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.
Automatic Bird Identification for Offshore Wind Farms: A Case Study for Deep Learning

An automatic bird identification system is required provided by the radar and information extracted from digital for offshore wind farms in Finland. Indubitably, a radar is obvious choice to detect birds but actual identification requires external information such as digital images. The final bird species identification is based on a fusion of radar data and image data. We applied deep learning method for image classification and we developed a data expansion technique for the training data. We present classification results for the image classifier based on small convolutional neural network.

Capacitive Facial Activity Measurement: Online Detection of Facial Expressions

Gaussian flow sigma point filter for nonlinear Gaussian state-space models

We propose a deterministic recursive algorithm for approximate Bayesian filtering. The proposed filter uses a function referred to as the approximate Gaussian flow transformation that transforms a Gaussian prior random variable into an approximate posterior random variable. Given a Gaussian filter prediction distribution, the succeeding filter prediction is approximated as Gaussian by applying sigma point moment-matching to the composition of the Gaussian flow transformation and the state transition function. This requires linearising the measurement model at each sigma point, solving the linearised models analytically, and introducing the measurement information gradually to improve the linearisation points progressively. Computer simulations show that the proposed method can provide higher accuracy and better posterior covariance matrix approximation than some state-of-the art computationally light approximative filters when the measurement model function is nonlinear but differentiable and the noises are additive and Gaussian. We also present a highly nonlinear scenario where the proposed filter occasionally diverges. In the accuracy-computational complexity axis the proposed algorithm is between Kalman filter extensions and Monte Carlo methods.
Monocular vision-based range estimation supported by proprioceptive motion

This paper describes an approach for fusion of monocular vision measurements, camera motion, odometer and inertial rate sensor measurements. The motion of the camera between successive images generates a baseline for range computations by triangulation. The recursive estimation algorithm is based on extended Kalman filtering. The depth estimation accuracy is strongly affected by the mutual observer and feature point geometry, measurement accuracy of observer motion parameters and line of sight to a feature point. The simulation study investigates how the estimation accuracy is affected by the following parameters: linear and angular velocity measurement errors, camera noise, and observer path. These results impose requirements to the instrumentation and observation scenarios. It was found that under favorable conditions the error in distance estimation does not exceed 2% of the distance to a feature point.

Suppressing Functional Electrical Stimulation Artifact from Facial Surface EMG Measurements

Methods for suppressing the electrical artifact that functional electrical stimulation introduces to surface electromyography (EMG) measurements are demonstrated. The methods are targeted for facial pacing for people who suffer from unilateral facial paralysis. The pacing includes the measurement of EMG signals from the healthy side of the face as a control signal to simultaneously activate the paralysed side with functional electrical stimulation.
Facial EMG signals typically have amplitudes up to a few hundreds of microvolts. The activation of facial muscles with functional electrical stimulation may require stimulation voltages that are more than 10^6 times larger. When electrical stimulation is fed to the paralysed one side of the face, the introduced voltage will also couple to the EMG measurements on the healthy side. This coupling is called the stimulation artifact. In the worst case, the EMG measurement inputs will saturate leaving it impossible to correctly detect facial muscle activations and their activation intensities. Additionally, the stimulation artifact may be erroneously detected as a muscle activation.

The presented methods for suppressing the stimulation artifact from EMG measurements include filtering implemented in the hardware and software, manipulating the stimulation waveform to help removing it with filtering, and sample-and-hold functionality implemented in the hardware of the EMG signal measurement chain to prevent amplifier saturation and to allow faster recovery from the artifacts. The methods are demonstrated with experimental results.

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ASJC Scopus subject areas: Biomedical Engineering
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Improved image quality in fast inpainting with omnidirectional filling

Image inpainting is an active research field of image processing. Previous inpainting methods often require a long computational time to give sufficient results, especially due to the extensive search process of exemplar-based methods. This work improves a previous fast inpainting method based on local similarity, which achieves runtimes measured in tens of milliseconds per image, but often results in unacceptable artifacts. We improve the resulting image quality by allowing pixels to be filled at any angle, determining the angle based only on the vicinity of the target region, and cross-fading between source pixels from opposite sides of the target region. The proposed method is shown to eliminate the two drawbacks, while retaining a fast runtime.

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Authors: Hirvola, O., Viitanen, T., Sintunata, V., Aoki, T.
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Automatic objective thresholding to detect neuronal action potentials

In this paper, we introduce a fully objective method to set thresholds (THs) for neuronal action potential spike detection from extracellular field potential signals. Although several more sophisticated methods exist, thresholding is still the most used spike detection method. In general, it is employed by setting a TH as per convention or operator decision, and without considering either the undetected or spurious spikes. Here, we demonstrate with both simulations and real microelectrode measurement data that our method can fully automatically and objectively yield THs comparable to those set by an expert operator. A Matlab function implementation of the method is described, and provided freely in Matlab Central File Exchange.

**General information**
State: Published
A survey on the feasibility of surface EMG in facial pacing

A survey on the feasibility of surface electromyography (EMG) measurements in facial pacing is presented. Pacing for unilateral facial paralysis consists of the measurement of activity from the healthy side of the face and functional electrical stimulation to reanimate the paralyzed one. The goal of this study is to evaluate the feasibility of surface EMG as a measurement method to detect muscle activations and to determine their intensities. Prior work is discussed, and results from experiments where 12 participants carried out a set of facial movements are presented. EMG was registered from zygomaticus major (smile), orbicularis oris (lip pucker), orbicularis oculi (eye blink), corrugator supercilii (frown), and masseter (chew). Most important facial functions that are limited due to the paralysis are blinking, smiling, and puckering. With majority of the participants, crosstalk between the measured EMG channels was found to be acceptably small to be able to pace smiling and puckering based on detecting their contraction intensities from the healthy side. However, pacing blinking based on orbicularis oculi EMG measurement does not seem possible due to crosstalk from other muscles, but the electro-oculographic (EOG) signals that couple to the same measurement channel could help to detect eye blinks and trigger stimuli. Furthermore, masseter greatly disturbs EMG measurement of most facial muscles, which needs to be addressed in the pacing system to avoid falsely interpreting its activity as the activity of another muscle.

