - Perspectives and problems**

Our society and business ecosystem is becoming data driven. The value of data is becoming comparable to the value of physical products and becoming an important source of business. Open data itself is seen as a meaningful source of new business, especially for small and medium-sized companies. Open data is purposely aimed at being public. In addition, there is a lot of data used as if it were public - more or less without permission. In addition, the ownership of data has become unclear - the data related to an individual is no longer under the control of the persons themselves. However, declaring data sets to be open and/or allowing access to qualified users does not yet make data useful in practice. On the contrary, this often creates opportunities for misuse and dangers regarding personal security.

**General information**

State: Published  
Ministry of Education publication type: A4 Article in a conference publication  
Organisations: Pori Department, Research group: Software Engineering and Intelligent Systems, Tallinn University of Technology  
Authors: Jaakkola, H., Henno, J., Soini, J.  
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**Publication series**

Name: CEUR Workshop Proceedings  
Volume: 1375  
ISSN (Print): 1613-0073
Delayed key exchange for constrained smart devices

In the Internet of Things some nodes, especially sensors, can be constrained and sleepy, i.e., they spend extended periods of time in an inaccessible sleep state. Therefore, the services they offer may have to be accessed through gateways. Typically this requires that the gateway is trusted to store and transmit the data. However, if the gateway cannot be trusted, the data needs to be protected end-to-end. One way of achieving end-to-end security is to perform a key exchange, and secure the subsequent messages using the derived shared secrets. However, when the constrained nodes are sleepy this key exchange may have to be done in a delayed fashion. We present a novel way of utilizing the gateway in key exchange, without the possibility of it influencing or compromising the exchanged keys. The paper investigates the applicability of existing protocols for this purpose. Furthermore, due to a possible need for protocol translations, application layer use of the exchanged keys is examined.
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.

Designing an Unobtrusive Analytics Framework for Monitoring Java Applications

In software development, attention has recently been placed on understanding users and their interactions with systems. User studies, practices such as A/B testing, and frameworks such as Google Analytics that gather data on production use have become common approaches in particular in the context of the Web, where it is easy to perform frequent updates as new needs emerge. However, when considering installable desktop applications, the situation gets more complex. While analytics facilities are still needed, they should address business logic, not generic traffic as is the case with many web sites. Moreover, analytics should be unobtrusive, and not have a high impact on the evolution of the actual application; thus, analytics should be treated as an add-on, as the target system may already exist. Finally, the instrumentation of features that are observed should be easy and flexible, but the provided mechanisms should be expressive enough for many use cases. In this paper, we examine different alternatives for implementing such monitoring mechanisms, and report results from an experiment with Vaadin, a web framework based on Java and Google Web Toolkit, GWT.
Designing Mobile Devices Encouraging and Supporting Collocated Interactions

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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Jarusritboonchai, P.
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Publisher: ACM
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Source: Bibtex
Source-ID: urn:095b1afaeb719bcbafacfeea29629b5
Research output: Scientific - peer-review › Conference contribution

Design Patterns for Model-Driven Development
Design patterns document solutions to recurring design and development challenges. UML, which is the de-facto modeling language in software development, supports defining and using patterns with its Collaboration concepts. However, as is demonstrated in the paper, the support is not sufficient for all kinds of patterns and all meaningful ways to use patterns. In this paper, the use of design patterns is suggested for documentation purposes in Model-Driven Development. The pattern support of UML is complemented with an approach that does not constrain the nature of pattern solutions. The approach is tool-supported in a model-driven development tool environment for basic control and safety-related control applications, UML AP tool. The developed tool support includes instantiating and highlighting patterns in models as well as gathering documentation on use of patterns, which could especially benefit safety system development.
Detecting and tracking the tips of fluorescently labeled mitochondria in U2OS cells

We present a method for automatically detecting the tips of fluorescently labeled mitochondria. The method is based on a Random Forest classifier, which is trained on small patches extracted from confocal microscope images of U2OS human osteosarcoma cells. We then adopt a particle tracking framework for tracking the detected tips, and quantify the tracking accuracy on simulated data. Finally, from images of U2OS cells, we quantify changes in mitochondrial mobility in response to the disassembly of microtubules via treatment with Nocodazole. The results show that our approach provides efficient tracking of the tips of mitochondria, and that it enables the detection of disease-associated changes in mitochondrial motility.
Detection and Segmentation of Nucleoids Based on Gradient Path Labelling

Cellular aging is one of the topics that live cell imaging can assist. With age, there is an increase of aggregates of misfolded proteins, to which age-related diseases have been linked to. In Escherichia coli, protein aggregates linked to its aging process exhibit a spatial distribution that appears to be caused by the nucleoid at midcell. To correlate the locations of protein aggregates and the nucleoid, it is necessary to detect and segment the nucleoid from microscopy images. We present an adaptation of methods for Drusen's detection and segmentation to nucleoids in E. coli. The size of the nucleoid, extracted using the method here proposed, was compared with an alternative measure (FWHM-based measure) and with the regions of anisotropies in aggregates motions. These comparisons suggest that our new method is of use, providing more accurate minor axis lengths. Also, it provides additional measures, such as the nucleoid's center orientation angle, area, and pixel list.

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Organisations: Department of Signal Processing, Research group: Laboratory of Biosystem Dynamics-LBD
Authors: Santinha, J., Mora, A. D., Fonseca, J., Goncalves, N., Ribeiro, A. S.
Number of pages: 5
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Original language: English
Links:
Research output: Scientific - peer-review › Article

Determining Minimized Galois Field Expressions for Ternary Functions by using Special Normal Form

The Special Normal Form (SNF) for Boolean functions is a redundant representation that is useful in determining minimized Exclusive-Or-Sum-Of-Product (ESOP) expressions. Generalized Reed-Muller expressions (GRM) can be viewed as expressions that are close to the ESOPs in the number of products, however, they are easier to determine, which makes them important in practical applications.

Galois field (GF) expressions are a generalization of Reed-Muller expressions to multiple-valued logic functions. This paper extends the notion of SNF for Boolean functions to ternary logic functions. An algorithm to minimize generalized Galois field (GF) expressions for ternary functions by using SNF is presented.

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Organisations: Department of Signal Processing, Research group: Algebraic and Algorithmic Methods in Signal Processing AAMSP, Signal Processing Research Community (SPRC)
Authors: Stankovic, R. S., Astola, H., Astola, J.
Number of pages: 19
Pages: 53-71
Publication date: 2015
Peer-reviewed: Yes
In this paper, we study the discrimination power of graph measures that are based on graph-theoretical matrices. The paper generalizes the work of [M. Dehmer, M. Moosbrugger, Y. Shi, Encoding structural information uniquely with polynomial-based descriptors by employing the Randić matrix, Applied Mathematics and Computation, 268(2015), 164-168]. We demonstrate that by using the new functional matrix approach, exhaustively generated graphs can be discriminated more uniquely than shown in the mentioned previous work.
Do we know how difficult the rainfall problem is?

The programming task known as the Rainfall Problem has developed a reputation for being surprisingly difficult for introductory-level (CS1) students. We contribute a survey of studies of the problem as well as a new study of students’ solutions collected at three institutions. In all three CS1s, at least about half of the students were able to fully solve the problem and the large majority were at least close. Failure to handle invalid or missing input accounted for most bugs. Our survey and study together suggest that the Rainfall Problem is not necessarily overwhelmingly difficult: Success rates vary and some reasonably good results have been achieved under multiple programming paradigms. We provide a breakdown of confounding factors and suggest improvements and hypotheses for future studies of the Rainfall Problem.

Early Product Design in Startups: Towards a UX Strategy

Startups often begin with minimal product versions to test and validate their product ideas as early as possible. Therefore, the first versions of
the product need to be able to communicate the product idea to users in order to receive meaningful feedback. However, if user experience (UX) of the product is poor, users tend to concentrate on the disturbing user interface instead of the actual product idea. Thus, we suggest that startups should have a UX strategy from the beginning in order to understand their goals related to UX at different stages of product maturity. To this end, we conducted an interview study with eight Finland-based startups and 13 participants. Our results contribute towards understanding both needs for early UX design in startups as well as the restrictions for UX work that the scarce resources of startups induce. This work contributes to creating a UX strategy model for startups.

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Authors: Hokkanen, L., Kuusinen, K., Väänänen, K.
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Research output: Scientific - peer-review › Conference contribution

EDB: A Multi-Master Database for Liquid Multi-Device Software
Device shipment trends indicate that the number of web-enabled devices will grow very rapidly. The rapid growth of different types of devices in our daily lives will fundamentally change the expectations on device synchronization. In this paper, we introduce EDB - a database architecture that has been built specifically to support automatic multi-master synchronization between multiple mobile devices with potentially intermittent network connectivity. EDB supports the broader vision of multiple device ownership and liquid software in which applications and services are expected to seamlessly roam from one device or computer to another.

General information
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Authors: Koskimies, O., Wikman, J., Mikola, T., Taivalsaari, A.
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Research output: Scientific - peer-review › Conference contribution

Educational Data Mining and Learning Analytics in Programming: Literature Review and Case Studies
Educational data mining and learning analytics promise better understanding of student behavior and knowledge, as well as new information on the tacit factors that contribute to student actions. This knowledge can be used to inform decisions related to course and tool design and pedagogy, and to further engage students and guide those at risk of failure. This
working group report provides an overview of the body of knowledge regarding the use of educational data mining and learning analytics focused on the teaching and learning of programming. In a literature survey on mining students’ programming processes for 2005-2015, we observe a significant increase in work related to the field. However, the majority of the studies focus on simplistic metric analysis and are conducted within a single institution and a single course. This indicates the existence of further avenues of research and a critical need for validation and replication to better understand the various contributing factors and the reasons why certain results occur. We introduce a novel taxonomy to analyse replicating studies and discuss the importance of replicating and reproducing previous work. We describe what is the state of the art in collecting and sharing programming data. To better understand the challenges involved in replicating or reproducing existing studies, we report our experiences from three case studies using programming data. Finally, we present a discussion of future directions for the education and research community.

General information
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Source: Bibtex
Source-ID: urn:be2a13ce90750480ee2924cac5c1e05f
Research output: Scientific › peer-review › Conference contribution

Effect of Carouseling on Angular Rate Sensor Error Processes

General information
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Authors: Collin, J., Kirkko-Jaakkola, M., Takala, J.
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Scopus rating (2015): SJR 0.949 SNIP 1.931 CiteScore 2.78
Scopus rating (2014): SJR 0.765 SNIP 2.102 CiteScore 2.5
Scopus rating (2013): SJR 0.736 SNIP 2.145 CiteScore 2.67
Scopus rating (2012): SJR 0.737 SNIP 1.835 CiteScore 2.21
Scopus rating (2011): SJR 0.669 SNIP 1.763 CiteScore 1.93
Scopus rating (2010): SJR 0.55 SNIP 1.235
Scopus rating (2009): SJR 0.486 SNIP 1.502
Scopus rating (2008): SJR 0.641 SNIP 1.198
Scopus rating (2007): SJR 0.716 SNIP 1.587
Efficiency of texture image enhancement by DCT-based filtering

Abstract Textures or high-detailed structures as well as image object shapes contain information that is widely exploited in pattern recognition and image classification. Noise can deteriorate these features and has to be removed. In this paper, we consider the influence of textural properties on efficiency of image enhancement by noise suppression for the posterior treatment. Among possible variants of denoising, filters based on discrete cosine transform known to be effective in removing additive white Gaussian noise are considered. It is shown that noise removal in texture images using the considered techniques can distort fine texture details. To detect such situations and to avoid texture degradation due to filtering, filtering efficiency predictors, including neural network based predictor, applicable to a wide class of images are proposed. These predictors use simple statistical parameters to estimate performance of the considered filters. Image enhancement is analysed in terms of both standard criteria and metrics of image visual quality for various scenarios of texture roughness and noise characteristics. The discrete cosine transform based filters are compared to several counterparts. Problems of noise removal in texture images are demonstrated for all of them. A special case of spatially correlated noise is considered as well. Potential efficiency of filtering is analysed for both studied noise models. It is shown that studied filters are close to the potential limits.

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Scopus rating (2014): SJR 0.942 SNIP 1.793 CiteScore 2.99
Scopus rating (2013): SJR 0.878 SNIP 2.006 CiteScore 2.95
Scopus rating (2012): SJR 0.874 SNIP 1.557 CiteScore 2.57
Scopus rating (2011): SJR 0.966 SNIP 1.84 CiteScore 2.6
Scopus rating (2010): SJR 0.696 SNIP 1.288
Scopus rating (2009): SJR 0.507 SNIP 1.334
Scopus rating (2008): SJR 0.538 SNIP 0.885
Emotion measurement services for knowledge workers

In order to understand and manage how emotions affect knowledge work, organizations need proper tools to become aware of emotions. Measuring emotions is an approach to consider. In this paper, three different emotion measurement services are tested: daily experience survey, electrodermal activity ring and self-tracking of emotions. The paper provides new insights and user experiences of emotion measurement services and their applicability in daily knowledge work. Managerial guidelines are drawn up for planning and executing emotion measurement services in an organization for two purposes – self-development and measuring company pulse.

**General information**

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Organisations: Department of Information Management and Logistics, Research group: Novi, Department of Information Management and Logistics, Intopalo Oy
Authors: Vuolle, M., Salonius, H., Lintinen, J., Mäkinen, J.
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Publication date: 2015

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Publisher: RESER European Association for Research on Services
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Bibliographical note

AUX=tlo,"Lintinen, Johanna"
Research output: Scientific › Conference contribution

Empowering Industrial Maintenance Personnel with Situationally Relevant Information using Semantics and Context Reasoning

Industrial maintenance is a complex discipline requiring experience and know-how. Information such as maintenance work orders are usually provided through mobile devices to field personnel. There are also other information sources with manuals, documented history, contact information etc. that is of value supporting the tasks at hand but typically this needs to be retrieved manually. The challenge is how to utilize information originating from heterogeneous information sources that, in addition, may change e.g. for outsourced maintenance service providers taking care of different sites. To facilitate the use of supporting materials an ontology knowledge management approach is developed that integrates data and documents, and provides relevant information for the task at hand using context and semantics based reasoning. Results from early prototyping show that the approach can improve utilization of information in existing systems through adapter layers and complement existing mobile as well as upcoming augmented reality applications by automatically providing situationally relevant information.

**General information**

State: Published
Entropy of weighted graphs with Randić weights

Shannon entropies for networks have been widely introduced. However, entropies for weighted graphs have been little investigated. Inspired by the work due to Eagle et al., we introduce the concept of graph entropy for special weighted graphs. Furthermore, we prove extremal properties by using elementary methods of classes of weighted graphs, and in particular, the one due to Bollobás and Erdös, which is also called the Randić weight. As a result, we derived statements on dendrimers that have been proven useful for applications. Finally, some open problems are presented.

General information

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Department of Computer Science & Information Systems, University of Limerick, Ireland, College of Computer and Control
Engineering, Nankai University, Universität der Bundeswehr München, Department of Mechatronics and Biomedical
Computer Science, UMIT, Center for Combinatorics and LPMC-TJKLC
Authors: Chen, Z., Dehmer, M., Emmert-Streib, F., Shi, Y.
Number of pages: 14
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Publication date: 2015
Peer-reviewed: Yes

Publication information

Journal: Entropy
Volume: 17
Issue number: 6
ISSN (Print): 1099-4300
Ratings:
Scopus rating (2016): SJR 0.584 SNIP 1.065 CiteScore 1.87
Scopus rating (2015): SJR 0.557 SNIP 1.166 CiteScore 1.99
Scopus rating (2014): SJR 0.51 SNIP 1.169 CiteScore 1.69
Scopus rating (2013): SJR 0.488 SNIP 1.347 CiteScore 1.8
Scopus rating (2012): SJR 0.409 SNIP 1.04 CiteScore 1.41
Scopus rating (2011): SJR 0.47 SNIP 1.109 CiteScore 1.29
Scopus rating (2010): SJR 0.394 SNIP 1.056
Scopus rating (2009): SJR 0.358 SNIP 0.612
Scopus rating (2008): SJR 0.325 SNIP 0.604
Scopus rating (2007): SJR 0.574 SNIP 0.925
Scopus rating (2006): SJR 0.35 SNIP 0.644
Scopus rating (2005): SJR 0.299 SNIP 0.382
Scopus rating (2004): SJR 0.244 SNIP 0.543
Scopus rating (2003): SJR 0.209 SNIP 0.351
Scopus rating (2002): SJR 0.178 SNIP 0.461
Scopus rating (2001): SJR 0.12 SNIP 0.292
Scopus rating (2000): SJR 0.141 SNIP 2.3
Evaluating the Impact of Sound Events' Rhythm Characteristics to Listener's Valence

While modern sound researchers generally focus on speech and music, mammalian hearing arose from the need to sense those events in the environment that produced sound waves. Such unorganized sound stimuli, referred to as Sound Events (SEs), can also produce an affective and emotional response. In this research, the investigators explore valence recognition of SEs utilizing rhythm-related acoustics cues. A well-known data set with emotionally annotated SEs was employed; various rhythm-related attributes were then extracted and several machine-learning experiments were conducted. The results portray that the rhythm of a SE can affect the listener's valence up to an extent and, combined with previous works on SEs, could lead to a comprehensive recognition of the rhythm's effect on the emotional state of the listener.