General information

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Authors: Rantanen, V., Ilves, M., Vehkaoja, A., Kontunen, A., Lylykangas, J., Mäkelä, E., Rautiainen, M., Surakka, V., Lekkala, J.
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Research output: Scientific - peer-review >> Conference contribution
An efficient indoor positioning particle filter using a floor-plan based proposal distribution

We present a novel floor-plan and PDR (pedestrian dead reckoning) based proposal distribution for indoor positioning particle filtering. Including floor-plan information in the proposal distribution makes the particle filtering more efficient than using the map only in the measurement model, because the proposal distribution becomes more accurate and the measurement model less accurate. The method uses offline-computed distances from each point of a regular grid to the closest wall in each direction. Our simulations show that the novel proposal distribution combined with a floor-plan and PDR based motion model improves the positioning accuracy with small numbers of particles and noisy PDR compared to the particle filters that use the floor-plan only for particle weighting.

Cramér-Rao Lower Bound for Linear Filtering with t-Distributed Measurement Noise

The Cramér-Rao lower bound (CRLB) on the achievable mean square error (MSE) can be used to evaluate approximate estimation algorithms. For linear filtering problems with non-Gaussian noises, the CRLB can be easily computed using the Kalman filter state covariance recursion with the Fisher information in place of the noise covariance term. This work studies a linear filtering problem with t-distributed measurement noise. It is found that for a t distribution with heavy tails, the CRLB significantly underestimates the optimal MSE, the Kalman filter has significantly larger MSE, and a computationally light variational-Bayes algorithm achieves nearly optimal MSE.

Statistical Trilateration with Skew-t Distributed Errors in LTE Networks

Localization accuracy of trilateration methods in Long Term Evolution (LTE) cellular networks, which are based on time-of-arrival (ToA), may be highly degraded due to multipath and non-line-of-sight (NLoS) conditions in urban and indoor environments.
environments. Multipath mitigation techniques usually involve a high computational burden and require wideband signals to be effective, which limit their adoption in certain low-cost and low-power mobile applications using narrow-band signals. As an alternative to these conventional techniques, this paper analyzes an Expectation Maximization (EM) localization algorithm that considers the skewness introduced by multipath in the LTE ranging error distribution. The EM algorithm is extensively studied with realistic emulated LTE signals of 1.4 MHz bandwidth. The EM method is compared to a standard Nonlinear Least Squares (NLS) algorithm under ideal simulated conditions and using realistic outdoor measurements from a laboratory testbed. The EM method outperforms the NLS method when the ranging errors in the training and test stages have similar distributions.

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Authors: Müller, P., del Peral-Rosado, J. A., Piche, R., Seco-Granados, G.
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**Graph-Based Map Matching for Indoor Positioning**
This article presents a probabilistic motion model that is based on an economical graph-based indoor map representation, such that the motion of the user is constrained according to the floor plan of a building. The floor plan is modeled as a combination of links and open space polygons that are connected by nodes. In the authors' earlier work the link transition probabilities in this graph are proportional to the total link lengths that are the total lengths of the subgraphs accessible by choosing the considered link option, and this article extends this model to include open space polygons as well. A particle filter using the extended motion model in which all particles are constrained according to the map structure is presented. Furthermore, wireless local area network and Bluetooth Low Energy positioning tests show that the proposed algorithm outperforms comparison methods especially if the measurement rate is low.

**General information**
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Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: Wireless Communications and Positioning, Department of Automation Science and Engineering, Research area: Dynamic Systems, Department of Mathematics, Research group: MAT Positioning,
Model structure selection for sparse predictive coding utilizing warped views

The color image encoding of one view, conditional on the other view, makes use of the disparity image for computing a warped partial approximation, to be used for sparse predictive coding. Different estimates of the disparity image, produced by different stereo matching algorithms, will result in different final codelength values for the conditional coding of the color image. In here we study how the ranking of stereo matching algorithms based on the predictive coding codelength, which does not need the knowledge of the ground-truth disparity, relates to the other rankings of the stereo matching algorithms, that require the availability of the ground truth disparity. We show that the two information-theoretic variables introduced herein correlate well with the most used quantity for stereo matching ranking.

CytoSpectre: A tool for spectral analysis of oriented structures on cellular and subcellular levels

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.
A NLOS-robust TOA positioning filter based on a skew-t measurement noise model

A skew-t variational Bayes filter (STVBF) is applied to indoor positioning with time-of-arrival (TOA) based distance measurements and pedestrian dead reckoning (PDR). The proposed filter accommodates large positive outliers caused by occasional non-line-of-sight (NLOS) conditions by using a skew-t model of measurement errors. Real-data tests using the fusion of inertial sensors based PDR and ultra-wideband based TOA ranging show that the STVBF clearly outperforms the extended Kalman filter (EKF) in positioning accuracy with the computational complexity about three times that of the EKF.

Noncontact Respiration Monitoring during Sleep with Microwave Doppler Radar

This paper demonstrates the measurement of respiration waveform during sleep with a noncontact radar sensor. Instead of measuring only the respiration rate, the methods that allow monitoring the absolute respiration displacement were studied. Absolute respiration displacement can in theory be measured with a quadrature microwave Doppler radar sensor and using the nonlinear demodulation as the channel combining method. However, in this paper, relative respiration displacement measures were used as a reference. This is the first time that longer data sets have been analyzed successfully with the nonlinear demodulation method. This paper consists of whole-night recordings of three patients in an
uncontrolled environment. The reference respiration data were obtained from a full polysomnography recorded simultaneously. The feasibility of the nonlinear demodulation in a real-life setting has been unclear. However, this paper shows that it is successful most of the time. The coverage of successfully demodulated radar data was ~ 58 %-78%. The use of the nonlinear demodulation is not possible in the following cases: 1) if the chest wall displacement is too small compared with the wavelength of the radar; 2) if the radar data do not form an arc-like shape in the $IQ$-plot; or 3) if there are large movement artifacts present in the data. Both in academic literature and in commercial radar devices, the data are processed based on the presumption that it forms either an arc or a line in the IQ-plot. Our measurements show that the presumption is not always valid.

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Authors: Zakrzewski, M., Vehkaoja, A., Joutsen, A. S., Palovuori, K. T., Vanhala, J. J.

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- Scopus rating (2010): SJR 0.533 SNIP 1.077
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- Scopus rating (2007): SJR 0.785 SNIP 1.484
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Research output: Scientific - peer-review › Article

**Gaussian filtering and variational approximations for Bayesian smoothing in continuous-discrete stochastic dynamic systems**

The Bayesian smoothing equations are generally intractable for systems described by nonlinear stochastic differential equations and discrete-time measurements. Gaussian approximations are a computationally efficient way to approximate the true smoothing distribution. In this work, we present a comparison between two Gaussian approximation methods. The
Gaussian filtering based Gaussian smoother uses a Gaussian approximation for the filtering distribution to form an approximation for the smoothing distribution. The variational Gaussian smoother is based on minimizing the Kullback-Leibler divergence of the approximate smoothing distribution with respect to the true distribution. The results suggest that for highly nonlinear systems, the variational Gaussian smoother can be used to iteratively improve the Gaussian filtering based smoothing solution. We also present linearization and sigma-point methods to approximate the intractable Gaussian expectations in the variational Gaussian smoothing equations. In addition, we extend the variational Gaussian smoother for certain class of systems with singular diffusion matrix.
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.
Open Cloud-Based PaaS Architecture for Service-Oriented Mobile Robots

Open-source software frameworks such as Apache Hadoop and Robot Operating System (ROS) are helping researchers to reduce arduous engineering work releasing them to concentrate more on the core research. The impact of extensive knowledge repositories of robot operating system interconnected with a large distributed data storage framework entails enormous developmental step in the future robotic systems era. Hadoop and ROS integrate the key frameworks presented in this paper to obtain the open source architecture. The main subject of research, an approach to apply service-oriented robotic (SOR) cloud enabling PaaS (Platform-as-a-Service) mobile multi-robot architecture, is presented. Moreover, the focus is based on cloud-communicating service robots with lightweight workload requirements for the purpose of offloading heavy computation into a cloud. In an integrated experiment, the Ubuntu Linux environment is experimented after installing Hadoop cloud computing platform and ROS.

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A comparison of five optical surface topography measurement methods
The results of optical surface topography measurement techniques have been questioned in the past because of possible measurement artifacts due to light penetration into the paper. We compared the topography measurement results from five optical techniques: laser profilometry, shape-from-focus, stripe projection, chromatic sensing, and photometric stereo. These techniques were tested on coated and uncoated papers with a PPS roughness range from 0.7 μm to 7.7 μm. We made the measurement results directly comparable by measuring exactly the same regions on the paper samples and registering the resulting topography maps. We then calculated the point-wise Pearson correlation between the maps at different wavelength bands to obtain quantitative values for the similarity of the measurement results at different structure sizes. The correspondences between the measured topography maps were also examined through multivariate linear regression and roughness indices evaluated at two different structure sizes. For rougher grades like office paper or sack paper, the topography measurements from the five measurement techniques showed corresponding results. For a moderately smooth lightweight coated (LWC) paper, the measured topographies agreed to some degree, and for smooth supercalendered (SC) and woodfree coated (WFC) papers, the agreement was poor. From the available data, it is impossible to tell which of the measurement techniques delivers the true surface topography of smooth papers.

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Authors: Mettänen, M., Hirn, U.
Adaptive autoregressive model for reduction of noise in SPECT

This paper presents improved autoregressive modelling (AR) to reduce noise in SPECT images. An AR filter was applied to prefilter projection images and postfilter ordered subset expectation maximisation (OSEM) reconstruction images (AR-OSEM-AR method). The performance of this method was compared with filtered back projection (FBP) preceded by Butterworth filtering (BW-FBP method) and the OSEM reconstruction method followed by Butterworth filtering (OSEM-BW method). A mathematical cylinder phantom was used for the study. It consisted of hot and cold objects. The tests were performed using three simulated SPECT datasets. Image quality was assessed by means of the percentage contrast resolution (CR%) and the full width at half maximum (FWHM) of the line spread functions of the cylinders. The BW-FBP method showed the highest CR% values and the AR-OSEM-AR method gave the lowest CR% values for cold stacks. In the analysis of hot stacks, the BW-FBP method had higher CR% values than the OSEM-BW method. The BW-FBP method exhibited the lowest FWHM values for cold stacks and the AR-OSEM-AR method for hot stacks. In conclusion, the AR-OSEM-AR method is a feasible way to remove noise from SPECT images. It has good spatial resolution for hot objects.