General information
State: Published
Organisations: Research Community on Data-to-Decision (D2D), Ionian University, Former organisation of the author
Authors: Drossos, K., Floros, A., Kermanidis, K. L.
Number of pages: 15
Publication date: 2015
Publication information
Journal: Journal of the Audio Engineering Society
Volume: 63
Issue number: 3
ISSN (Print): 1549-4950
Ratings:
Scopus rating (2016): SJR 0.376 SNIP 0.963 CiteScore 0.95
Scopus rating (2015): SJR 0.512 SNIP 1.346 CiteScore 1.11
Scopus rating (2014): SJR 0.617 SNIP 1.419 CiteScore 1.05
Scopus rating (2013): SJR 0.466 SNIP 1.94 CiteScore 1.35
Scopus rating (2012): SJR 0.443 SNIP 1.217 CiteScore 0.68
Scopus rating (2011): SJR 0.502 SNIP 1.059 CiteScore 0.58
Scopus rating (2010): SJR 0.437 SNIP 1.103
Scopus rating (2009): SJR 0.516 SNIP 0.922
Scopus rating (2008): SJR 0.711 SNIP 1.115
Scopus rating (2007): SJR 0.356 SNIP 1.163
Scopus rating (2006): SJR 0.35 SNIP 0.78
Scopus rating (2005): SJR 0.361 SNIP 1.037
Scopus rating (2004): SJR 0.471 SNIP 1.757
Scopus rating (2003): SJR 0.452 SNIP 1.357
Scopus rating (2002): SJR 0.355 SNIP 1.344
Scopus rating (2001): SJR 0.486 SNIP 0.951
Scopus rating (2000): SJR 0.489 SNIP 1.587
Scopus rating (1999): SJR 0.336 SNIP 0.921
Original language: English
Links:
http://www.aes.org/e-lib/browse.cfm?elib=17573
Source: Bibtex
Source-ID: urn:22de44c09cefa6469313fdb958657759
Research output: Scientific - peer-review › Article
Existence and synthesis of complex hopfield type associative memories
In this research paper, a complex valued generalization of associative memory synthesized by Hopfield is considered and it is proved that it is impossible to synthesize such a neural network with desired unitary stable states when the dimension of the network (number of neurons) is odd. The linear algebraic structure of such a neural network is discussed. Using Sylvester construction of Hadamard matrix of suitable dimension, an algorithm to synthesize such a complex Hopfield neural network is discussed. Also, it is discussed how to synthesize real/complex valued associative memories with desired energy landscape (i.e. desired stable states and desired energy values of associated quadratic energy function).

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), International Institute of Information Technology Hyderabad
Authors: Rama Murthy, G., Gabbouj, M.
Number of pages: 14
Pages: 356-369
Publication date: 2015

Host publication information
Title of host publication: Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)
Publisher: Springer Verlag
ISBN (Print): 9783319192215

Publication series
Name: Lecture Notes in Computer Science
Volume: 9095
ISSN (Print): 0302-9743
ISSN (Electronic): 1611-3349
ASJC Scopus subject areas: Computer Science(all), Theoretical Computer Science
DOI:
10.1007/978-3-319-19222-2_30
Links:
http://www.scopus.com/inward/record.url?scp=84937710457&partnerID=8YFLogxK (Link to publication in Scopus)
Source: Scopus
Source-ID: 84937710457
Research output: Scientific - peer-review › Conference contribution

Experience-Driven Design of Ambiences for Future Pop Up Workspaces
Knowledge work is in transformation and new means for supporting workers’ wellbeing and productivity are needed. Pop Up workspaces are temporary and often social working environments where people can modify their environment to suit their current work mode. The aim of the present research was to explore the opportunities of future Pop Up workspaces, and specifically their technology-mediated ambiences that can provide meaningful experiences for the workers. We employed the Experience-Driven Design (EDD) approach to gain insights of the desired experiences in Pop Up workspaces. We first conducted three participatory group sessions to ideate experience types for Pop Up workspaces. We then run a multidisciplinary concepting workshop in which we designed concepts for technology-mediated ambiences. Five experience categories for worker mindsets were identified, namely Liberty, Fellowship, Determination, Retreat and Recovery. We present ambience concepts that utilise the mindsets and related target experiences, and how they can be supported by ambient technologies.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research group: Public Buildings, School of Architecture, Department of Information Management and Logistics, Research group: Novi, Research area: User experience, Augmented Human Activities (AHA), Institute of Society and Space (SOCIS)
Authors: Ahtinen, A., Poutanen, J., Vuolle, M., Väänänen, K., Peltoniemi, S.
Number of pages: 17
Pages: 296-312
Publication date: 2015

Host publication information
Title of host publication: Ambient Intelligence : 12th European Conference, Aml 2015, Athens, Greece, November 11-13, 2015, Proceedings
Explorative study of teaching programming to vocational teachers in Finland

In this study we explore the possibility of organizing and structuring an information technology training day for upper secondary vocational teacher training in automotive and transport engineering. The objective is to show the development process of the three training sessions in response to survey data completed by teachers. Information technology has widely penetrated into the car industry during the last few decades but some teachers have difficulty in adapting and teaching new technologies to their students. This paper presents one approach to break the ice between 'old school' teachers and information technology, through the use of an 8-hour training day consisting of programming, electronic technology and data bus technology.

The aim of this study is to discover how to structure training of new technology for experienced vocational teachers. In this paper we describe how we developed, organized and assessed information technology training for vocational teachers within the case study. The training day was organized in three locations in Finland: In Pori, Jyväskylä and Vantaa. After the first surveys were completed by the vocational teachers, the arrangement of the next training day was adjusted in response to the outcome of the initial surveys. After the first lecture session, the training feedback indicated that there should be more 'learning-by-doing' type of action. The next sessions included Arduino board [1], electronic components and a laptop software development environment.

In this study we found that the attitudes of the training attendees were different in three locations around Finland. This is an interesting finding. When comparing the results obtained from Jyväskylä and Vantaa the outcomes were slightly more negative in Jyväskylä than in Vantaa. However the training was identical in both cases. The results also showed a difference in attitude between teachers of different age groups.

One of the biggest problems in this type of training was the limitation of time. Most of the teachers were familiar with the automotive based digital testing equipment, but they were also aware that their students were far more advanced in information technology than they were. This may have generated tensions and resistance from the older generation of teacher when adopting any new technology.

The overall outcome was positive. Teachers were pleased with this training in an automotive context, because it was first time they had received generic technological training. The attendees felt it was important because the training sessions were targeted directly to them. The collected survey results provided information about what vocational teachers are actually missing in practice. In the conceptual part of this paper we discuss motivation to learn [2], [3] and Adult Education. In the empirical part of this paper we introduce the training method utilized and finally discuss the presented outcomes and conclusions of the survey data.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Pori Department, Research group: Data-analytics and Optimization, Research group: Business Ecosystems, Networks and Innovations
Authors: Saari, M., Turunen, J., Linna, P., Aramo-Immonen, H., Huhtala, M., Joel-Edgar, S.
Number of pages: 10
Pages: 2860-2869
Publication date: 2015

Host publication information
Title of host publication: 7th International Conference on Education and New Learning Technologies
Exploratory analysis of associations between individual lifestyles and heart rate variability-based recovery during sleep

Sleep is the most important period for recovering from daily stress and load. Assessment of the stress recovery during sleep is therefore, an important metric for care and quality of life. Heart rate variability (HRV) is a non-invasive marker of autonomic nervous system (ANS) activity, and HRV-based methods can be used to assess physiological recovery, characterized by parasympathetic domination of the ANS. HRV is affected by multiple factors of which some are unmodifiable (such as age and gender) but many are related to daily lifestyle choices (e.g. alcohol consumption, physical activity, sleeping times). The purpose of this study was to investigate the association of these aforementioned factors on HRV-based recovery during sleep on a large sample. Variable importance measures yielded by random forest were used for identifying the most relevant predictors of sleep-time recovery. The results emphasize the disturbing effects of alcohol consumption on sleep-time recovery. Good physical fitness is associated to good recovery, but acute physical activity seems to challenge or delay the recovery process for the next night. Longer sleeping time enables more recovery minutes, but the proportion of recovery (i.e. recovery efficiency) seems to peak around 7.0–7.25 hours of sleep.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI, Research Community on Data-to-Decision (D2D), Northeastern University
Authors: Pietilä, J., Helander, E., Myllymaki, T., Korhonen, I., Jimison, H., Pavel, M.
Pages: 2339-2342
Publication date: 2015

Host publication information
Title of host publication: 2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)
ISBN (Print): 978-1-4244-9270-1
Keywords: Atmospheric measurements, Heart rate variability, Particle measurements, Physiology, Radio frequency, Stress
DOIs: 10.1109/EMBC.2015.7318862

Bibliographical note
EXT="Jimison, Holly"
Source: RIS
Source-ID: urn:FD3E2171E145AFAE9241038AA0724993
Research output: Scientific - peer-review » Conference contribution

Exploring Attitudes, Knowledge and Competencies for Security Technology: A Cross-Cultural Survey in Higher Education

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Information security, Intelligent dexterity for secure networked infrastructure and applications (IDSNIA), University of Tampere, University of Patras
Authors: Chaudhary, S., Zhao, Y., Berki, E., Valtanen, J., Li, L., Helenius, M., Mystakidis, S., Nalam, T., Thapa, R. B.
Number of pages: 8
Pages: 11-18
Publication date: 2015

Host publication information
Title of host publication: 8th International Conference on ICT, Society and Human Beings 2015
ISBN (Print): 978-989-8533-41-8
Research output: Scientific - peer-review » Conference contribution

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.
Faster 128-EEA3 and 128-EIA3 Software
The 3GPP Task Force recently supplemented mobile LTE network security with an additional set of confidentiality and integrity algorithms, namely 128-EEA3 and 128-EIA3 built on top of ZUC, a new keystream generator. We contribute two techniques to improve the software performance of these algorithms. We show how delayed modular reduction increases the efficiency of the LFSR feedback function, yielding performance gains for ZUC and thus both 128-EEA3 and 128-EIA3. We also show how to leverage carryless multiplication to evaluate the universal hash function making up the core of 128-EIA3. Our software implementation results on Qualcomm’s Hexagon DSP architecture indicate significant performance gains when employing these techniques: up to roughly a 2.4-fold and a 4-fold throughput improvement for 128-EEA3 and 128-EIA3, respectively.
Faster Software for Fast Endomorphisms

GLV curves (Gallant et al.) have performance advantages over standard elliptic curves, using half the number of point doublings for scalar multiplication. Despite their introduction in 2001, implementations of the GLV method have yet to permeate widespread software libraries. Furthermore, side-channel vulnerabilities, specifically cache-timing attacks, remain unpatched in the OpenSSL code base since the first attack in 2009 (Brumley and Hakala) even still after the most recent attack in 2014 (Benger et al.). This work reports on the integration of the GLV method in OpenSSL for curves from 160 to 256 bits, as well as deploying and evaluating two side-channel defenses. Performance gains are up to 51%, and with these improvements GLV curves are now the fastest elliptic curves in OpenSSL for these bit sizes.

Fixed-Pattern Noise Modeling and Removal in Time-of-Flight Sensing

In this paper, we discuss the modeling and removal of fixed-pattern noise (FPN) in photonic mixture devices employing the time-of-flight (ToF) principle for range measurements and scene depth estimation. We present a case that arises from low-sensing (LS) conditions caused by either external factors related to scene reflectivity or internal factors related to the power and operation mode of the sensor or both. In such a case, the FPN becomes especially dominating and invalidates previously adopted noise models, which have been used for removal of other noise contaminations in ToF measurements. To tackle LS cases, we propose a noise model specifically addressing the presence of FPN and develop a relevant FPN removal procedure. We demonstrate, by experiments with synthetic and real-world data, that the proper modeling and removing of FPN is substantial for the subsequent Gaussian denoising and yields accurate depth maps comparable to the ones obtainable in normal operating mode.
Flow feature extraction for underwater robot localization: preliminary results

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: Vision, Department of Signal Processing
Authors: Muhammad, N., Strokinia, N., Toming, G., Tuhtan, J., Kämäräinen, J., Kruusmaa, M.
Number of pages: 6
Pages: 1125-1130
Publication date: 2015

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Title of host publication: 2015 IEEE International Conference on Robotics and Automation (ICRA), 26-30 May 2015, Seattle, WA
Publisher: IEEE
ISBN (Print): 978-1-4799-6923-4
DOIs: 10.1109/ICRA.2015.7139317
From Apps to Liquid Multi-Device Software

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Software engineering, Nokia Technologies
Authors: Taivalsaari, A., Mikkonen, T.
Number of pages: 7
Pages: 34-40
Publication date: 2015
Peer-reviewed: Yes

**Publication information**
Journal: Procedia Computer Science
Volume: 56
ISSN (Print): 1877-0509
Ratings:
Scopus rating (2016): SJR 0.267 SNIP 0.705 CiteScore 0.88
Scopus rating (2015): SJR 0.275 SNIP 0.825 CiteScore 0.85
Scopus rating (2014): SJR 0.258 SNIP 0.781 CiteScore 0.67
Scopus rating (2013): SJR 0.243 SNIP 0.609 CiteScore 0.64
Scopus rating (2012): SJR 0.527 SNIP 1.077 CiteScore 0.63
Scopus rating (2011): SJR 0.172 SNIP 0.731 CiteScore 0.55
Original language: English
DOIs: 10.1016/j.procs.2015.07.179

From Mobile to Wearable: Using Wearable Devices to Enrich Mobile Interaction

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience, Augmented Human Activities (AHA)
Authors: Schneegass, S., Mayer, S., Olsson, T., Van Laerhoven, K.
Number of pages: 4
Pages: 936-939
Publication date: 2015

**Host publication information**
Title of host publication: MobileHCI '15 Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct
Place of publication: New York, NY, USA
Publisher: ACM
ISBN (Print): 978-1-4503-3653-6
Keywords: Actuating, Interaction, Sensing, Smart Garments, Wearable Computing, Workshop
DOIs: 10.1145/2786567.2795396

Gender classification by LUT based boosting of overlapping block patterns
The paper addresses the problem of gender classification from face images. For feature extraction, we propose discrete Overlapping Block Patterns (OBP), which capture the characteristic structure from the image at various scales. Using integral images, these features can be computed in constant time. The feature extraction at multiple scales results in a high dimensionality and feature redundancy. Therefore, we apply a boosting algorithm for feature selection and classification. Look- Up Tables (LUT) are utilized as weak classifiers, which are appropriate to the discrete nature of the
OBP features. The experiments are performed on two publicly available data sets, Labeled Faces in the Wild (LFW) and MOBIO. The results demonstrate that Local Binary Pattern (LBP) features with LUT boosting outperform the commonly used block-histogram-based LBP approaches and that OBP features gain over Multi-Block LBP (MB-LBP) features.

Getting started with the experience design process
A shared vision of the targeted user experience and further user experience goals are required when designing for experiences. To achieve this, the design process should start with an experience-goals elicitation process where all relevant stakeholders together prioritize and choose the target experience goals. In the subsequent evaluation, appropriate metrics are needed to ensure that the targeted experiences are realized.
High-Level Synthesis Design Flow for HEVC Intra Encoder on SoC-FPGA

This paper presents a High-Level Synthesis (HLS) flow for mapping a software HEVC encoder into Altera CycloneV SoC-FPGA. The starting point is a C implementation of an open-source Kvazaar HEVC intra encoder, which is minimally refined for SystemC design space exploration and automatic Catapult-C RTL generation. The final implementation involves Kvazaar encoder executed in Linux on dual-core ARM, and HW accelerated intra prediction on FPGA. Changing the SW/HW partitioning or modifying the implementation takes hours instead of weeks with Catapult-C HLS. In addition, the design is portable to other platforms without major manual re-writing. We obtained 9 fps full-HD intra prediction speed with a single accelerator on Altera Cyclone V SX on Terasic VEEK-MT-C5SoC board including video capture and HEVC video streaming via Ethernet. To the best of our knowledge, this is the first reported HLS assisted implementation of HEVC encoder on SoC-FPGA.

Hydrodynamic Classification of Natural Flows Using an Artificial Lateral Line and Frequency Domain Features

Hydrodynamic Classification of Natural Flows Using an Artificial Lateral Line and Frequency Domain Features
Image restoration using 2D autoregressive texture model and structure curve construction

In this paper an image inpainting approach based on the construction of a composite curve for the restoration of the edges of objects in an image using the concepts of parametric and geometric continuity is presented. It is shown that this approach allows to restore the curved edges and provide more flexibility for curve design in damaged image by
interpolating the boundaries of objects by cubic splines. After edge restoration stage, a texture restoration using 2D autoregressive texture model is carried out. The image intensity is locally modeled by a first spatial autoregressive model with support in a strongly causal prediction region on the plane. Model parameters are estimated by Yule-Walker method. Several examples considered in this paper show the effectiveness of the proposed approach for large objects removal as well as recovery of small regions on several test images.

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Computational Imaging-CI, Signal Processing Research Community (SPRC), Don State Tech Univ, Dept Radioelect Syst, CJSC Nordavind, Univ Texas San Antonio, University of Texas at San Antonio (UTSA), Dept Elect & Comp Engn
Authors: Voronin, V. V., Marchuk, V. I., Petrosov, P., Svirin, I., Agaian, S., Egiazarian, K.
Number of pages: 11
Publication date: 2015

**Host publication information**
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Place of publication: BELLINGHAM
Publisher: SPIE
Editors: Agaian, S., Jassim, S., Du, E.

**Publication series**
Name: Proceedings of SPIE
Publisher: SPIE-INT SOC OPTICAL ENGINEERING
Volume: 9497
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Keywords: image inpainting, edge reconstruction, spline interpolation, texture synthesis, autoregressive model
DOI:
10.1117/12.2076508
Source: WOS
Source-ID: 000357930300005
Research output: Scientific - peer-review » Conference contribution

**Image Retrieval: Information and Rough Set Theories**
In this research paper, we propose novel features based on information theory for image retrieval. We propose the novel concept of "probabilistic filtering". We propose a hybrid approach for image retrieval that combines annotation approach with content based image retrieval approach. Also rough set theory is proposed as a tool for audio/video object retrieval from multi-media databases.

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D), Department of Signal Processing, IIT - Hyderabad
Authors: Garimella, R. M., Gabbouj, M., Ahmad, I.
Number of pages: 7
Pages: 631-637
Publication date: 2015
Peer-reviewed: Yes

**Publication information**
Journal: Procedia Computer Science
Volume: 54
ISSN (Print): 1877-0509
Ratings:
Scopus rating (2016): SJR 0.267 SNIP 0.705 CiteScore 0.88
Scopus rating (2015): SJR 0.275 SNIP 0.825 CiteScore 0.85
Scopus rating (2014): SJR 0.258 SNIP 0.781 CiteScore 0.67
Scopus rating (2013): SJR 0.243 SNIP 0.609 CiteScore 0.64
Scopus rating (2012): SJR 0.527 SNIP 1.077 CiteScore 0.63
Scopus rating (2011): SJR 0.172 SNIP 0.731 CiteScore 0.55
Original language: English
Keywords: Hierarchical features, Image Retrieval, K-L divergence, Normalized histogram, Roughset
Increasing user and customer understanding through rapid ethnography in emerging markets

Rapid ethnography enables us to gain an in-depth understanding of customers and end-users as well as the business of the customers and the local market. A new approach was developed and trialled for company R&D purposes at Konecranes during the FIMECC UXUS programme.

General information
State: Published
Ministry of Education publication type: D2 Article in professional manuals or guides or professional information systems or text book material
Organisations: Department of Pervasive Computing, Research area: User experience, Konecranes Plc
Authors: Väätäjä, H., Haggrén, J.
Pages: 99-101
Publication date: 2015

Host publication information
Title of host publication: User Experience and Usability in Complex Systems - UXUS : FIMECC Publications Series No. 8, 2010-2015
ISBN (Print): 978-952-238-146-0
ISBN (Electronic): 978-952-238-147-7

Publication series
Name: FIMECC Publication series
Publisher: FIMECC Oy
Volume: 8
ISSN (Print): 2342-2688
ISSN (Electronic): 2342-2696
ASJC Scopus subject areas: Management of Technology and Innovation, Human-Computer Interaction
Keywords: user experience, Usability, complex systems, human-computer interaction, human-centered design, rapid ethnography
Links:

Indoor Localization Methods Using Dead Reckoning and 3D Map Matching

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Signal Processing Research Community (SPRC)
Authors: Bojja, J., Kirkko-Jaakkola, M., Collin, J., Takala, J.
Number of pages: 12
Pages: 301-312
Publication date: 2015
Peer-reviewed: Yes
Early online date: 1 Jan 2014

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Volume: 76
Issue number: 3
ISSN (Print): 1939-8018
Ratings:
Scopus rating (2016): CiteScore 0.78 SJR 0.226 SNIP 0.625
Scopus rating (2015): SJR 0.228 SNIP 0.639 CiteScore 0.7
Scopus rating (2014): SJR 0.292 SNIP 1 CiteScore 0.99
Scopus rating (2013): SJR 0.27 SNIP 0.858 CiteScore 0.97
In Search of the Emotional Design Effect in Programming

A small number of recent studies have suggested that learning is enhanced when the illustrations in instructional materials are designed to appeal to the learners' emotions through the use of color and the personification of key elements. We sought to replicate this emotional design effect in the context of introductory object-oriented programming (OOP). In this preliminary study, a group of freshmen studied a text on objects which was illustrated using anthropomorphic graphics while a control group had access to abstract graphics. We found no significant difference in the groups' scores on a comprehension post-test, but the experimental group spent substantially less time on the task than the control group. Among those participants who had no prior programming experience, the materials inspired by emotional design were perceived as less intelligible and appealing and led to lower self-reported concentration levels. Although this result does not match the pattern of results from earlier studies, it shows that the choice of illustrations in learning materials matters and calls for more research that addresses the limitations of this preliminary study.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Regulation of learning and active learning methods (REALMEE)
Authors: Haaranen, L., Ihantola, P., Sorva, J., Vihavainen, A.
Number of pages: 7
Pages: 428-434
Publication date: 2015

Host publication information
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Place of publication: Piscataway, NJ, USA
Publisher: IEEE Press
DOIs: 10.1109/ICSE.2015.175
Source: Bibtex
Source-ID: urn:a5c0607dd9794a5b82a489dd8986e816
Research output: Scientific - peer-review › Conference contribution

In silico analysis of division times of Escherichia coli populations as a function of the partitioning scheme of non-functional proteins
**Interaction and humans in internet of things**

Internet of Things is mainly about connected devices embedded in our everyday environment. Typically, ‘interaction’ in the context of IoT means interfaces which allow people to either monitor or configure IoT devices. Some examples include mobile applications and embedded touchscreens for control of various functions (e.g., heating, lights, and energy efficiency) in environments such as homes and offices. In some cases, humans are an explicit part of the scenario, such as in those cases where people are monitored (e.g., children and elderly) by IoT devices. Interaction in such applications is still quite straightforward, mainly consisting of traditional graphical interfaces, which often leads to clumsy co-existence of human and IoT devices. Thus, there is a need to investigate what kinds of interaction techniques could provide IoT to be more human oriented, what is the role of automation and interaction, and how human originated data can be used in IoT.

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**General information**

**State:** Published

**Ministry of Education publication type:** A4 Article in a conference publication

**Organisations:** Department of Pervasive Computing, Research area: User experience, Augmented Human Activities (AHA), University of Tampere, DFKI, Technische Universität Berlin, S1nn GmbH and Co. KG, University of Southern Denmark

**Authors:** Turunen, M., Sonntag, D., Engelbrecht, K., Olsson, T., Schnelle-Walka, D., Lucero, A.

**Number of pages:** 4

**Pages:** 633-636

**Publication date:** 2015
Internal Marketplace as a Mechanism for Promoting Software Reuse

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Ripatti, M., Kilamo, T., Salli, K., Mikkonen, T.
Number of pages: 15
Pages: 119-133
Publication date: 2015

Host publication information
Title of host publication: Proceedings of the 14th Symposium on Programming Languages and Software Tools

Publication series
Name: CEUR Workshop Proceedings
Volume: 1525
ISSN (Electronic): 1613-0073
Research output: Scientific - peer-review › Conference contribution

Jossakin vuoti öljy, muualla tihkuvat tiedot - etiikka katoavien rajojen ja suurten skandaalien aikakaudella

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Pori Department
Authors: Lilja, K.
Number of pages: 16
Pages: 85-101
Publication date: 2015

Host publication information
Title of host publication: Silmät auki It-etiikkaan
Publisher: EDUSKUNNAN TULEVAISUUSVALIOKUNTA
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Knowledge Intensive Entrepreneurship Fostering Digital Society

The history of active digitalisation started roughly from the invention of transistor. After microprocessors the digitalisation has followed the Moore's law. Earlier digitalisation was clearly focused on technology sciences e.g. robotics, mobile phones, automation, intelligent vision, neural networks, 3D printing. Slowly also service and client based applications are in a more and more active role. Intelligent construction, intelligent clothes, clean tech, logistics, intelligent healthcare and whole social media. These topics among other things e.g. car tire with it's own internet address, deal more and more with big data and step by step the whole society is under digital control and guidance and also the intelligent innovation and development procedures are run by complicated digitalised algorithms.

The above development gives us huge challenges and a great part of them are developed, activated and used and the most potential results are run as profited business. On the other hand how many challenges are lost, destroyed, never found or have not got correct push or start-up actions? Anyway the main thing is that to run and mutually develop this digitalised society is knowledge intensive entrepreneurship. It includes two principles. The first one is that the new enterprises are based on higher education to guarantee the updated knowledge in the young brains. The second one is the role of higher education which is integrated also in the succession procedures of enterprises because that just the point to evaluate present business ideas and take into account business challenges of digital society. Finnish universities of applied sciences (UAS) have developed several successful activities for promoting entrepreneurship. In this presentation the possibilities of knowledge intensive entrepreneurship are discussed. The discussion is based on the progressive results and the models which are developed during the last years. Great demands are also set for universities (Entrepreneurial University) where knowledge intensive entrepreneurship is successfully moving ahead. The strong strategic and operational commitment is one of the main things.

Discussion is based on authors’ diverse and active experiences, research activities and observations in promoting entrepreneurship in UASes and Universities.

Knowledge security risk management in contemporary companies – toward a proactive approach

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT), Luleå University of Technology
Authors: Ilvonen, I., Jussila, J., Kärkkäinen, H., Päivärinta, T.
Number of pages: 10
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Kvazaar HEVC encoder for Efficient Intra Coding

General information
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Computer engineering, Signal Processing Research Community (SPRC), Tampere University of Technology
Authors: Viitanen, M., Koivula, A., Lemmetti, A., Vanne, J., Hämäläinen, T. D.
Number of pages: 4
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ISBN (Print): 9781479983919
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Lean Startup Meets Software Product Lines: Survival of the Fittest or Letting Products Bloom?
Startups often operate with limited resources and are desperate for validating their products as fast as possible. Such validation is the key concept in Lean Startup, where companies build, measure and learn by creating multiple Minimum Viable Products (MVP). Similarly Software product lines (SPL) promise increased productivity and reduced time-to-market in situations where multiple similar products are created. In this paper we propose that there are parallels between these methods. We investigated two software companies using the Lean Startup method through a case study. We found that the companies had a hard time closing developed MVPs which were already used by customers. They ended up with multiple MVPs in production, tying up all the resources. This situation shares many parallels with classic SPLs such as product versioning and lifecycle management. This would indicate that we could use the established knowledge of SPLs to help manage MVP production and its risks.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Terho, H., Suonsyrjä, S., Jaaksi, A., Mikkonen, T., Kazman, R., Chen, H.
Number of pages: 15
Pages: 134-148
Publication date: 2015

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Title of host publication: SPLST 2015 - Symposium on Programming Languages and Software Tools : Proceedings of the 14th Symposium on Programming Languages and Software Tools (SPLST'15)
Publisher: CEUR-WS
Learning Analytics Architecture to Scaffold Learning Experience through Technology-based Methods
The challenge of delivering personalized learning experiences is often increased by the size of classrooms and online learning communities. Serious Games (SGs) are increasingly recognized for their potential to improve education. However, the issues related to their development and their level of effectiveness can be seriously affected when brought too rapidly into growing online learning communities. Deeper insights into how the students are playing is needed to deliver a comprehensive and intelligent learning framework that facilitates better understanding of learners' knowledge, effective assessment of their progress and continuous evaluation and optimization of the environments in which they learn. This paper discusses current SOTA and aims to explore the potential in the use of games and learning analytics towards scaffolding and supporting teaching and learning experience. The conceptual model (ecosystem and architecture) discussed in this paper aims to highlight the key considerations that may advance the current state of learning analytics, adaptive learning and SGs, by leveraging SGs as an suitable medium for gathering data and performing adaptations.

General information
State: Published
 Ministry of Education publication type: A1 Journal article-refereed
 Organisations: Pori Department, Research group: TUT Game Lab
 Authors: Baalsrud Hauge, J., Stanescu, I., Arnab, S., Moreno Ger, P., Lim, T., Serrano-Laguna, A., Lameras, P., Hendrix, M., Kiili, K. J. M., Ninaus, M., Mazzetti, A., Dahlbom, A., Degano, C.
 Number of pages: 16
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ISSN (Print): 2384-8766
Original language: English
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http://journal.seriousgamessociety.org/index.php?journal=IJSG&page=article&op=view&path%5B%5D=38
Research output: Scientific - peer-review › Article

Lifelog scene change detection using cascades of audio and video detectors

General information
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 Organisations: Research group: Audio research group, Department of Signal Processing, Research group: Vision, Research Community on Data-to-Decision (D2D)
 Authors: Mahkonen, K., Kämäräinen, J., Virtanen, T.
 Number of pages: 11
 Pages: 434-444
 Publication date: 2015

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Contribution: organisation=sgn,FACT1=1<br/>
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Source: researchoutputwizard
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Research output: Scientific - peer-review › Conference contribution
Lightweight Immaterial Particle Displays with Mid-Air Tactile Feedback

Immaterial mid-air displays formed of flowing light-scattering particles are becoming feasible for displaying information in thin air and interacting with it. With light-weight desktop fogscreens and low-cost hand tracking, the user can easily and unobtrusively interact with virtual information. Any real objects can be seen or reached through the screen, as it is permeable and almost intangible. However, no tactile feedback can be perceived when interacting with a mid-air display. Our contribution in this paper is the construction of an interactive mid-air fogscreen employing ultrasonic phased arrays in order to create mid-air tactile feedback. The feedback is suitable for small desktop-sized fogscreens. This creates a mixed reality setup where real objects and e.g., augmented reality content can be brought closer together conceptually and physically. In an experimental evaluation of the mid-air tactile feedback for the fogscreen we found no statistically significant difference in performance, but the mid-air tactile feedback was slightly preferred over no tactile feedback by the users. They found the tactile feedback as more engaging.