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Organisations: Department of Automation Science and Engineering, Division of Nuclear Medicine, Department of Diagnostic Radiology, Oulu University Hospital, Department of Clinical Physiology and Nuclear Medicine, Joint Authority
Biodegradable passive resonance sensor: Fabrication and initial testing

Biodegradable resonance circuits were studied. The circuits have a novel two-layer resonator structure without galvanic through hole vias. A patterned magnesium layers were evaporated on biodegradable PLA sheets by using a 3D printed mask. The circuits were assembled by heat sealing two magnesium patterned sheets together to encapsulate the circuit structure. An inductive link is used to wirelessly detect the resonance frequency of the circuit. The circuits were tested when immersed in de-ionised water and saline. According to the tests, the designed resonator structure can be measured in aqueous environment. The resonance of the tested circuit was observable at least for 51 hours. The concept still needs more development to extend degradation time and to increase the stability during immersion.
Distant speech separation using predicted time-frequency masks from spatial features

Speech separation algorithms are faced with a difficult task of producing high degree of separation without containing unwanted artifacts. The time-frequency (T-F) masking technique applies a real-valued (or binary) mask on top of the signal's spectrum to filter out unwanted components. The practical difficulty lies in the mask estimation. Often, using efficient masks engineered for separation performance leads to presence of unwanted musical noise artifacts in the separated signal. This lowers the perceptual quality and intelligibility of the output. Microphone arrays have been long studied for processing of distant speech. This work uses a feed-forward neural network for mapping microphone array's spatial features into a T-F mask. Wiener filter is used as a desired mask for training the neural network using speech examples in simulated setting. The T-F masks predicted by the neural network are combined to obtain an enhanced separation mask that exploits the information regarding interference between all sources. The final mask is applied to the delay-and-sum beamformer (DSB) output. The algorithm's objective separation capability in conjunction with the separated speech intelligibility is tested with recorded speech from distant talkers in two rooms from two distances. The results show improvement in instrumental measure for intelligibility and frequency-weighted SNR over complex-valued non-negative matrix factorization (CNMF) source separation approach, spatial sound source separation, and conventional beamforming methods such as the DSB and minimum variance distortionless response (MVDR).
Effects of sensor type and sensor location on signal quality in bed mounted ballistocardiographic heart rate and respiration monitoring

Sleeping is a crucial part of our circadian rhythm and the quality of sleep has substantial impact on the quality of life in general and the overall well-being of a person. That is why sleep related physiological measurements have been in the focus of many scientific studies along the years, and why a large number of different measurement methods have been developed for this purpose. The ability to monitor heart rate respiration without any sensors or electrodes being directly attached to the body is extremely useful especially in long-term monitoring and it allows automated daily measurements without any medical staff present. This is the reason why ballistocardiographic force sensors and accelerometers have been introduced alongside electrocardiography (ECG) and thermistors or respiration belts as a means to monitor the heart rate and respiration during sleep. While ECG remains as the most reliable and accurate method for heart rate monitoring, the development of unobtrusive monitoring methods has improved to the point where the commercialization of such sleep monitoring systems has been possible. In this paper, the signals of five sensors and sensor placement combinations for measuring physiological parameters from a sleeping person are evaluated and compared in terms of their measurement sensitivities and waveform quality. The sensors are accelerometer and film type force sensors made of PVDF and EMFi material placed under the mattress topper and PVDF and EMFi sensors placed under the bed posts.

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Effects of Sensor Type and Sensor Location on Signal Quality in Bed Mounted Ballistocardiographic Heart Rate and Respiration Monitoring

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Research output: Scientific › Article

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.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Research area: Dynamic Systems, Research group: Wireless Communications and Positioning, Department of Mathematics, Research group: MAT Positioning, Research
Navigation Algorithm Combining Building Plans With Autonomous Sensor Data

This paper presents an approach to navigation system’s position and heading correction using building floor plans. The algorithm includes three steps: (a) autonomous sensors data processing to obtain position and heading, (b) map-matching correction, and (c) navigation system errors estimation. A particle filter is used to incorporate the building plan information and a Kalman filter estimates the dead reckoning error states. This algorithm was designed for vehicle navigation systems operating inside buildings with known floor plans and can be adapted for implementation on real-time navigation systems using low-cost MEMS gyroscope and speed sensor as dead reckoning instruments. The real-world data collected from the vehicle indoor tests has shown that the proposed algorithm is able to correct significant errors in dead reckoning position and heading by applying the map constraints.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Computer engineering, Signal Processing Research Community (SPRC), Wireless Communications and Positioning (WICO), ITMO University
Authors: Davidson, P., Kirkko-Jaakkola, M., Collin, J., Takala, J.
Number of pages: 9
Pages: 188-196
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Gyroscopy and Navigation
Volume: 6
Issue number: 3
ISSN (Print): 2075-1087
Ratings:
Scopus rating (2016): CiteScore 0.99 SJR 0.27 SNIP 0.825
Scopus rating (2015): SJR 0.269 SNIP 1.206 CiteScore 0.93
Scopus rating (2014): SJR 0.279 SNIP 1.006 CiteScore 0.65
Scopus rating (2013): SJR 0.292 SNIP 0.65 CiteScore 0.44
Scopus rating (2012): SJR 0.248 SNIP 0.366 CiteScore 0.34
Scopus rating (2011): SJR 0.163 SNIP 0.135 CiteScore 0.12
Original language: English
DOIs:
10.1134/S2075108715030037
Novel Method For Online Stereo Self-Calibration

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Authors: Melin, J., Ritala, R.
Publication date: 2015

Host publication information
Title of host publication: XXI IMEKO World Congress "Measurements In Research and Industry"
ISBN (Print): 978-80-01-05793-3
Research output: Scientific - peer-review › Conference contribution

OpenCRP Ecosystem Demonstration Platform

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Pori Department, Research group: Telecommunication Research Centre
Authors: Oksa, P., Loula, P., Alapaholuoma, T.
Pages: 134-138
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Procedia Computer Science
Volume: 76
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.2015.12.323
Research output: Scientific - peer-review › Article

Photometric stereo system for detailed analysis of material surfaces
This paper describes a photometric stereo system for the measurement of surface topography. The system provides versatile experimental possibilities due to movable multicolor LEDs, movable camera, and a traveling (xy-)table for the sample. We introduce our measurement setup and present analysis of its performance. Our topography maps correlate well with the contact profilometry reference map, and reveal different details of the surfaces depending on the illumination wavelength and pixel size.

General information
State: Accepted/In press
Ministry of Education publication type: A4 Article in a conference publication
Authors: Mettänen, M., Melin, J., Ihlainen, H.
Number of pages: 6
Prediction of Outcome in Traumatic Brain Injury Patients Using Long-term qEEG Features

Treatment of patients suffering from severe traumatic brain injury (TBI) commonly involves sedation and mechanical ventilation during prolonged stay in the intensive care unit. Continuous EEG is often monitored in these patients to detect epileptic seizures. It has also been suggested that EEG has prognostic value regarding the outcome of the treatment. In this study the ability of 186 qEEG features to predict the outcome of the treatment of TBI patients is assessed. The features are based on the power spectrum of the EEG. The data underlying the study contains long term (over 24 h) recordings from 20 patients treated in the postoperative intensive care unit of the North Estonian Medical Center. 12 qEEG features were found to have predictive value when evaluated by calculating the area under the receiver operating curve constructed from feature probabilities.
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.
Transformation and Texture Based Features in Terrasar-X Data Classification for Environmental Monitoring

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 Community on Data-to-Decision (D2D)
Authors: Kumpumäki, T., Lipping, T.
Pages: 3278-3281
Publication date: 2015

Host publication information
Title of host publication: IGARSS 2015 IEEE International Geoscience & Remote Sensing Symposium, July 26-31, Milan, Italy
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Electronic): 978-1-4799-7928-8
DOIs: 10.1109/IGARSS.2015.7326518
Research output: Scientific - peer-review › Conference contribution

Wind-farm Visualization in Western Finland

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Pori Department, Research group: Data-analytics and Optimization, Research Community on Data-to-Decision (D2D)
Authors: Eteläaho, A., Kumpumäki, T., Turunen, J., Lipping, T., Nummela, A.
Pages: 91-106
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Journal of Architectural and Planning Research
Volume: 32
Issue number: 2
ISSN (Print): 0738-0895
Ratings:
Scopus rating (2016): SJR 0.189 SNIP 0.595 CiteScore 0.33
Scopus rating (2015): SJR 0.316 SNIP 0.869 CiteScore 0.45
Scopus rating (2014): SJR 0.27 SNIP 0.691 CiteScore 0.41
Scopus rating (2013): SJR 0.311 SNIP 0.553 CiteScore 0.33
Scopus rating (2012): SJR 0.208 SNIP 0.907 CiteScore 0.39
Scopus rating (2011): SJR 0.223 SNIP 0.887 CiteScore 0.29
Scopus rating (2010): SJR 0.246 SNIP 0.906
Scopus rating (2009): SJR 0.165 SNIP 1.581
Scopus rating (2008): SJR 0.179 SNIP 1.312
Scopus rating (2007): SJR 0.222 SNIP 0.639
Scopus rating (2006): SJR 0.123 SNIP 0.458
Scopus rating (2005): SJR 0.141 SNIP 0.178
Scopus rating (2004): SJR 0.176 SNIP 0.279
Scopus rating (2003): SJR 0.147 SNIP 1.079
Scopus rating (2002): SJR 0.115 SNIP 0.327
Scopus rating (2001): SJR 0.268 SNIP 1.293
Scopus rating (2000): SJR 0.243 SNIP 1.075
Scopus rating (1999): SJR 0.172 SNIP 0.911
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.
A combined DCT/DWT asymmetric multi-view video coding for real-time applications

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, Research group: Video
Authors: Belyaev, E., Georgiev, M., Egiazarian, K., Gabbouj, M.
Number of pages: 5
Pages: 1-5
Publication date: 2014

Host publication information
Title of host publication: Proceedings of the Eighth International Workshop on Video Processing and Quality Metrics for Consumer Electronics, VPQM-2014, January 30-31, 2014, Chandler, Arizona, USA
Place of publication: Chandler, Arizona, USA
Links:
http://www.vpqm.org/

Bibliographical note
Contribution: organisation=sgn,FACT1=1<br/>Portfolio EDEND: 2014-12-30
Source: researchoutputwizard
Source-ID: 160
Research output: Scientific - peer-review › Conference contribution

Adaptive mobile tracking in unknown non-line-of-sight conditions with application to digital TV networks