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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Augmented Human Activities (AHA), University of Tampere, School of Information Sciences
Authors: Sand, A., Rakkolainen, I., Isokoski, P., Raisamo, R., Palovuori, K.
Number of pages: 5
Pages: 30-34
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Research output: Scientific - peer-review › Conference contribution

Linear Congruential Sequences: Feedback and Recurrent Neural Networks

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video, International Institute of Information Technology Hyderabad
Authors: Garimella, R. M., Gabbouj, M.
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Bibliographical note
EXT="Garimella, Rama Murthy"
Research output: Scientific - peer-review › Conference contribution

Localization of Storyboards for Cross-cultural User Studies

Storyboards are useful for presenting ideas visually to users helping them understand possible uses of technology allowing them to identify with use situations, especially when no prototypes are available to demonstrate. Storyboards are good for cross-cultural user studies, because they reduce the amount of text users with different native languages have to read. Storyboards are easy to implement in online surveys, which are convenient in gathering data from geographically dispersed groups of users. However, creating localized storyboards requires considering a number of culture related factors. Little research exists in Human-Computer Interaction about how to create localized storyboards for online UX surveys although the need for gathering global user feedback of technology products and services noticeable. We used two focus groups with Chinese participants to inform the design of localization of storyboards for an online survey. Results showed that localization was successful and some design implications were found of localizing storyboards.
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.

Managing software engineering competences with domain ontology for customer and team profiling and training

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.
Motion Model for Positioning with Graph-Based Indoor Map
This article presents a training-free probabilistic pedestrian motion model that uses indoor map information represented as a set of links that are connected by nodes. This kind of structure can be modelled as a graph. In the proposed model, as a position estimate reaches a link end, the choice probabilities of the next link are proportional to the total link lengths (TLL), the total lengths of the subgraphs accessible by choosing the considered link alternative. The TLLs can be computed off-line using only the graph, and they can be updated if training data are available. A particle filter in which all the particles move on the links following the TLL-based motion model is formulated. The TLL-based motion model has advantageous theoretical properties compared to the conventional models. Furthermore, the real-data WLAN positioning tests show that the positioning accuracy of the algorithm is similar or in many cases better than that of the conventional algorithms. The TLL-based model is found to be advantageous especially if position measurements are used infrequently, with 10-second or more time intervals.

M-PCA Binary Embedding For Approximate Nearest Neighbor Search
Principal Component Analysis (PCA) is widely used within binary embedding methods for approximate nearest neighbor search and has proven to have a significant effect on the performance. Current methods aim to represent the whole data using a single PCA however, considering the Gaussian distribution requirements of PCA, this representation is not appropriate. In this study we propose using Multiple PCA (M-PCA) transformations to represent the whole data and show that it increases the performance significantly compared to methods using a single PCA.
Myostatin/ activin blocking combined with exercise reconditions skeletal muscle expression profile of mdx mice

Duchenne muscular dystrophy is characterized by muscle wasting and decreased aerobic metabolism. Exercise and blocking of myostatin/activin signaling may independently or combined counteract muscle wasting and dystrophies. The effects of myostatin/activin blocking using soluble activin receptor-Fc (sActRIIB-Fc) administration and wheel running were tested alone or in combination for 7 weeks in dystrophic mdx mice. Expression microarray analysis revealed decreased aerobic metabolism in the gastrocnemius muscle of mdx mice compared to healthy mice. This was not due to reduced home-cage physical activity, and was further downregulated upon sActRIIB-Fc treatment in enlarged muscles. However, exercise activated pathways of aerobic metabolism and counteracted the negative effects of sActRIIB-Fc. Exercise and sActRIIB-Fc synergistically increased expression of major urinary protein, but exercise blocked sActRIIB-Fc induced phosphorylation of STAT5 in gastrocnemius muscle. In conclusion, exercise alone or in combination with myostatin/activin blocking corrects aerobic gene expression profiles of dystrophic muscle toward healthy wild type mice profiles.
**New Ways of Working** as a tool for improving the performance of a knowledge-intensive company

This paper explores ‘New Ways of Working’ (NewWoW) – that is, non-traditional mobile and flexible work practices, settings and locations using sufficient ICT tools – as a novel approach to improve the performance of a knowledge-intensive organization. This paper makes a contribution by illustrating how the measurement of the impacts of NewWoW can be done and by producing empirical evidence of the benefits of NewWoW. The conceptual background of the study is anchored in the literature on knowledge work productivity and performance as well as on NewWoW. The empirical section reports a longitudinal case study of a change process during which the case company, Rapal, went through a NewWoW project. The impacts of the change are evaluated based on the results of both objective and subjective performance measures. The project was successful and resulted in significant cost savings as well as improvements in environmental performance (CO2 emissions).

**General information**

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Organisations: Department of Information Management and Logistics, Managing digital industrial transformation (mDIT)
Authors: Ruostela, J., Lönnqvist, A., Palvalin, M., Vuolle, M., Patjas, M., Raij, A.
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Scopus rating (2014): SJR 0.368 SNIP 0.848 CiteScore 0.83
Scopus rating (2013): SJR 0.463 SNIP 0.882 CiteScore 0.95
Scopus rating (2012): SJR 0.568 SNIP 0.76 CiteScore 1.05
Scopus rating (2011): SJR 0.483 SNIP 1.063 CiteScore 0.88
Scopus rating (2010): SJR 0.567 SNIP 0.808
Scopus rating (2009): SJR 0.594 SNIP 0.871
Scopus rating (2008): SJR 0.461 SNIP 1.459
Scopus rating (2007): SJR 0.273 SNIP 0.155
Original language: English
DOI:
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**Bibliographical note**

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Source: researchoutputwizard
Source-ID: 1410
Research output: Scientific - peer-review › Article
Noise Robust Speaker Recognition with Convolutive Sparse Coding

Recognition and classification of speech content in everyday environments is challenging due to the large diversity of real-world noise sources, which may also include competing speech. At signal-to-noise ratios below 0 dB, a majority of features may become corrupted, severely degrading the performance of classifiers built upon clean observations of a target class. As the energy and complexity of competing sources increase, their explicit modelling becomes integral for successful detection and classification of target speech. We have previously demonstrated how non-negative compositional modelling in a spectrogram space is suitable for robust recognition of speech and speakers even at low SNRs. In this work, the sparse coding approach is extended to cover the whole separation and classification chain to recognise the speaker of short utterances in difficult noise environments. A convolutive matrix factorisation and coding system is evaluated on 2nd CHiME Track 1 data. Over 98% average speaker recognition accuracy is achieved for shorter than three second utterances at +9…-6 dB SNR, illustrating the system's performance in challenging conditions.

Nonlinear Digital Filtering with Python: An Introduction

This paper proposes a non-local modification of well-known sigma filter, Nonlocal Sigma filter (NSF), intended to suppress additive white Gaussian noise from images. Similarly to the Nonlocal Mean Filter (NLM), every output pixel value is computed as a nonlocal weighted average of pixels coming from similar patches to the patch around the current pixel. The main difference between the proposed NSF and NLM is in the following: there are pixels in NSF not used in a weighted averaging (if the difference between them and the central pixel value is above a predefined threshold value, and if the distance between patch neighborhood and the central patch neighborhood is greater than a second threshold value). The weights used to estimate the output pixel depend on the patch size as well as on a distance between considered and reference patches. The proposed filter is compared to its counter-parts, namely, the conventional sigma filter and the NLM filter. It is shown that NSF outperforms both of them in PSNR and visual quality metrics values, PSNR-HVS-M and MSSIM. In this paper, a novel filtering quality criterion that takes into account distortions introduced into processed images due to denoising is proposed. It is demonstrated that, according to this criterion, NSF has similar edge-detail preservation property as the conventional sigma filter but has better noise suppression ability.
Non-negative tensor factorization models for Bayesian audio processing

We provide an overview of matrix and tensor factorization methods from a Bayesian perspective, giving emphasis on both the inference methods and modeling techniques. Factorization based models and their many extensions such as tensor factorizations have proved useful in a broad range of applications, supporting a practical and computationally tractable framework for modeling. Especially in audio processing, tensor models help in a unified manner the use of prior knowledge about signals, the data generation processes as well as available data from different modalities. After a general review of tensor models, we describe the general statistical framework, give examples of several audio applications and describe modeling strategies for key problems such as deconvolution, source separation, and transcription.
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.
Novel statistical offline nonuniform sampling of time-limited signal

General information
State: Published
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Organisations: Department of Signal Processing, Research group: Video, Research Community on Data-to-Decision (D2D)
Authors: Sankhe, K., Garimella, R. M., Gabbouj, M.
Number of pages: 6
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Publication date: 2015

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Title of host publication: Proceedings IEEE 3rd International Conference on Signal Processing, Communication and Networking (ICSCN), 2015
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10.1109/ICSCN.2015.7219870
Research output: Scientific - peer-review › Conference contribution

On the Design of a Collaborative Online Development Environment

General information
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Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Nieminen, A.
Number of pages: 73
Publication date: 2015

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Publisher: Tampere University of Technology
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Awarding institution:Tampere University of Technology
Research output: Collection of articles › Doctoral Thesis

On the Design of a Responsive User Interface for a Multi-Device Web Service
The introduction of numerous new, web-enabled devices is leading to a change in the mindset in the design of web systems. Increasingly often, they are designed to take into account the special characteristics of different devices. In terms of implementation, designing these responsive web services requires frameworks and guidelines for user interface design for both desktop and mobile devices. In this paper we present a case study which was done during the implementation of open data. Fi service. During the project responsive mobile user interfaces were implemented to existing open source software with preserving as much of the original layouts as possible. We provide some insights to tools and libraries used in building the responsive user interfaces and share some of the findings that work well in customizing existing software. We also provide examples of solutions that wont work so well and look how to solve them properly.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Gofore Ltd
Authors: Voutilainen, J., Salonen, J., Mikkonen, T.
Number of pages: 4
Pages: 60-63
Publication date: 2015
On the Kernel Extreme Learning Machine speedup
In this paper, we describe an approximate method for reducing the time and memory complexities of the kernel Extreme Learning Machine variants. We show that, by adopting a Nyström-based kernel ELM matrix approximation, we can define an ELM space exploiting properties of the kernel ELM space that can be subsequently used to apply several optimization schemes proposed in the literature for ELM network training. The resulted ELM network can achieve good performance, which is comparable to that of its standard kernel ELM counterpart, while overcoming the time and memory restrictions on kernel ELM algorithms that render their application in large-scale learning problems prohibitive.

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Authors: Iosifidis, A., Gabbouj, M.
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Scopus rating (2015): SJR 0.976 SNIP 2.105 CiteScore 2.87
Scopus rating (2014): SJR 0.797 SNIP 2.211 CiteScore 2.72
Scopus rating (2013): SJR 0.838 SNIP 2.616 CiteScore 2.86
Scopus rating (2012): SJR 0.719 SNIP 2.4 CiteScore 2.57
Scopus rating (2011): SJR 0.738 SNIP 2.009 CiteScore 2.56
Scopus rating (2010): SJR 0.832 SNIP 1.998
Scopus rating (2009): SJR 0.847 SNIP 2.364
Scopus rating (2008): SJR 0.97 SNIP 2.021
Scopus rating (2007): SJR 0.878 SNIP 1.858
Scopus rating (2006): SJR 0.965 SNIP 1.98
Scopus rating (2005): SJR 0.768 SNIP 2.312
Scopus rating (2004): SJR 0.579 SNIP 1.643
Scopus rating (2003): SJR 0.586 SNIP 1.459
Scopus rating (2002): SJR 0.764 SNIP 1.35
Scopus rating (2001): SJR 0.827 SNIP 1.27
Scopus rating (2000): SJR 0.482 SNIP 0.76
Scopus rating (1999): SJR 0.531 SNIP 0.855
Original language: English
Keywords: Extreme learning machine, Machine learning, speedup, extreme learning machine (ELM)
DOIs:
10.1016/j.patrec.2015.09.015
Research output: Scientific - peer-review › Article

On the Role of Gamification and Localization in an Open Online Learning Environment: Javala Experiences
Massive Open Online Courses (MOOCs) have rapidly become an important tool for educational institutes in teaching programming. Nevertheless, high drop-out rates have always been a problem in online learning. As MOOCs have become
an important part of modern education, reducing the drop-out rate has become a more and more relevant research problem. This work studies a nine-year-long period of maintaining an open, online learning environment of programming. The aim is to find out how the implementation of the learning environment could engage the students to learning and this way affect the drop-out rate. We provide an insight to experiences stemming from nine years of data collected with Javala, an online system created to help shifting from C++ to Java programming. The paper also discusses two key properties of Javala, gamification, and localization, together with data to assess their significance.

General information
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Organisations: Department of Pervasive Computing, Research area: Software engineering, Regulation of learning and active learning methods (REALMEE), Solita Oy
Authors: Lehtonen, T., Aho, T., Isohanni, E., Mikkonen, T.
Number of pages: 10
Pages: 50-59
Publication date: 2015

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Research output: Scientific - peer-review › Conference contribution

Ontology-Based Backend Engine for Manufacturing and Logistics Systems

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Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Automation Science and Engineering
Authors: Xu, X.
Number of pages: 14
Pages: 259-272
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ISBN (Print): 978-83-7814-440-3
Keywords: Folder - eScopBook
Research output: Scientific - peer-review › Chapter

Optimal operation of a three camera system on a four-wheel robot
At present the automated moving of a robot is made possible by a complete measurement system including GPS, laser scanners, radars and static cameras. Such approach is reliable but rather expensive. In this paper the optimal operation of a three camera system on a four-wheel robot is studied. The benefit of the dynamic camera system over the complete static measurement system is the reasonable price and the possibility to focus at certain directions.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Authors: Raunio, J., Ritala, R., Välimäki, T.
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Bibliographical note
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.
the URS/DRS elements of the promoter reveals a counterplay behavior during cell phases. The promoter transition rate coupled with cell phases determines the mRNA and transcriptional noise. We further show that bias in partitioning of RNA does not lead to phenotypic switching. Our results demonstrate that the balance between the URS and the DRS in transcriptional regulation determines population diversity.

IMPORTANCE By measuring individual mRNA production at the single-cell level, we investigated the lac promoter transcriptional transition during cell growth phases. In exponential phase, variation in transition rate generates two mixed phenotypes producing low and high numbers of mRNAs by modulating the burst frequency and size. Independent activation of the regulatory gene sequence does not produce bimodal populations at the mRNA level, while it does when activated together through the coordination of upstream/downstream promoter sequences (URS/DRS). Time-lapse microscopy of mRNAs for lac and a lac variant promoter confirm this observation. Activation of the URS/DRS elements of the promoter reveals a counterplay behavior during cell phases. The promoter transition rate coupled with cell phases determines the mRNA and transcriptional noise. We further show that bias in partitioning of RNA does not lead to phenotypic switching. Our results demonstrate that the balance between URS and DRS in transcription regulation is determining the population diversity.
Outlier detection in weight time series of connected scales.

In principle, connected sensors allow effortless long-term self-monitoring of health and wellness that can help maintain health and quality of life. However, data collected in the “wild” may be noisy and contain outliers, e.g., due to uncontrolled sources or data from different persons using the same device. The removal of the “outliers” is therefore critical for accurate interpretation of the data. In this paper we study the detection and elimination of outliers in selfweighing time series data obtained from connected weight scales. We examined three techniques: (1) a method based on autoregressive integrated moving average (ARIMA) time series modelling, (2) median absolute deviation (MAD) scale estimate, and (3) a method based on Rosner statistics. We applied these methods to both a data set with real outliers and a clean data set corrupted with simulated outliers. The results suggest that the simple MAD algorithm and ARIMA performed well with both test sets while the Rosner statistics was significantly less effective. In addition, the ARIMA approach appeared to be significantly less sensitive to long periods of missing data than MAD and Rosner statistics.
Paradoxes of change management in information system development

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Information Management and Logistics, Research group: Novi, Aalto University
Authors: Salmimaa, T., Hekkala, R., Pekkola, S.
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Parameters affecting the energy performance of the transport sector in smart cities
The energy requirements of cities’ inhabitants have grown during the last decade. Recent studies justify the necessity of reducing the energy consumption/emissions in cities. The present paper gives an overview of the factors affecting the energy consumption of the citizens based on studies conducted in cities across the globe. The studies cover all the factors that affect citizens' mobility choice that at the end, affects in the same way their final energy consumption. The results of the review are being used to support authorities in mobility decisions in order to achieve a sustainable transport sector in smart cities.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Department of Mechanical Engineering and Industrial Systems, Research group: Factory automation systems technology
Authors: Mantilla R., M. F., Nieto Lee, A., Lastra, J. L. M.
Number of pages: 6
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ASJC Scopus subject areas: Computer Networks and Communications, Information Systems
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Source: Scopus
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Research output: Scientific - peer-review » Conference contribution

Parallellization of non-linear & non-Gaussian Bayesian state estimators (Particle filters)
Particle filter has been proven to be a very effective method for identifying targets in non-linear and non-Gaussian environment. However, particle filter is computationally intensive and may not achieve the real time requirements. So, it's desirable to implement it on parallel platforms by exploiting parallel and pipelining architecture to achieve its real time requirements. In this work, an efficient implementation of particle filter in both FPGA and GPU is proposed. Particle filter has also been implemented using MATLAB Parallel Computing Toolbox (PCT). Experimental results show that FPGA and GPU architectures can significantly outperform an equivalent sequential implementation. The results also show that FPGA implementation provides better performance than the GPU implementation. The achieved execution time on dual core and quad core Dell PC using PCT were higher than FPGAs and GPUs as was expected.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Algebraic and Algorithmic Methods in Signal Processing AAMSP, Research group: Video, Research Community on Data-to-Decision (D2D), Signal Processing
Pattern recognition with Spiking Neural Networks: a simple training method

As computers are getting more pervasive, software becomes transferable to different types of hardware and, at the extreme, being bio-compatible. Recent efforts in Artificial Intelligence propose that software can be trained and taught instead of “hard-coded” sequences. This paper addresses the learnability of software in the context of platforms integrating biological components. A method for training Spiking Neural Networks (SNNs) for pattern recognition is proposed, based on spike timing dependent plasticity (STDP) of connections. STDP corresponds to the way connections between neurons change according to the spiking activity in the network, and we use STDP to stimulate outputs of the network shortly after feeding it with a pattern as input, thus creating specific pathways in the network. The computational model used to test this method through simulations is developed to fit the behaviour of biological neural networks, showing the potential for training neural cells into biological processors.

Patterns for Distributed Machine Control Systems

Control systems are getting more and more complex and include growing number of features. The control systems are nowadays software controlled to high degree. All features of the machine, however, are not useful for all customers and customers do not want to pay for the features they do not need. The product, the work machine, needs to be tailored to fit the customer's needs. However, tailoring the product for each customer is not an option as there would be too many control system software versions and configurations of the control system and for example updating the control system software would became impossible. In this paper, we will present three patterns for control systems to help in addressing the aforementioned problems. These patterns generate software architecture that supports varying the control system for different customer needs.
Perceived Impacts as User Experience Components in Mobile News Making with Smartphones
This chapter discusses users’ perceptions of system impacts as one of the user experience components. Findings from twelve case studies on mobile news making with smartphones are summarized, focusing on the perceived impacts of system use and system characteristics that can contribute to user’s perception of system quality. The findings indicate that the perceived impacts of system, i.e., the benefits and costs, for the mobile user, activity, outcome (news and news content), and journalism are important for understanding user experience and therefore the overall evaluative judgments of the system.

Perfect Pavelka Logic

General information
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Organisations: Department of Mathematics, Research group: MAT Computer Science and Applied Logics
Authors: Turunen, E., Navara, M.
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Publication information
Journal: Fuzzy Sets and Systems
Performance management practices in construction business - a service recovery perspective

This paper studies how service recovery perspective can be utilized in order to improve performance management practices in construction industry in Finland. The purpose is to redesign service recovery encounters to better handle negative customer experiences when service failure or other problem has occurred. From performance management point of view, the key challenge is to manage negative customer experiences in order to avoid negative impacts on the performance of the company. The analysis focuses on how negative customer encounters can be used as a source of learning and thus, improving customer and employee satisfaction and the whole image of the industry.

Literature on service failure and recovery discusses various components of unsuccessful customer experience, their cognitive elements and ways of reacting to service failures. However, this discussion is separated from the business performance management literature. Theoretically the paper combines methods from service management and performance management and contributes with its holistic approach to the role of service quality in construction business.

Empirical data was gathered first by interviewing 16 employees and customer engaging to customer service in 4 construction companies. The purpose was to identify the key pitfalls and practices of service recovery encounters in three main phases of the customer journey: 1) buying and planning a new home, 2) construction period, and 3) living in a new home. After interviews, two workshops in two companies were organized to reflect findings and to improve and create new service recovery encounter practices.

As a result, three performance management practices were identified: 1) guideline for customer recovery encounters, 2) developing systematic service recovery process and related quality metrics, and 3) developing the service oriented attitude and recovery of employees.
Phishing knowledge based user modelling in software design

Due to the limitations of anti-phishing software and limitations in creating such software, we propose the usage of metamodelling frameworks and software tools for implementing software systems where phishing prevention is already designed as a part of the system itself. An expressive computational, verifiable and validatable metamodel is created that captures user behaviour.

Next it is shown through examples that the metamodel follows and describes reported phishing scams accurately. The model is then used to create specification in an executable formal specification tool. The formal specification, which can be executed to observe user behaviour, can be used as a building block in the specification of a larger software system, resulting in an inherently phishing-resilient software system design in the form of a formal specification.

Pluggable Systems as Architectural Pattern: An Ecosystemability Perspective

In this paper we review the use of plug-in architectures as a technological platform for software ecosystems. Our observation is that the software community has viewed and used plug-ins as powerful extension mechanisms offering a wide range of quality properties. Looking beyond such low-level technical interpretation, we argue that pluggable systems should be perceived and treated as a higher level architectural pattern. In order to back our perspective we present the pattern following widely adopted documentation scheme, we show example usage of the pattern in the Eclipse ecosystem, and we discuss different implementation options of the pattern when building new technical solutions for ecosystems.
**pocl: A Performance-Portable OpenCL Implementation**

OpenCL is a standard for parallel programming of heterogeneous systems. The benefits of a common programming standard are clear; multiple vendors can provide support for application descriptions written according to the standard, thus reducing the program porting effort. While the standard brings the obvious benefits of platform portability, the performance portability aspects are largely left to the programmer. The situation is made worse due to multiple proprietary vendor implementations with different characteristics, and, thus, required optimization strategies.

In this paper, we propose an OpenCL implementation that is both portable and performance portable. At its core is a kernel compiler that can be used to exploit the data parallelism of OpenCL programs on multiple platforms with different parallel hardware styles. The kernel compiler is modularized to perform target-independent parallel region formation separately from the target-specific parallel mapping of the regions to enable support for various styles of fine-grained parallel resources such as subword SIMD extensions, SIMD datapaths and static multi-issue. Unlike previous similar techniques that work on the source level, the parallel region formation retains the information of the data parallelism using the LLVM IR and its metadata infrastructure. This data can be exploited by the later generic compiler passes for efficient parallelization.

The proposed open source implementation of OpenCL is also platform portable, enabling OpenCL on a wide range of architectures, both already commercialized and on those that are still under research. The paper describes how the portability of the implementation is achieved. We test the two aspects to portability by utilizing the kernel compiler and the OpenCL implementation to run OpenCL applications in various platforms with different style of parallel resources. The results show that most of the benchmarked applications when compiled using pocl were faster or close to as fast as the best proprietary OpenCL implementation for the platform at hand.

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Authors: Jääskeläinen, P., De La Lama, C. S., Schnetter, E., Raiskila, K., Takala, J., Berg, H.
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Scopus rating (2013): SJR 0.229 SNIP 0.988 CiteScore 0.87
Scopus rating (2012): SJR 0.282 SNIP 1.051 CiteScore 1.08
Scopus rating (2011): SJR 0.246 SNIP 0.775 CiteScore 0.94
Scopus rating (2010): SJR 0.354 SNIP 0.807
Scopus rating (2009): SJR 0.534 SNIP 1.082
Scopus rating (2008): SJR 0.474 SNIP 0.911
Scopus rating (2007): SJR 0.314 SNIP 0.821
Scopus rating (2006): SJR 0.288 SNIP 0.862
Scopus rating (2005): SJR 0.318 SNIP 1.185
Scopus rating (2004): SJR 0.317 SNIP 1.087
Scopus rating (2003): SJR 0.422 SNIP 0.739
Scopus rating (2002): SJR 0.207 SNIP 0.758
Scopus rating (2001): SJR 0.275 SNIP 0.777
Scopus rating (2000): SJR 0.238 SNIP 1.144
Scopus rating (1999): SJR 0.216 SNIP 0.834
Original language: English
Electronic versions: pocl
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.
Progressive Visual Object Detection with Positive Training Examples Only

Density-aware generative algorithms learning from positive examples have verified high recall for visual object detection, but such generative methods suffer from excessive false positives which leads to low precision. Inspired by the recent success of detection-recognition pipeline with deep neural networks, this paper proposes a two-step framework by training a generative detector with positive samples first and then utilising a discriminative model to get rid of false positives in those detected bounding box candidates by the generative detector. Evidently, the discriminative model can be viewed as a post-processing step which improves the robustness by distinguishing true positives from false positives that confuse the generative detector. We exemplify the proposed approach on public ImageNet classes to demonstrate the significant improvement on precision while using only positive examples in training.
Quality measures for improving technology trees

The quality of technology trees in digital games can be improved by adjusting their structural and quantitative properties. Therefore, there is a demand for recognizing and measuring such properties. Part of the process can be automated; there are properties measurable by computers, and analyses based on the results (and visualizations of them) may help to produce significantly better technology trees, even practically without extra workload for humans. In this paper, we introduce useful technology tree properties and novel measuring features implemented into our software tool for manipulating technology trees.

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.
Recurrent SKIL-activating rearrangements in ETS-negative prostate cancer

Prostate cancer is the third most common cause of male cancer death in developed countries, and one of the most comprehensively characterized human cancers. Roughly 60% of prostate cancers harbor gene fusions that juxtapose ETS-family transcription factors with androgen regulated promoters. A second subtype, characterized by SPINK1 overexpression, accounts for 15% of prostate cancers. Here we report the discovery of a new prostate cancer subtype characterized by rearrangements juxtaposing the SMAD inhibitor SKIL with androgen regulated promoters, leading to increased SKIL expression. SKIL fusions were found in 6 of 540 (1.1%) prostate cancers and 1 of 27 (3.7%) cell lines and xenografts. 6 of 7 SKIL-positive cancers were negative for ETS overexpression, suggesting mutual exclusivity with ETS fusions. SKIL knockdown led to growth arrest in PC-3 and LNCaP cell line models of prostate cancer, and its overexpression led to increased invasiveness in RWPE-1 cells. The role of SKIL as a prostate cancer oncogene lends support to recent studies on the role of TGF-β signaling as a rate-limiting step in prostate cancer progression. Our findings highlight SKIL as an oncogene and potential therapeutic target in 1-2% of prostate cancers, amounting to an estimated 10,000 cancer diagnoses per year worldwide.
Relational Capital for Shared Vision in Innovation Ecosystems
This paper provides a multiscopic view of the relationship profiles of businesses in three selected urban innovation ecosystems. With the Triple Helix framework, the ecosystem perspective and with shared vision for transformation initiatives, we explore relationships as structure in the metropolitan areas of Austin, TX, Minneapolis, MN, and Paris, France. Network metrics are interpreted as relationship indicators; and network visualizations reveal existing relationships and distinct patterns that structure the business ecosystems in each geographic area at the enterprise, growth and startup levels. We illustrate that relationship indicators and their visualization can be valuable resources for quantitatively and qualitatively understanding and analyzing the complexities of engagement, agility, structural cohesion, vitality, embeddedness, and linking factors in innovation ecosystems. Furthermore, these indicators highlight opportunities for the development of shared vision through interventions and network orchestration.

General information
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Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory
Authors: Russell, M. G., Huhtamäki, J., Still, K., Rubens, N., Basole, R. C.
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Source: RIS
Source-ID: urn:F38A9FE4A6D713DF7D7D6341B47D22C2
Research output: Scientific - peer-review › Article

Requirements, Architecture, and Quality in a Mission-Critical System: 12 Lessons Learned
Public tender processes typically start with a comprehensive specification phase, where representatives of the eventual owner of the system, usually together with a hired group of consultants, spend a considerable amount of time to determine the needs of the owner. For the company that implements the system, this setup introduces two major challenges: (1) the written down requirements can never truly describe to a person, at least to one external to the specification process, the true intent behind the requirement; (2) the vision of the future system, stemming from the original idea, will change during the specification process – over time simultaneously invalidating at least some of the requirements. This paper reflects the experiences encountered in a large-scale mission critical information system – ERICA, an information system for the emergency services in Finland – regarding design, implementation, and deployment. Based on the experiences we propose more dynamic ways of system specification, leading to simpler design, implementation, and deployment phases and finally to a better perceived quality.

General information
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Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Koski, A., Mikkonen, T.
Number of pages: 4
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Riding for a fall in outsourced ISD: Knowledge transfer challenges between the onshore vendor and the offshored unit

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Organisations: Department of Information Management and Logistics, Research group: Novi, Managing digital industrial transformation (mDIT)
Authors: Alanne, A., Pekkola, S.
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Research output: Scientific - peer-review › Conference contribution

Robust Regulation Theory for Transfer Functions With a Coprime Factorization
Classical frequency domain results of robust regulation are extended by requiring only a right or a left coprime factorization of a plant, but not both. The famous internal model principle is generalized first, which leads to a necessary and sufficient solvability condition of the robust regulation problem and to a parametrization of all robustly regulating controllers. In addition, a procedure for constructing robustly regulating controllers is proposed.

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Authors: Laakkonen, P.
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Scopus rating (2014): SJR 4.196 SNIP 3.347 CiteScore 5.14
Rolling Out a Mission Critical System in an Agilish Way: Reflections on Building a Large-Scale Dependable Information System for Public Sector

Despite the increasing pace of development and deployment of new software systems, the expectations regarding critical information systems have not changed. Consequently, to ensure high quality in spite of rapid updates, the fashion these facilities are taken to use need careful considerations. This paper presents and analyses real-life experiences gathered during the many years of planning, design, implementation, testing and finally deploying as a service a large, multi-million euro, extremely mission critical information system for emergency services. The project was to be carried out in an agile way, although the scope, the price and the duration were fixed by signed contracts. Fortunately, the customer was willing and able to learn how to do system development iteratively and incrementally, as well as to provide personnel to constantly collaborate with the developers. Along the way, we learned that to truly succeed in such an endeavor as this one, it is not enough to do the things almost right or by the book. Instead, everyone involved must keep raising the bar every day, in a continuous, disciplined, and controlled way.

Semantic-Driven CEP for Delivery of Information Streams in Data-Intensive Monitoring Systems

Modern control and monitoring systems incorporate large number of heterogeneous devices and are operated by many users with different roles and responsibilities. The information generated by these devices, although preprocessed and filtered, is usually delivered to users regardless of their actual information needs, thus overwhelming cognitive capacities and potentially affecting safety of the system. This paper addresses the problem of personalized information delivery and presents hybrid system capable to deliver information tailored to user needs based on his/her role and responsibilities. The system utilizes Semantic Web technologies (specifically OWL-DL ontologies and SPARQL queries) for configuration...
purposes and Complex Event Processing (CEP) for run-time analyzing. The combination of mentioned technologies brings two major advantages: (1) the behavior of the system could be easily changed by configuring only underlying ontology; (2) utilization of CEP at run-time makes system event-driven and reactive to frequent changes in the environment. It is expected that proposed approach is able to make monitoring systems personal oriented and thus safer during the operation. The paper presents implemented software tools and illustrates approach with scenarios from building automation domain. Current implementation of the proposed approach suggests feasibility of the solution and prompts directions for future research.