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Chen, L., Piche, R., Kuusniemi, H., Chen, R.
Number of pages: 10
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Eurasip Journal on Advances in Signal Processing
Volume: 2014
Article number: UNSP 22
ISSN (Print): 1687-6172
Ratings:
Scopus rating (2016): SJR 0.313 SNIP 0.78 CiteScore 1.21
Scopus rating (2015): SJR 0.279 SNIP 0.592 CiteScore 0.83
Scopus rating (2014): SJR 0.229 SNIP 0.54 CiteScore 0.7
Scopus rating (2013): SJR 0.267 SNIP 0.506 CiteScore 0.63
Scopus rating (2012): SJR 0.278 SNIP 0.582 CiteScore 0.72
Scopus rating (2011): SJR 0.371 SNIP 0.724 CiteScore 0.91
Scopus rating (2010): SJR 0.403 SNIP 0.982
Scopus rating (2009): SJR 0.474 SNIP 0.823
Scopus rating (2008): SJR 0.468 SNIP 0.897
Scopus rating (2007): SJR 0.386 SNIP 0.913
Scopus rating (2006): SJR 0.362 SNIP 0.92
Scopus rating (2005): SJR 0.519 SNIP 0.968
Scopus rating (2004): SJR 0.603 SNIP 1.155
Scopus rating (2003): SJR 0.63 SNIP 1.023
Scopus rating (2002): SJR 0.14 SNIP 0.329
Adaptive Window Size Selection for Efficient Probability Estimation in Binary Range Coder of the 3-D DWT Video Codec

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing
Authors: Belyaev, E.
Number of pages: 9
Pages: 112-119
Publication date: 2014

Host publication information
Title of host publication: Multiple Access Communications, 7th International Workshop, MACOM 2014, Halmstad, Sweden, August 27-28, 2014, proceedings
Place of publication: Halmstad, Sweden
Publisher: Springer International Publishing
Editors: Jonsson, M., Vinel, A., Bellalta, B., Belyaev, E.
ISBN (Print): 978-3-319-10261-0
ISBN (Electronic): 978-3-319-10262-7

Publication series
Name: Lecture Notes in Computer Science
Volume: 8715
ISSN (Print): 0302-9743
DOIs:
10.1007/978-3-319-10262-7_11
Links:
http://www.macom.ws/

Bibliographical note
Contribution: organisation=ase,FACT1=1
Portfolio EDEND: 2014-05-25
Publisher name: Springer
Source: researchoutputwizard
Source-ID: 219
Research output: Scientific - peer-review » Article

Asymmetric Luminance Based Filtering for Stereoscopic Video Compression

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Research group: Video
Authors: Homayouni, M., Aflaki Beni, P., Hannuksela, M., Gabbouj, M.
Number of pages: 6
Pages: 1-6
Publication date: 2014

Host publication information
Title of host publication: IC3D 2014: International Conference on 3D Imaging, December 9-11, 2014, Liege, Belgium
Place of publication: Piscataway
Publisher: Institute of Electrical and Electronics Engineers IEEE

Bibliographical note
Contribution: organisation=sgn,FACT1=1
Portfolio EDEND: 2014-12-10
Publisher name: Springer International Publishing
Source: researchoutputwizard
Source-ID: 159
Research output: Scientific - peer-review » Conference contribution
Characterizing Porous Ceramics by Frequency-Response Method

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Department of Automation Science and Engineering, Engineering materials science and solutions (EMASS), Smart Energy Systems (SES)
Authors: Järveläinen, M., Salpavaara, T., Seppälä, S., Roinila, T., Yli-Hallila, T., Levänen, E., Vilkko, M.
Number of pages: 6
Pages: 10012-10017
Publication date: 2014

Host publication information
Title of host publication: Proceedings of 19th IFAC World Congress, Cape Town, South Africa, August 24-29, 2014
Publisher: International Federation of Automatic Control
Editors: Boje, E., Xia, X.
ISBN (Print): 978-3-902823-62-5

Publication series
Name: IFAC papers online
Publisher: International Federation of Automatic Control
Volume: 19
No.: 1
ISSN (Print): 1474-6670
DOIs:
10.3182/20140824-6-ZA-1003.02423

Bibliographical note
Contribution: organisation=sgn,FACT1=1<br/>Portfolio EDEND: 2015-01-19
Source: researchoutputwizard
Source-ID: 496
Research output: Scientific - peer-review › Conference contribution

Depth-aware 3D video filtering targeting multiview video plus depth compression

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: Aflaki, P., Hannuksela, M., Homayouni, M., Gabbouj, M.
Number of pages: 4
Pages: 1-4
Publication date: 2014

Host publication information
Title of host publication: 3DTV-Conference: The True Vision - Capture, Transmission and Display of 3D Video (3DTV-CON), Budapest, Hungary, 2-4 July 2014
Publisher: IEEE
ISBN (Print): 978-1-4799-4758-4
DOIs:
10.1109/3DTV.2014.6874712

Bibliographical note
Contribution: organisation=mol,FACT1=0.5<br/>Contribution: organisation=ase,FACT2=0.5<br/>Portfolio EDEND: 2014-12-29
Source: researchoutputwizard
Source-ID: 582
Research output: Scientific - peer-review › Conference contribution
Indirect Estimation of Signal-Dependent Noise With Nonadaptive Heterogeneous Samples