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Authors: Evchina, Y., Martinez Lastra, J. L.
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Research output: Scientific - peer-review › Conference contribution

**Service Architecture and Interface Design for Mobile Machine Parameter Optimization System**
Abstract Performance improvement is a constantly important topic in manufacturing, and mobile work machines are no exception. In some mobile machines, machine behaviour is affected by various device parameters. Their effect can be examined by statistical analysis, but exploiting analysis results during machine operation requires a sophisticated distributed information system. This paper introduces an architecture for such a system suitable for geographically dispersed machine fleets. It covers aspects on data collection, storage, analysis and utilization. Once statistical analysis has been performed, its results are made available for applications that assess machine performance locally during operation. If there is room for improvement in parameter values, the operator of the machine is given suggestions to change them. A prototype implementation is presented. The results show that such an information system has a considerable potential of bringing competitive advantage to machine operators. Besides, added value is also expected to the manufacturer of the machine as performance-related knowledge is augmented. Thus, further service business development is also contributed.

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ShakeMe: Key Generation From Shared Motion

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Authors: Yüzügüzel, H., Niemi, J., Kiranyaz, S., Gabbouj, M., Heinz, T.
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Smartphones as Personal Profile Providers: Enhancing Mobile App Architectures

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Organisations: Department of Pervasive Computing, Research area: Software engineering
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Research output: Scientific - peer-review » Conference contribution

Social Approach for Context Analysis: Modelling and Predicting Social Network Evolution using Homophily
Understanding the user’s context is important for mobile applications to provide personalized services. Such context is typically based on the user’s own information. In this paper, we show how social network analysis and the study of the individual in a social network can provide meaningful contextual information. According to the phenomenon of homophily, similar users tend to be connected more frequently than dissimilar. We model homophily in social networks over time. Such models strengthen context inference algorithms, which helps determine future status of the user, resulting in prediction accuracy improvements of up to 118% with respect to a naïve classifier.

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Social Displays on Mobile Devices: Increasing Collocated People's Awareness of the User's Activities

Activities that have traditionally been performed with tangible artifacts, e.g. reading the newspaper and browsing printed photos, have increasingly moved to mobile devices. This has made it harder for the surrounding people to become aware of the activities a person is performing with the device. As a result, the possibilities for serendipitous social interactions between the user and the collocated people have diminished. We introduce social displays, additional displays on mobile devices providing social cues about the activities of device user's activities for surrounding people. We conducted five focus groups with in total 23 participants, each discussing four scenarios and co-designing the presentation of cues on the display. The results suggest that the display has potential to break the private bubble of mobile device activities, as well as to provide tickets-to-talk to enhance social interaction, especially between acquaintances. We discuss social opportunities and challenges as well as possible design directions for social displays.
Sound event detection in real life recordings using coupled matrix factorization of spectral representations and class activity annotations

Methods for detection of overlapping sound events in audio involve matrix factorization approaches, often assigning separated components to event classes. We present a method that bypasses the supervised construction of class models. The method learns the components as a non-negative dictionary in a coupled matrix factorization problem, where the spectral representation and the class activity annotation of the audio signal share the activation matrix. In testing, the dictionaries are used to estimate directly the class activations. For dealing with large amount of training data, two methods are proposed for reducing the size of the dictionary. The methods were tested on a database of real life recordings, and outperformed previous approaches by over 10%.

Sparse approximations of phase and amplitude for wave field reconstruction from noisy data

The topic of sparse representations (SR) of images has attracted tremendous interest from the research community in the last ten years. This interest stems from the fundamental role that the low dimensional models play in many signal and image processing areas, i.e., real world images can be well approximated by a linear combination of a small number of atoms (i.e., patches of images) taken from a large frame, often termed dictionary. The principal point is that these large dictionaries as well as the elements of these dictionaries taken for approximation are not known in advance and should be taken from given noisy observations. The sparse phase and amplitude reconstruction (SPAR) algorithm has been developed for monochromatic coherent wave field reconstruction, for phase-shifting interferometry and holography. In this paper the SPAR technique is extended to off-axis holography. Pragmatically, SPAR representations are result in design of efficient data-adaptive filters. We develop and study the algorithm where these filters are applied for denoising of phase and amplitude in object and sensor planes. This algorithm is iterative and developed as a maximum likelihood optimal solution provided that the noise in intensity measurements is Gaussian. The multiple simulation and real data experiments demonstrate the advance performance of the new technique.
Speaker verification using adaptive dictionaries in non-negative spectrogram deconvolution
This article presents a new method for speaker verification, which is based on the non-negative matrix deconvolution (NMD) of the magnitude spectrogram of an observed utterance. In contrast to typical methods known from the literature, which are based on the assumption that the desired signal dominates (for example GMM-UBM, joint factor analysis, i-vectors), compositional models such as NMD describe a recording as a non-negative combination of latent components. The proposed model represents a spectrogram of a signal as a sum of spectrotemporal patterns that span durations of order about 150 ms, while many state of the art automatic speaker recognition systems model a probability distribution of features extracted from much shorter excerpts of speech signal (about 50 ms). Longer patterns carry information about dynamical aspects of modeled signal, for example information about accent and articulation. We use a parametric dictionary in the NMD and the parameters of the dictionary carry information about the speakers' identity. The experiments performed on the CHiME corpus show that with the proposed approach achieves equal error rate comparable to an i-vector based system.

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Organisations: Department of Signal Processing, Research group: Audio research group, Research Community on Data-to-Decision (D2D), Poznan University of Technology
Authors: Drgas, S., Virtanen, T.
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ASJC Scopus subject areas: Computer Science(all), Theoretical Computer Science
DOIs: 10.1007/978-3-319-22482-4_54
Source: Scopus
Source-ID: 84944710306
Research output: Scientific - peer-review » Conference contribution

Spicing Up Open Source Development with a Touch of Crowdsourcing
Leveraging the work and innovation of third party developers has risen as a viable business model for software companies. Most obviously, open source software has become an opportune ecosystem for creating innovative products with minimum number of paid developers. Then, having a company core where most of the development is done in-house by developers employed by the company can lead to a situation where the community contributions are not smoothly integrated into the code base of the open source product. Similarly, during the last decade, the use of the specialized workforce available online -- so-called crowd sourcing -- has received a lot of attention. While tapping into the unknown group of experts differs from the open source community-driven approach, they share certain similarities as well. In this paper, we present results of an initial study on how adopting and utilizing elements from crowd sourcing can help to boost community contributions in company lead development of an open source software product. We further discuss how such
activity can be supported by an in-house development model where all contributions whether done by the developers of the company or community participants enter a common, automated integration pipeline.

**General information**
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Kilamo, T., Rahikkala, J., Mikkonen, T.
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Pages: 390-397
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Research output: Scientific - peer-review » Conference contribution

**Subjective evaluation of Super Multi-View compressed contents on high-end light-field 3D displays**
Super Multi-View (SMV) video content is composed of tens or hundreds of views that provide a light-field representation of a scene. This representation allows a glass-free visualization and eliminates many causes of discomfort existing in current available 3D video technologies. Efficient video compression of SMV content is a key factor for enabling future 3D video services. This paper first compares several coding configurations for SMV content and several inter-view prediction structures are also tested and compared. The experiments mainly suggest that large differences in coding efficiency can be observed from one configuration to another. Several ratios for the number of coded and synthesized views are compared, both objectively and subjectively. It is reported that view synthesis significantly affects the coding scheme. The amount of views to skip highly depends on the sequence and on the quality of the associated depth maps. Reported ranges of bitrates required to obtain a good quality for the tested SMV content are realistic and coherent with future 4K/8K needs. The reliability of the PSNR metric for SMV content is also studied. Objective and subjective results show that PSNR is able to reflect increase or decrease in subjective quality even in the presence of synthesized views. However, depending on the ratio of coded and synthesized views, the order of magnitude of the effective quality variation is biased by PSNR. Results indicate that PSNR is less tolerant to view synthesis artifacts than human viewers. Finally, preliminary observations are initiated. First, the light-field conversion step does not seem to alter the objective results for compression. Secondly, the motion parallax does not seem to be impacted by specific compression artifacts. The perception of the motion parallax is only altered by variations of the typical compression artifacts along the viewing angle, in cases where the subjective image quality is already low. To the best of our knowledge, this paper is the first to carry out subjective experiments and to report results of SMV compression for light-field 3D displays. It provides first results showing that improvement of compression efficiency is required, as well as depth estimation and view synthesis algorithms improvement, but that the use of SMV appears realistic according to next generation compression technology requirements.

**General information**
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Orange Labs, Holografika Kft., Pamany Peter Katolikus Egyetem
Authors: Dricot, A., Jung, J., Cagnazzo, M., Pesquet, B., Dufaux, F., Kovács, P., Adhikarla, V. K.
Pages: 369–385
Publication date: 2015
Peer-reviewed: Yes

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Journal: Signal Processing: Image Communication
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Scopus rating (2015): SJR 0.529 SNIP 1.484 CiteScore 2.57
Scopus rating (2014): SJR 0.512 SNIP 1.531 CiteScore 2.04
Scopus rating (2013): SJR 0.439 SNIP 1.417 CiteScore 2.19
Scopus rating (2012): SJR 0.766 SNIP 1.896 CiteScore 2.5
Scopus rating (2011): SJR 0.754 SNIP 1.811 CiteScore 2.39
Scopus rating (2010): SJR 0.566 SNIP 1.687
Scopus rating (2009): SJR 0.482 SNIP 1.439
Scopus rating (2008): SJR 0.525 SNIP 1.129
Scopus rating (2007): SJR 1.042 SNIP 1.682
Scopus rating (2006): SJR 0.945 SNIP 1.465
Scopus rating (2005): SJR 0.722 SNIP 2.262
Scopus rating (2004): SJR 0.55 SNIP 1.563
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ASJC Scopus subject areas: Computer Vision and Pattern Recognition, Signal Processing, Software, Electrical and Electronic Engineering
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Supplier's Expectations on Usage Data Analytics of Complex Industrial Systems

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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: User experience, University of Tampere
Authors: Väätäjä, H., Heimonen, T., Tiitinen, K., Hakulinen, J., Turunen, M.
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ISBN (Electronic): 9781911136002
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ASJC Scopus subject areas: Human-Computer Interaction, Information Systems, Management of Technology and Innovation
Research output: Scientific - peer-review › Conference contribution

Synchrony between Genetic Repressilators in Sister Cells in Different Temperatures
We used live E. coli containing synthetic genetic oscillators to study how the degree of synchrony between the genetic circuits of sister cells changes with temperature. We found that both the mean and the variability of the degree of synchrony between the fluorescence signals from sister cells are affected by temperature. Also, while most pairs of sister cells were found to be highly synchronous in each condition, the number of asynchronous pairs increased with increasing temperature, which was found to be due to disruptions in the oscillations. Finally we provide evidence that these disruptions tend to affect multiple generations as opposed to individual cells. These findings provide insight in how to design more robust synthetic circuits and in how cell division can affect their dynamics.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Laboratory of Biosystem Dynamics-LBD
Authors: Chandraseelan, J. G., Oliveira, S. M., Häkkinen, A., Startceva, S., Ribeiro, A. S.
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http://waset.org/abstracts/Bioengineering-and-Life-Sciences
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Source-ID: urn:ad9f9ddacfdf5c4da9d8411b88da981dc4
Research output: Scientific - peer-review › Conference contribution

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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Vogel, B., Kilamo, T., Kurti, A.
Number of pages: 8
Pages: 31:1-31:8
Publication date: 2015

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Publisher: ACM
ISBN (Print): 978-1-4503-3393-1

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DOIs: 10.1145/2797433.2797465
Source: Bibtex
Source-ID: urn:51d684de21a1760bb4c53a22c9cd5260
Research output: Scientific - peer-review › Conference contribution

**Techniques for Genetic Software Architecture Design**

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT), University of Tampere
Authors: Sievi-Korte, O., Koskimies, K., Mäkinen, E.
Pages: 3141-3170
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Texture Classification Using Dense Micro-block Difference (DMD)
The paper proposes a novel image representation for texture classification. The recent advancements in the field of patch based features compressive sensing and feature encoding are combined to design a robust image descriptor. In our approach, we first propose the local features, Dense Micro-block Difference (DMD), which capture the local structure from the image patches at high scales. Instead of the pixel we process the small blocks from images which capture the micro-structure from it. DMD can be computed efficiently using integral images. The features are then encoded using Fisher Vector method to obtain an image descriptor which considers the higher order statistics. The proposed image representation is combined with linear SVM classifier. The experiments are conducted on the standard texture datasets (KTH-TIPS-2a, Brodatz and Curet). On KTH-TIPS-2a dataset the proposed method outperforms the best reported results by 5.5% and has a comparable performance to the state-of-the-art methods on the other datasets.

The Fuzzy Front End of Experience Design: Workshop Proceedings
To start an experience design process, the designers should determine what experience they intend to aim for. How should this decision be made? In the fuzzy front end of the experience design process, there are often several alternative sources for gaining insight and inspiration. There may be different, even conflicting viewpoints and opinions. In addition to user studies, insight and inspiration for experience, goals can be sought from brand promises, technology and societal trends, as well as from just a vision of renewal.

In these proceedings, we present the results of the "Fuzzy Front End of Experience Design" workshop held in NordiCHI 2014 in Helsinki. The workshop brought together practitioners and academics to share knowledge and lessons learned on and explore how to get from the fuzzy front end to a shared vision of the experience to aim for.

We accepted to the workshop eight excellent position papers that presented experience goal setting on different fields. Prior to the workshop, we collected with an online questionnaire participants’
views related to experience design. These results were analysed and presented in the workshop. During the workshop, we shared experiences and discussed where insight and inspiration to experience goals setting can be sought, what the characteristics of good experience goals are, and how experience goals should be communicated. Our goal is that this report will provide inspiration and guidance to defining experience goals, thus shedding light on the fuzzy front end of experience design.

These proceedings include the following: an introduction and description of the workshop as well as related phases and activities, an overview of the survey results, results of the workshop activities, and the position papers presented at the workshop. The description of the workshop has been published earlier in NordiCHI 2014 conference proceedings. The papers have been published on the workshop website.

The Fuzzy Front End of Experience Design: Eliciting and Communicating Experience Goals

When starting an experience design process, designers should first determine the experience to aim for. In the fuzzy front end of the experience design process, there are often several alternative sources for gaining insight and inspiration in defining this experience. In this paper, we describe the results of a survey where we studied experience design practitioners’ views of experience goal setting and approaches to communicate about these goals with stakeholders. The results from 9 different design cases suggest that “empathic understanding of the users’ world” is the most used source of insight and inspiration in defining experience goals. As an end result, we propose an initial model for an Experience Goal Elicitation Process to clarify the fuzzy front end of experience design. Also, instructions to support designers in defining and evaluating experience goals are presented.
The Shape of Health: A Comparison of Five Alternative Ways of Visualizing Personal Health and Wellbeing

The combination of clinical and personal health and wellbeing data can tell us much about our behaviors, risks and overall status. The way this data is visualized may affect our understanding of our own health. To study this effect, we conducted a small experiment with 30 participants in which we presented a holistic overview of the health and wellbeing of two modeled individuals, one of them with metabolic syndrome. We used an insight-based methodology to assess the effectiveness of the visualizations. The results show that adequate visualization of holistic health data helps users without medical background to better understand the overall health situation and possible health risks related to lifestyles. Furthermore, we found that the application of insight-based methodology in the health and wellbeing domain remains unexplored and additional research and methodology development are needed.

General information
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Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI, Research Community on Data-to-Decision (D2D), Northeastern University, VTT Tech Res Ctr Finland, VTT Technical Research Center Finland
Authors: Ledesma, A., Nieminen, H., Valve, P., Pavel, M., Jimison, H., Ermes, M.
Number of pages: 4
Pages: 7638-7641
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Publisher: Institute of Electrical and Electronics Engineers IEEE
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10.1109/EMBC.2015.7320161
Research output: Scientific - peer-review › Conference contribution

The Social Developer – Now, Then, and Tomorrow

The practice of software engineering needs both individual commitment as well as social interaction. It has long been widely recognized that communication problems are a major factor in the delay and failure of software projects. However, the patterns of communication that can be associated with the different development paradigms have gained less attention. In this paper, we present some views to the evolution of social dimensions in the light of software engineering methodologies and associated tools. To study this, we have surveyed a number of software developers working in industry to reflect our views into the state-of-practice in software development companies and shed light to the impact of distributed and agile development has had on developer communication. Towards the end of the paper, we provide some ideas for future research and draw some final conclusions.

General information
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Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Kilamo, T., Leppänen, M., Mikkonen, T.
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Research output: Scientific - peer-review › Conference contribution

The spatial presence experience scale (SPES): A short self-report measure for diverse media settings

The study of spatial presence is currently receiving increased attention in both media psychology and communication research. The present paper introduces the Spatial Presence Experience Scale (SPES), a short eight-item self-report measure. The SPES is derived from a process model of spatial presence (Wirth et al., 2007, Media Psychology, 9, 493-525), and assesses spatial presence as a two-dimensional construct that comprises a user's self-location and perceived possible actions in a media environment. The SPES is shorter than many other available spatial presence scales, and can be conveniently applied to diverse media settings. Two studies are reported (N-1 = 290, N-2 = 395) that confirm sound psychometric qualities for the SPES.

General information
Time-series modeling of long-term weight self-monitoring data

Long-term self-monitoring of weight is beneficial for weight maintenance, especially after weight loss. Connected weight scales accumulate time series information over long term and hence enable time series analysis of the data. The analysis can reveal individual patterns, provide more sensitive detection of significant weight trends, and enable more accurate and timely prediction of weight outcomes. However, long term self-weighing data has several challenges which complicate the analysis. Especially, irregular sampling, missing data, and existence of periodic (e.g. diurnal and weekly) patterns are common. In this study, we apply time series modeling approach on daily weight time series from two individuals and describe information that can be extracted from this kind of data. We study the properties of weight time series data, missing data and its link to individuals behavior, periodic patterns and weight series segmentation. Being able to understand behavior through weight data and give relevant feedback is desired to lead to positive intervention on health behaviors.
**To UML or not to UML? – Empirical Study on the Approachability of Software Architecture Diagrams**

Software architecture design is key to building systems that meet quality demands. Choosing the appropriate way to model the architecture ensures it is rightly understood by everyone involved. UML diagrams are commonly used in software engineering but free-form diagrams are almost as common. In this paper, we study the factors influencing the approachability of diagrams, and particularly whether there is a difference in the approachability between UML and non-UML diagrams and colored and black & white diagrams. Our results show that colors do not necessarily increase the approachability of diagrams and free-form diagrams can suffer from ambiguousness. We conclude that simplicity and correctness are key factors when modeling architectures.

**General information**

State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT), Regulation of learning and active learning methods (REALMEE), Vincit Oy
Authors: Eloranta, V., Isohanni, E., Lahtinen, S., Sievi-Korte, O.
Number of pages: 5
Pages: 101-105
Publication date: 2015
Towards blended learning: A case study
Abstract - University education is in the middle of a technological and pedagogical revolution. Traditional models are under considerable pressure to change. In this paper, we introduce a case where IT education was radically challenged by new possibilities. The case is a small university department, which runs a Master’s degree program for an annual intake of about 60 students. The students study while working either full or part-time. Thus, the key challenge is to enable an efficient balance between work and studies especially by supporting distance learning. This means that the location and schedule of studies have to be flexible. One way has been to increase the multiformity of the pedagogical methods. For example, teaching is moving increasingly toward the flipped classroom method. In addition to the teachers' own video production, external academic Internet sources have been used and experiments have also been made of using external Massive Open Online Course materials for example in executing web development and database courses. This paper is a summary and analysis of the observations from the viewpoint of the students, teachers, and administration. Some plans and future intentions are also presented.

Towards Deeper Understanding of User Experience with Ubiquitous Computing Systems: Systematic Literature Review and Design Framework
Over the past decades, a plethora of innovative ubiquitous computing (ubicomp) systems have been constructed. The acceptance of the systems, however, depends on how users experience them in real contexts. While many of the ubicomp research projects include some form of user study, there is no overview of how user experience (UX) is approached in ubicomp research. To this end, we conducted a systematic literature review of ubicomp UX studies. Our findings reveal that users' experiences with ubicomp systems have often been investigated in rather lightweight ways, for example by addressing basic usability issues, collecting ratings by simple, predetermined scales, or producing descriptions of general experiences such as fun and trust. Based on the findings we argue that a deeper and more fine-grained understanding of user experience would help developing more successful ubicomp systems. We propose a ubicomp UX framework that can help design and evaluate ubicomp systems with a desirable set of target experiences.
Towards liquid web applications

As the complexity of rich Web applications grows together with the power and number of Web browsers, the next Web engineering challenge to be addressed is to design and deploy Web applications to make coherent use of all devices. As users nowadays operate multiple personal computers, smart phones, tablets, and computing devices embedded into home appliances or cars, the architecture of current Web applications needs to be redesigned to enable what we call Liquid Software. Liquid Web applications not only can take full advantage of the computing, storage and communication resources available on all devices owned by the end user, but also can seamlessly and dynamically migrate from one device to another continuously following the user attention and usage context. In this paper we address the Liquid Software concept in the context of Web applications and survey to which extent and how current Web technologies can support its novel requirements.

Towards Post-Agile Development Practices Through Productized Development Infrastructure

Modern software is developed to meet evolving customer needs in a timely fashion. The need for a rapid time-to-market together with changing requirements has led software intensive companies to utilize agile development, where each iteration aims at producing end-user value and change is embraced. In today’s post-agile software development world,
there is a need for processes and tools that deliver new software to the end-user as fast as possible. The level of adoption of these continuous software engineering practices depends on the product, customers, and the business domain. In this paper, we investigate the benefits gained from implementing a completely continuous delivery workflow using a domain specific productized development infrastructure through a descriptive single case study. Embracing the continuous delivery mindset throughout the development pipeline allows the case customer company to gain fast insight on new business directions and lends the services to live experimentation which in turn adds to end-user value. Up-to-date feedback cycles between all stakeholders all the way from concept design to end-users are offered.

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Organisations: Department of Pervasive Computing, Research area: Software engineering, Managing digital industrial transformation (mDIT)
Authors: Leppänen, M., Kilamo, T., Mikkonen, T.
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Pages: 34-40
Publication date: 2015

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DOIs: 10.1109/RCoSE.2015.14
Research output: Scientific - peer-review › Conference contribution

**Towards Traditional Simulation Models of Context Using Process Mining**
Context (sensor) systems are hard to model: they require constant updating and insightful approaches, especially considering the increasing data volume, variety, and generation rate of contemporary networking paradigms, like the Internet of Things. In this paper, we argue that intelligent process models can be mined to look at the actual system activity from alternative context perspectives, i.e., perspectives observable from the sensor attributes themselves. We explain how the close relationship between the models derived using Process Mining, and Event-Driven Simulation can be exploited to help not only better understand what is happening in such systems but also provide alternative models for the intelligent solutions they support, such as context inference. We demonstrate this using a real-world example and discuss the feasibility of extending these alternative process models to be viewed as simulation. We envision automated steps that would result in traditional simulation models of context using Process Mining.

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory
Authors: Pileggi, P., Rivero-Rodriguez, A., Nykänen, O.
Number of pages: 6
Pages: 70-75
Publication date: 2015

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Research output: Scientific - peer-review › Conference contribution

**Training based cell detection from bright-field microscope images**
This paper proposes a framework for cell detection from bright-field microscope images. The method is trained using manually annotated images, and it uses Support Vector Machine classifiers with Histogram of Oriented Gradient features.
The performance of the method is evaluated using 16 training and 12 test images with altogether 10736 human prostate cancer cells. Both the implementation and the annotated image database are released for download. The experiments consider various parameters and their effect on performance, and reaches accurate detection results with cross-validated AUC over 0.98, and mean relative deviation of 9 % from manually counted annotations in the growth curve over six days.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Pori Department, Research group: Data-analytics and Optimization, Research group: Computational Systems Biology, Department of Signal Processing, Research group: Vision, Prostate cancer research center (PCRC)
Authors: Tikkanen, T., Ruusuvuori, P., Latonen, L., Huttunen, H.
Number of pages: 5
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10.1109/ISPA.2015.7306051

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ORG=pla,0.5
ORG=sgn,0.5
Source: RIS
Source-ID: urn:64D249813CF28C8F790287E19155A804
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Transcription closed and open complex dynamics studies reveal balance between genetic determinants and co-factors

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Organisations: Department of Signal Processing, Research group: Computational Systems Biology, Research group: Molecular Signaling Lab, Prostate cancer research center (PCRC)
Authors: Sala, A., Shoaib, M., Anufrieva, O., Mutharasu, G., Hoque, R. J., Yli-Harja, O., Kandhavelu, M.
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Peer-reviewed: Yes

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Scopus rating (2015): SJR 1.268 SNIP 0.689 CiteScore 2.06
Scopus rating (2014): SJR 1.639 SNIP 0.811 CiteScore 2.53
Scopus rating (2013): SJR 1.499 SNIP 0.731 CiteScore 2.61
Scopus rating (2012): SJR 1.543 SNIP 0.866 CiteScore 2.48
Scopus rating (2011): SJR 1.341 SNIP 0.869 CiteScore 2.63
Scopus rating (2010): SJR 1.852 SNIP 0.978
Scopus rating (2009): SJR 2.129 SNIP 0.985
Scopus rating (2008): SJR 2.103 SNIP 1.133
Scopus rating (2007): SJR 1.914 SNIP 1.057
Scopus rating (2006): SJR 1.409 SNIP 0.794
Scopus rating (2005): SJR 0.858 SNIP 0.894
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General information
State: Published
Ministry of Education publication type: Not Eligible
Organisations: Department of Information Management and Logistics, Research group: Novi, Pori Department, Research group: Business Ecosystems, Networks and Innovations, Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory, Managing digital industrial transformation (mDIT)
Authors: Jussila, J. J., Kärkkäinen, H., Aramo-Immonen, H., Huhtamäki, J.
Number of pages: 2
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Publication date: 2015

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Publisher: Tampereen teknillinen yliopisto, Porin laitos
Editor: Väkiparta, M.

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Publisher: Tampereen teknillinen yliopisto. Porin laitos - Tampere University of Technology. Pori Department
ISSN (Print): 2323-8976
Keywords: social media, productivity
Links:
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General information
State: Published
Ministry of Education publication type: B1 Article in a scientific magazine
Organisations: Department of Mathematics, Research group: MAT Intelligent Information Systems Laboratory
Authors: Vainikka, E., Huhtamäki, J.
Number of pages: 19
Twist predicts poor outcome of patients with astrocytic glioma

Aims and methods Epithelial-mesenchymal transition (EMT) has previously been linked to glioma invasion and progression. To determine whether EMT regulators, Twist and Zeb1, had clinical significance in astrocytic gliomas, the association of Twist and Zeb1 with clinicopathological and molecular factors was studied in 269 astrocytoma samples. Results Twist and Zeb1 were widely expressed in astrocytic gliomas, but the expression of the former did not correlate with that of the latter. Stronger Twist expression levels were associated with higher WHO grades (p=0.001), whereas Zeb1 did not correlate with WHO grades. We found no association between Twist and proliferation activity (Ki67/MIB-1), p53 status, epidermal growth factor receptor (EGFR) amplification or neural cell adhesion molecule (NCAM) expression. There was no significant difference in Twist or Zeb1 expression when primary and secondary gliomas were analysed. Tumours with high Twist expression were IDH1 negative (p=0.009). High hypoxia-inducible factor-1a expression correlated significantly with positive Twist expression (p<0.001), whereas it was not associated with Zeb1 expression. Zeb1 expression did not correlate with proliferation, EGFR or IDH1. Nevertheless, we did find a correlation between high Zeb1 expression and low p53 expression levels (p=0.027). Positive NCAM expression was significantly associated with Zeb1 positivity (p=0.022). Zeb1 had no association with patient survival, whereas positive Twist expression predicted poor survival for patients in both univariate (p<0.001) and multivariable analyses (p=0.027). Conclusions EMT regulators, Twist and Zeb1, are common features of infiltrating astrocytomas, and Twist is upregulated in glioblastomas in particular. Twist may be a novel marker for poor prognosis in glioma patients.
Two mature products of MIR-491 coordinate to suppress key cancer hallmarks in glioblastoma

MIR-491 is commonly co-deleted with its adjacent CDKN2A on chromosome 9p21.3 in glioblastoma multiforme (GBM). However, it is not known whether deletion of MIR-491 is only a passenger event or has an important role. Small-RNA sequencing of samples from GBM patients demonstrated that both mature products of MIR-491 (miR-491-5p and -3p) are downregulated in tumors compared with the normal brain. The integration of GBM data from The Cancer Genome Atlas (TCGA), miRNA target prediction and reporter assays showed that miR-491-5p directly targets EGFR, CDK6 and Bcl-xL, whereas miR-491-3p targets IGFBP2 and CDK6. Functionally, miR-491-3p inhibited glioma cell invasion; overexpression of both miR-491-5p and -3p inhibited proliferation of glioma cell lines and impaired the propagation of glioma stem cells (GSCs), thereby prolonging survival of xenograft mice. Moreover, knockdown of miR-491-5p in primary Ink4a-Arf-null mouse glial progenitor cells exacerbated cell proliferation and invasion. Therefore, MIR-491 is a tumor suppressor gene that, by utilizing both mature forms, coordinately controls the key cancer hallmarks: proliferation, invasion and stem cell propagation.
Typical and atypical domain combinations in human protein kinases: functions, disease causing mutations and conservation in other primates

General information
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Organisations: Department of Signal Processing
Authors: Rakshambikai, R., Manoharan, M., Gnanavel, M., Srinivasan, N., Mutharasu, G.
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Scopus rating (2013): SJR 1.117 SNIP 0.903 CiteScore 3.74
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Source: Bibtex
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Unsupervised Visual Alignment with Similarity Graphs

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Organisations: Research group: Vision, Department of Signal Processing, Research Community on Data-to-Decision (D2D)
Authors: Yancheshmeh, F. S., Chen, K., Kämäräinen, J.
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User experience goals as a guiding light in design and development – Early findings

User experience (UX) goals are one means to describe user experience requirements and guide the design and evaluation of interactive systems in different application domains. This position paper discusses the results of a pre-workshop questionnaire for participants of a workshop on UX goals and their utilization. The domains of the case studies that participants described vary from workplace to consumer applications and education. Workshop participants defined a good UX goal as something that (1) helps in focusing the design, (2) is measurable, (3) describes positive emotions, and (4) communicates the desired experience. Furthermore, UX goals were considered useful in keeping the focus on important issues during design and development, and providing inspiration for design.

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Organisations: Department of Pervasive Computing, Research area: User experience, Aalto University, VTT Technical Research Centre of Finland
Authors: Väätäjä, H., Savioja, P., Roto, V., Olsson, T., Varsaluoma, J.
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https://opus4.kobv.de/opus4-bamberg/frontdoor/index/index/docId/25644
Research output: Scientific - peer-review » Conference contribution
User Experience of Digital News: Two Semi-long Term Field Studies

Reading of digital news on personal devices has dramatically increased. Parallel to new devices, novel service or even content types are created forming new habits and experiences for readers. However, previous research is limited in understanding temporal aspects of such users’ experiences (UX). The goal of this study is to understand user experience of mobile news reading in a real context of use over one week in two different case studies. UX of digital replicas, browser optimized versions of digital news, and novel media authentication method for news reading and ordering were explored with actual news readers (N=36) in field using their own tablets and personal computers. Data-collection included in daily diaries with the UX questionnaires and the retrospective interviews. The results showed that the studied forms of digital news and authentication methods provided positive user experience and they were appealing for future digital news. UX also showed a tendency of improving over a time. In addition, the user’s habits of reading digital news reflected the conventions of reading a print newspaper.