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Research group: Signal and Image Restoration-RST, Department of Signal Processing, Signal Processing Research Community (SPRC)
Authors: Azzari, L., Foi, A.
Number of pages: 9
Pages: 3459-3467
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Image Processing
Volume: 23
Issue number: 8
ISSN (Print): 1057-7149
Ratings:
Scopus rating (2016): CiteScore 6.73 SJR 2.102 SNIP 3.318
Scopus rating (2015): SJR 2.1 SNIP 3.886 CiteScore 6.36
Scopus rating (2014): SJR 1.553 SNIP 4.347 CiteScore 5.81
Scopus rating (2013): SJR 1.67 SNIP 4.537 CiteScore 6.14
Scopus rating (2012): SJR 1.698 SNIP 4.694 CiteScore 5.58
Scopus rating (2011): SJR 1.735 SNIP 3.983 CiteScore 5.04
Scopus rating (2010): SJR 1.939 SNIP 4.18
Scopus rating (2009): SJR 2.299 SNIP 4.318
Scopus rating (2008): SJR 2.179 SNIP 3.856
Scopus rating (2007): SJR 2.685 SNIP 4.622
Scopus rating (2006): SJR 2.224 SNIP 4.503
Scopus rating (2005): SJR 2.092 SNIP 5.444
Scopus rating (2004): SJR 1.506 SNIP 4.644
Scopus rating (2003): SJR 3.619 SNIP 5.34
Scopus rating (2002): SJR 2.94 SNIP 4.236
Scopus rating (2001): SJR 2.419 SNIP 3.581
Scopus rating (2000): SJR 1.371 SNIP 2.563
Scopus rating (1999): SJR 1.17 SNIP 2.011
Original language: English
DOIs:
10.1109/TIP.2014.2321504

Bibliographical note
Contribution: organisation=sgn,FACT1=1<br/>Portfolio EDEND: 2014-09-18<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 130
Research output: Scientific - peer-review › Article

Joint Depth and Texture Filtering Targeting MVD Compression

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)
Live Video Streaming in Vehicular Networks

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing
Authors: Vinel, A., Belyaev, E., Bellalta, B., Hu, H.
Number of pages: 7
Pages: 156-162
Publication date: 2014

Host publication information
Title of host publication: Communication Technologies for Vehicles, 6th International Workshop, Nets4Cars/Nets4Trains/Nets4Aircraft 2014, Offenburg, Germany, May 6-7, 2014. Proceedings
Publisher: Springer
Editors: Sikora, A., Berbineau, M., Vinel, A., Jonsson, M., Pirovano, A., Aguado, M.
ISBN (Print): 978-3-319-06643-1
ISBN (Electronic): 978-3-319-06644-8

Publication series
Name: Lecture Notes in Computer Science
Publisher: Springer
Methods for Rapid Frequency-Domain Characterization of Leakage Currents in Silicon Nanowire-Based Field-Effect Transistors

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE), Smart Energy Systems (SES)
Authors: Roinila, T., Yu, X., Verho, J., Li, T., Kallio, P., Vilkko, M., Gao, A., Wang, Y.
Number of pages: 9
Pages: 964-972
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Beilstein Journal of Nanotechnology
Volume: 5
ISSN (Print): 2190-4286
Ratings:
Scopus rating (2016): SJR 1.065 SNIP 0.986 CiteScore 2.86
Scopus rating (2015): SJR 0.958 SNIP 0.952 CiteScore 3.05
Scopus rating (2014): SJR 1.162 SNIP 1.078 CiteScore 2.67
Scopus rating (2013): SJR 1.27 SNIP 1.069 CiteScore 2.56
Scopus rating (2012): SJR 1.04 SNIP 1.045 CiteScore 2.01
Scopus rating (2011): SJR 0.399 SNIP 0.469
Original language: English
DOIs:
10.3762/bjnano.5.110

Bibliographical note
Contribution: organisation=ase,FACT1=1
Portfolio EDEND: 2014-12-20
Publisher name: Beilstein - Institut zur Foerderung der Chemischen Wissenschaften
Source: researchoutputwizard
Source-ID: 1398
Research output: Scientific - peer-review › Article


General information
State: Published
Ministry of Education publication type: C2 Edited books
Organisations: Department of Signal Processing
Number of pages: 137
Publication date: 2014

Publication information
Place of publication: Halmstad, Sweden
Publisher: Springer International Publishing
ISBN (Print): 978-3-319-10261-0
Online fault detection of industrial processes by applying pseudo-random sequences

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Smart Energy Systems (SES)
Authors: Roinila, T., Huovinen, M., Vilkko, M.
Number of pages: 16
Pages: 495-510
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: International Journal of Industrial and Systems Engineering
Volume: 17
Issue number: 4
ISSN (Print): 1748-5037
Ratings:
Scopus rating (2016): SJR 0.317 SNIP 0.489 CiteScore 0.63
Scopus rating (2015): SJR 0.409 SNIP 0.665 CiteScore 1.01
Scopus rating (2014): SJR 0.492 SNIP 1.042 CiteScore 1.62
Scopus rating (2013): SJR 0.404 SNIP 0.669 CiteScore 1.25
Scopus rating (2012): SJR 0.313 SNIP 0.609 CiteScore 1.12
Scopus rating (2011): SJR 0.425 SNIP 1.022 CiteScore 1.65
Scopus rating (2010): SJR 0.403 SNIP 0.874
Scopus rating (2009): SJR 0.432 SNIP 0.774
Scopus rating (2008): SJR 0.276 SNIP 0.267
Scopus rating (2007): SJR 0.15 SNIP 0.344
Original language: English

Bibliographical note
Contribution: organisation=sgn,FAC1=1<br/>Portfolio EDEND: 2014-12-30
Source: researchoutputwizard
Source-ID: 608
Research output: Scientific - peer-review › Anthology

Online Grid Impedance Measurement Using Discrete-Interval Binary Sequence Injection

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Smart Energy Systems (SES)
Authors: Roinila, T., Vilkko, M., Sun, J.
Number of pages: 9
Rhythm-based Accuracy Improvement of Heart Beat Detection Algorithms