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Authors: Pesonen, E., Jumisko-Pyykkö, S., Väätäjä, H.
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Links:
Research output: Scientific - peer-review › Conference contribution

User Experience of Mobile Proximity-Based Applications for Playful Social Interaction

Mobile proximity-based connectivity technology like Wi-Fi Direct allows detecting nearby devices and establishing a direct data transfer between them. The opportunities provided by that are still underutilized. My doctoral research looks into proximity-based playful social interactions as a way to enhance interactivity between collocated people, both friends and strangers. I do qualitative user research on new research prototypes as well as on existing commercial systems like Nintendo’s StreetPass.

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Authors: Paasovaara, S.
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Research output: Scientific - peer-review › Conference contribution
Using context overlays to analyse the role of a priori information with Process Mining
Notwithstanding the significant advances in context-aware computing in pervasive computing and self-adaptive systems, there is still much more to be desired in providing better context services. The number of sensors deployed world-wide increases very rapidly. The Internet of Things, amongst others, generates vast amounts of data of many different data types. How data are used is essential to improve user experience and efficiencies of the systems in which they occur. We explain how familiar concepts of Process Mining strengthen generalised sensor context services. We present a laboratory case to explain the approach. By way of a real-world example, we confirm the viability of using Process Mining to strengthen context-aware computing.

Using video games to combine learning and assessment in mathematics education

UX sensors - Understanding the UX of complex systems through usage analysis
UX work in startups: Current practices and future needs

Startups are creating innovative new products and services while seeking fast growth with little resources. The capability to produce software products with good user experience (UX) can help the startup to gain positive attention and revenue. Practices and needs for UX design in startups are not well understood. Research can provide insight on how to design UX with little resources as well as to gaps about what kind of better practices should be developed. In this paper we describe the results of an interview study with eight startups operating in Finland. Current UX practices, challenges and needs for the future were investigated. The results show that personal networks have a significant role in helping startups gain professional UX advice as well as user feedback when designing for UX. When scaling up startups expect usage data and analytics to guide them towards better UX design.

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Organisations: Department of Pervasive Computing, Research area: User experience, Augmented Human Activities (AHA)
Authors: Hokkanen, L., Väänänen-Vainio-Mattila, K.
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Pages: 81-92
Publication date: 2015

Vibrotactile Stimulation as an Instructor for Mimicry-Based Physical Exercise

The present aim was to investigate functionality of vibrotactile stimulation in mimicry-based behavioral regulation during physical exercise. Vibrotactile stimuli communicated instructions from an instructor to an exerciser to perform lower extremity movements. A wireless prototype was tested first in controlled laboratory conditions (Study 1) and was followed
by a user study (Study 2) that was conducted in a group exercise situation for elderly participants with a new version of the system with improved construction and extended functionality. The results of Study 1 showed that vibrotactile instructions were successful in both supplementing and substituting visual knee lift instructions. Vibrotactile stimuli were accurately recognized, and exercise with the device received affirmative ratings. Interestingly, tactile stimulation appeared to stabilize acceleration magnitude of the knee lifts in comparison to visual instructions. In Study 2 it was found that user experience of the system was mainly positive by both the exercisers and their instructors. For example, exercise with vibrotactile instructions was experienced as more motivating than conventional exercise session. Together the results indicate that tactile instructions could increase possibilities for people having difficulties in following visual and auditory instructions to take part in mimicry-based group training. Both studies also revealed development areas that were primarily related to a slight delay in triggering the vibrotactile stimulation.

## View upsampling optimization for mixed resolution 3D video coding

3D video is composed out of two or more, temporally synchronized, 2D video streams acquired at different camera poses and accompanied by geometrical information. In a mixed resolution 3D video stream, a subset of views is coded at reduced resolution. It has been shown in the literature that subjective quality of mixed resolution 3D video is close to that of full resolution 3D video. In order to improve the coding gain in mixed resolution coding scenario we present a new depth encoding method called view upsampling optimization. A novel depth distortion metric based on the performance of the depth-based super resolution is also presented. Finally, to improve the quality of the decoded video an improved depth-based super resolution method that uses view synthesis quality mapping is used for upsampling of low resolution views. The simulations, performed with the recently standardized MVC+D encoder, show that the proposed solution combined with the state of the art view synthesis distortion outperforms the anchor MVC+D coding scheme by 14.5 % of dBR on average for the total coded bitrate and by 17 % of dBR on average for the synthesized views.
Visual Saliency by Extended Quantum Cuts

In this study, we propose an unsupervised, state-of-the-art saliency map generation algorithm which is based on a recently proposed link between quantum mechanics and spectral graph clustering, Quantum Cuts. The proposed algorithm forms a graph among superpixels extracted from an image and optimizes a criterion related to the image boundary, local contrast and area information. Furthermore, the effects of the graph connectivity, superpixel shape irregularity, superpixel size and how to determine the affinity between superpixels are analyzed in detail. Furthermore, we introduce a novel approach to propose several saliency maps. Resulting saliency maps consistently achieves a state-of-the-art performance in a large number of publicly available benchmark datasets in this domain, containing around 18k images in total.
W2E - Wellness Warehouse Engine for Semantic Interoperability of Consumer Health Data

Novel health monitoring devices and applications allow consumers easy and ubiquitous ways to monitor their health status. However, technologies from different providers lack both technical and semantic interoperability and hence the resulting health data is often deeply tied to a specific service, which is limiting its re-usability and utilization in different services. We have designed a Wellness Warehouse Engine (W2E) that bridges this gap and enables seamless exchange of data between different services. W2E provides interfaces to various data sources and makes data available via unified Representational State Transfer Application Programming Interface (REST API) to other services. Importantly, it includes Unifier – an engine that allows transforming input data into generic units re-usable by other services, and Analyzer – an engine that allows advanced analysis of input data, such as combining different data sources into new output parameters.

In this paper, we describe the architecture of W2E and demonstrate its applicability by using it for unifying data from four consumer activity trackers, using a test base of 20 subjects each carrying out three different tracking sessions. Finally, we discuss challenges of building a scalable Unifier engine for the ever-enlarging number of new devices.

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Authors: Honko, H., Andalibi, V., Aaltonen, T., Parak, J., Saaranen, M., Viik, J., Korhonen, I.
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Scopus rating (2013): SJR 1.049 SNIP 2.405
Scopus rating (2012): SJR 0.799 SNIP 2.261
Scopus rating (2011): SJR 0.681 SNIP 2.042
Scopus rating (2010): SJR 0.632 SNIP 1.862
Scopus rating (2009): SJR 0.588 SNIP 1.809
Scopus rating (2008): SJR 0.605 SNIP 2.01
Scopus rating (2007): SJR 0.716 SNIP 2.154
Scopus rating (2006): SJR 0.685 SNIP 2.199
Scopus rating (2005): SJR 0.596 SNIP 1.843
Scopus rating (2004): SJR 0.486 SNIP 1.355
Scopus rating (2003): SJR 0.616 SNIP 1.65
Scopus rating (2002): SJR 0.491 SNIP 1.309
Scopus rating (2001): SJR 0.821 SNIP 1.548
Scopus rating (2000): SJR 0.459 SNIP 1.515
Scopus rating (1999): SJR 0.367 SNIP 0.952
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ASJC Scopus subject areas: Biomedical Engineering
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10.1109/JBHI.2015.2469718
Ways to Cross the Rubicon: Pivoting in Software Startups

Startup, or a potential company looking for form and repeatable, scalable business model, has become an advocated mechanism for embracing high ambition, innovativeness, and growth. The success of a startup is often related to the time it takes the startup to develop their business model. When the entire business is based on extreme uncertainty the main business hypothesis of the business model must be continuously tested and improved. This main business hypothesis can be split into smaller business hypotheses and when one of these business hypotheses proves to be false, a change in the direction of the company – so-called pivot – must be considered. Readily made approaches exist to accomplish this, including in particular the Lean Startup framework, that aims at iteratively developing, experimenting, and validating business hypotheses. In this paper study how pivots can change business hypotheses shown as segments in Lean Model Canvas, a strategic management tool for developing business models. As an empirical contribution, we describe this definition of pivots with three case companies – all small software startups from Tampere region, Finland – and map the pivot effects on the business hypotheses. We found out that the pivots can be identified by changes in the Lean Model Canvas, that pivots typically take place in groups, and that comprehensive pivots happen early in the startup’s life, whereas once the business model is clarified, fine-tuning is more likely to take place.

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Organisations: Department of Pervasive Computing, Research area: Software engineering
Authors: Terho, H., Suonsyrjä, S., Karisalo, A., Mikkonen, T.
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Name: Lecture Notes in Computer Science
Volume: 9459
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Ways to measure spatial presence: Review and future directions

General information
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Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Pervasive Computing, Research area: User experience
Authors: Laarni, J., Ravaja, N., Saari, T., Böcking, S., Hartmann, T., Schramm, H.
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WHIRLBOB, the Whirlpool Based Variant of STRIBOB

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Organisations: Department of Pervasive Computing, Intelligent dexterity for secure networked infrastructure and applications (IDSNIA)
Authors: Saarinen, M. O., Brumley, B. B.
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Publisher: Springer Verlag
Editors: Buchegger, S., Dam, M.
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An investigation of nuclear properties of even-even natural Mo92-100 isotopes
In this study, we have calculated the basic nuclear properties such as binding energies, root mean square (rms) charge radii, and neutron and proton densities of the even-even natural Mo92-100 isotopes. Investigations were performed using the Hartree-Fock-Bogoliubov (HFB) method with different Skyrme-like forces. Separation energies, which have an important role in nuclear structure, of neutron, proton, deuteron, triton, helium-3 and alpha were also investigated with TALYS 1.4 code. The calculated results were discussed and compared with experimental results.

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Authors: Artun, O., Aytekin, C., Aytekin, H.
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Guard-based Partial Order Reduction

This paper aims at making partial-order reduction independent of the modeling language. To this end, we present a guard-based method which is a general-purpose implementation of the stubborn set method. We approach the implementation through so-called necessary enabling sets and do-not-accord sets, and give an algorithm suitable for an abstract model checking interface. We also introduce necessary disabling sets and heuristics to produce smaller stubborn sets and thus better reduction at low costs. We explore the effect of these methods using an implementation in the model checker LTSMin. We experiment with partial-order reduction on a number of Promela models, on benchmarks from the BEEM database in the DVE language, and with several with LTL properties. The efficiency of the heuristic algorithm is established by a comparison to the subset-minimal Deletion algorithm and the simple closure algorithm. We also compare our results to the Spin model checker. While the reductions take longer, they are consistently better than Spin’s ample set and often surpass the upper bound for the process-based ample sets, established empirically earlier on BEEM models.

GPU parallel implementation of the approximate K-SVD algorithm using OpenCL

Training dictionaries for sparse representations is a time consuming task, due to the large size of the data involved and to the complexity of the training algorithms. We investigate a parallel version of the approximate K-SVD algorithm, where multiple atoms are updated simultaneously, and implement it using OpenCL, for execution on graphics processing units (GPU). This not only allows reducing the execution time with respect to the standard sequential version, but also gives dictionaries with which the training data are better approximated. We present numerical evidence supporting this somewhat surprising conclusion and discuss in detail several implementation choices and difficulties.
The fuzzy front end of experience design

The basic idea behind Experience Design approach is that before ideating the solution, you define what experience to design for. This is a critical point in a design process, because the experience goal needs to be appropriate for the target context of use, in line with the brand experience, and meaningful to truly engage users. In the early phases of the experience design process, in the fuzzy front end, there are several sources that can guide experience goal setting. One important way is empathic understanding of the users' world and stepping into the users' shoes, but there are also other sources of insight and inspiration for setting the experiential goals such as brand promise, technology and societal trends as well as mere vision of renewal. In this workshop, we aim to collect examples of the fuzzy front end of the experience design process and analyze how the different sources of insight and inspiration influence experience goal setting. Copyright is held by the owner/author(s).
Compensation of Missing Wedge Effects with Sequential Statistical Reconstruction in Electron Tomography

Electron tomography (ET) of biological samples is used to study the organization and the structure of the whole cell and subcellular complexes in great detail. However, projections cannot be acquired over full tilt angle range with biological samples in electron microscopy. ET image reconstruction can be considered an ill-posed problem because of this missing information. This results in artifacts, seen as the loss of three-dimensional (3D) resolution in the reconstructed images. The goal of this study was to achieve isotropic resolution with a statistical reconstruction method, sequential maximum a posteriori expectation maximization (sMAP-EM), using no prior morphological knowledge about the specimen. The missing wedge effects on sMAP-EM were examined with a synthetic cell phantom to assess the effects of noise. An experimental dataset of a multivesicular body was evaluated with a number of gold particles. An ellipsoid fitting based method was developed to realize the quantitative measures elongation and contrast in an automated, objective, and reliable way. The method statistically evaluates the sub-volumes containing gold particles randomly located in various parts of the whole volume, thus giving information about the robustness of the volume reconstruction. The quantitative results were also compared with reconstructions made with widely-used weighted backprojection and simultaneous iterative reconstruction technique methods. The results showed that the proposed sMAP-EM method significantly suppresses the effects of the missing information producing isotropic resolution. Furthermore, this method improves the contrast ratio, enhancing the applicability of further automatic and semi-automatic analysis. These improvements in ET reconstruction by sMAP-EM enable analysis of subcellular structures with higher three-dimensional resolution and contrast than conventional methods.

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Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
Scopus rating (2010): SJR 2.631 SNIP 1.161
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Bibliographical note
Contribution: organisation=sgn,FAC1=1
Portfolio EDEND: 2014-10-30
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Source-ID: 1211
Research output: Scientific - peer-review ⬹ Article
In this work we aim to combine a game platform with the concept of collaborative music synthesis. We use bio-inspired intelligence for developing a world - the Lake - where multiple tribes of artificial, autonomous agents live within, having survival as their ultimate goal. The tribes exhibit primitive social swarm-based behavior and intelligence, which is used for taking actions that will potentially allow to dominate the game world. Tribes’ populations also demonstrate a number of physical properties that re-strict their ability to act illimitably. Multiuser interventions employed in parallel, affecting the automated decisions and the physical parameters of the tribes, thus infusing the gaming orientation of the application context. Finally, sound synthesis is achieved through a complex mapping scheme established between the events occurring in the Lake and the rhythmic, harmonic and dynamic-range parameters of an advanced, collaborative sound composition engine. This complex mapping scheme allows the production of interesting and complicated sonic patterns that fol-low the performance evolution in both objective and conceptual levels. The overall synthesis process is controlled by the conductor, a virtual entity that determines the synthesis evolution in a way that is very similar to directing an ensemble performance in real world.

The human facial activity consists of voluntary and spontaneous behavior that can be measured to provide valuable information for several application domains. The objective of this thesis is to introduce a new, capacitive measurement method for the task. The motivation to develop a new method was to avoid some of the drawbacks that existing methods have. The existing ones that have been used to measure activity from the entire face are electromyography (EMG) that measures the electric activity of the facial muscles and image-based methods that use machine vision. EMG has drawbacks due to its requirement to attach electrodes to the face, whereas vision-based methods rely on using cameras and heavy computational processing to collect information about the facial behaviour. The presented capacitive method does not require physical contact to the face, the computational requirements of the needed signal processing are low, and it can be used in mobile applications because the measurement can be integrated to head-mounted devices. The thesis includes several studies where prototypes were constructed, experiments carried out, signal and data processing methods applied, and results analysed. The method was first applied as a way to detect facial movements for human–computer interaction. It was integrated with a gaze tracker to point targets on a computer screen with the gaze and click with facial movements. Later, the method was extended from the detection of single facial movements to be feasible in the detection and classification of movements and expressions of the entire face. It was also applied to the measurement of the activation intensities of certain facial muscles. The results of the thesis show that the new measurement method detects facial movements with a good performance. Pointing and clicking also performs well when the detection method is combined with gaze tracking. The classification of facial movements performs very well with the ones included in the experiments of the thesis, and the classification can be expected to work also with more complex facial expressions. Further, the measurement method’s performance in determining the intensities of facial muscle activations was good for ones that have a wide movement range. Finally, the thesis also states the limitations of the new measurement method and includes suggestions to overcome them and to develop the method further.
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.

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Authors: Zhu, S., Zeng, B., Gabbouj, M.
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