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing
Authors: Gilian, Z., Kovacs, P., Samiee, K.
Number of pages: 3
Pages: 269-272
Publication date: 2014

Host publication information
Title of host publication: Computing in Cardiology - 41st Annual Conference, September 7-10, 2014, Boston, Massachusetts, USA
Place of publication: Boston, Massachusetts
Publisher: Computing in Cardiology
ISBN (Print): 978-1-4799-4346-3
ISBN (Electronic): 978-1-4799-4347-0
Links:

Bibliographical note
Contribution: organisation=sgn,FACT1=1
Portfolio EDEND: 2014-12-30
Source: researchoutputwizard
Source-ID: 347
Research output: Scientific - peer-review › Conference contribution

Row-Interleaved Sampling for Stereoscopic Video Coding Targeting Polarized Displays

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: Aflaki Beni, P., Homayouni, M., Hannuksela, M. M., Gabbouj, M.
Number of pages: 5
Pages: 1-5
Publication date: 2014

Host publication information
Title of host publication: IC3D 2014: International Conference on 3D Imaging, 9-11 December, 2014, Liege, Belgium
Unconstrained Night-Time Heart Rate Monitoring with Capacitive Electrodes

**General information**
State: Published

Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Vehkaoja, A., Salo, A., Peltokangas, M., Verho, J., Salpavaara, T., Lekkala, J.
Number of pages: 4
Pages: 1511-1514
Publication date: 2014

**Host publication information**
Title of host publication: XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013, MEDICON 2013, 25 - 28 September 2013, Seville, Spain. IFMB Proceedings Volume 41
Place of publication: Berlin
Publisher: Springer
Editor: Roa Romero, L. M.
ISBN (Print): 978-3-319-00845-5
ISBN (Electronic): 978-3-319-00846-2

**Publication series**
Name: IFMBE Proceedings
ISSN (Print): 1680-0737
ASJC Scopus subject areas: Biomedical Engineering

A linear state model for PDR+WLAN positioning
Indoor positioning based on WLAN signals is often enhanced using pedestrian dead reckoning (PDR) based on an inertial measurement unit. The state evolution model in PDR is usually nonlinear. We present a new linear state evolution model for PDR. In simulated-data and real-data tests of tightly coupled WLAN-PDR positioning, we find that the positioning accuracy with this linear model is almost as good as with traditional models when the initial state is known, and better when the initial state is not known. The proposed method is computationally light and is also suitable for smoothing.

**General information**
State: Published

Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: MAT Positioning, Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Raitoharju, M., Nurminen, H., Piche, R.
Number of pages: 6
Pages: 113-118
Publication date: 2013
Bandwidth and Storage Reduction of Radio Maps for Offline WLAN Positioning

Most of the existing mobile device positioning methods require data connectivity, i.e. they work in the mobile-assisted, or online mode. However, this consumes energy, induces transmission costs and results in unnecessarily long time-to-first-fix. These issues can be alleviated using mobile-based, or offline, mode. In this mode the device carries a subset of the global radio map in memory for fast positioning without data connection. The challenge of this approach is the large size of the offline radio map that needs to be downloaded, stored and updated periodically in the mobile device. This paper presents a method to find the significant APs in the global radio map and proposes using only those in offline positioning in order to compress the size of the required offline radio map. We also propose a method to further compress the size of the offline radio map by hashing the globally unique AP BSSIDs into locally unique shortened BSSIDs. We test the proposed methods with real-world data.
Device self-calibration in location systems using signal strength histograms

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Research group: Positioning, Wireless Communications and Positioning (WICO)
Authors: Laoudias, C., Piche, R., Panayiotou, C. G.
Number of pages: 17
Pages: 165-181
Publication date: 2013
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Location Based Services
Volume: 7
Issue number: 3
ISSN (Print): 1748-9725
Ratings:
Scopus rating (2016): SJR 0.307 SNIP 0.78 CiteScore 1.2
Scopus rating (2015): SJR 0.253 SNIP 0.631 CiteScore 1.14
Scopus rating (2014): SJR 0.231 SNIP 1.382 CiteScore 1.4
Scopus rating (2013): SJR 0.395 SNIP 0.98 CiteScore 0.96
Scopus rating (2012): SJR 0.355 SNIP 0.968 CiteScore 0.96
Scopus rating (2011): SJR 0.283 SNIP 1.155 CiteScore 0.85
Scopus rating (2010): SJR 0.365 SNIP 1.488
Scopus rating (2009): SJR 0.151 SNIP 1.064
Original language: English
Electronic versions:
Laoudias self-calibration JLBS
DOIs:
10.1080/17489725.2013.816792
Links:
http://urn.fi/URN:NBN:fi: tty-201603173649

**Bibliographical note**
Contribution: organisation=ase, FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: Taylor & Francis
Source: researchoutputwizard
Source-ID: 2723
Research output: Scientific - peer-review › Article

**Particle filter and smoother for indoor localization**
We present a real-time particle filter for 2D and 3D hybrid indoor positioning. It uses wireless local area network (WLAN) based position measurements, step and turn detection from a hand-held inertial sensor unit, floor plan restrictions, altitude change measurements from barometer and possibly other measurements such as occasional GNSS fixes. We also present a particle smoother, which uses future measurements to improve the position estimate for non-real-time applications. A lightweight fallback filter is run in the background for initialization, divergence monitoring and possibly re-initialization. In real-data tests the particle filter is more accurate and consistent than the methods that do not use floor plans. An example is shown on how smoothing helps to improve the filter estimate. Moreover, a floor change case is presented, in which the filter is capable of detecting the floor change and improving the 2D accuracy using the floor change information.

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