2018 International Conference on Signal Processing and Information Security (ICSPIS 2018)

Dubai, United Arab Emirates
7 – 8 November 2018

IEEE Catalog Number: CFP18RPB-POD
ISBN: 978-1-5386-6582-4

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IEEE Catalog Number: CFP18RPB-POD
ISBN (Print-On-Demand): 978-1-5386-6582-4
ISBN (Online): 978-1-7281-0257-3

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Wednesday, November 7

Wednesday, November 7 9:00 - 9:30

OS: Opening Remarks

Room: Conference Room

Wednesday, November 7 9:30 - 10:00

KN1: Keynote Speech: Towards Secured IoT Systems

Prof. Magdy Bayoumi (University of Louisiana, USA)

Room: Conference Room

Abstract: Internet of Things (IoT) is one of the fastest-growing technologies across all aspects of our life. It has been projected that billions of devices will surround us and fundamentally alter the way we interact with our physical environment in countless applications such as healthcare, home automation, energy conservation, security, wearable computing, asset tracking, maintenance of public infrastructure, etc. IoT security however, remains to be the biggest concern and the biggest obstacle facing IoT application growth. While earlier research reports estimated that between 20 to 50 billion devices will be installed by 2020, security issues may hinder such expectation.

A research report by HP has shown that more than 70% of connected devices have significant security problems including personal information leaks, unencrypted connection use and lack of secure passwords. Another IoT security assessment effort was performed by Kaspersky lab and found vulnerabilities in critical applications such as SCADA (Supervisory control and data acquisition) systems and traffic controllers. More recently, IoT security weakness have been showing in news headlines when privacy issues have been identified in wearable fitness trackers and medical heart implants were recalled cybersecurity concerns. It is becoming clearer that IoT security is indeed the most important challenge hindering the IoT growth.

In this talk, an introduction to security issues/problems of the IoT is given. Security challenges at IoT layers are outlined. IoT security frameworks are discussed. A new framework that can categorize the devices and technologies of the IoT according to their security threats and security requirements is highlighted. Several case studies are discussed.

Wednesday, November 7 10:00 - 10:30

KN2: Keynote Speech: Big Data, AI and Imaging for the Development of Space and Digital Health Applications

Prof. Rami Qahwaji (University of Bradford, UK)

Room: Conference Room

Abstract: Space and health data are complex, big, multi-dimensional, multi-wavelength and could be challenging in terms of noise, completeness, consistency, etc. However, these datasets are very useful for extracting meaningful information and knowledge using AI, imaging and big data technologies, making it possible to develop different useful applications such as prediction, Modelling, visualisation, diagnostic, etc. This talk will present some of the interesting aspects of these datasets and our ongoing work to improve the quality of data processing, knowledge extraction and applications development.

Wednesday, November 7 10:30 - 11:00

CB: Coffee Break

Room: Conference Room

Wednesday, November 7 11:00 - 12:00

PD: Panel Discussion: The Impact of Research in Signal Processing and Information Security on the Knowledge Based Economy

Dr. Mohammed Al-Mualla, Dr. Bushra Al Blooshi, Bashar Kilani, Prof. Magdy Bayoumi, Prof. Rami Qahwaji, Prof. Konstantinos Markantonakis, Prof. Hussain Al Ahmad

Room: Conference Room

Chair: Hussain Al-Ahmad (University of Dubai, United Arab Emirates)

Wednesday, November 7 12:00 - 13:30

L: Lunch

Room: Conference Room

Wednesday, November 7 13:30 - 15:00

S1: Session 1

Room: Conference Room

Chair: Sabina Abdul Hadi (University of Dubai, United Arab Emirates)

Fractional Brownian Bridge Model for Alzheimer Disease Detection from EEG Signal

Martin Dlask (Czech Technical University in Prague, Czech Republic); Jaromir Kukal (Institute of Chemical Technology, Czech Republic); Pavel Sovka (Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic)

A number of biomedical data can be investigated using methods of fractal geometry. A measurement of their nonlinear character and chaoticity can be used for subsequent data classification or irregularity detection. In this paper, we introduce the method of the fractional Brownian bridge for the Hurst exponent estimation from a signal and apply it to the electroencephalogram (EEG) data. The technique is used to detect the early stages of Alzheimer's disease, exhibiting significant performance when compared with control patients. The measures of variability where the most significant changes occur together with the recommended EEG channels are presented in the paper.

pp. 1-4

Evaluating Feasibility of Image-Based Cognitive APIs for Home Context Sensing

Sinan Chen, Sachio Saiki and Masahide Nakamura (Kobe University, Japan)

Cognitive API is API of emerging AI-based cloud services, which extracts various contextual information from non-numerical multimedia data including image and audio. Our interest is to apply image-based cognitive APIs to implement smart and affordable context sensing services in a smart home. However, since the existing APIs are trained for general-purpose image recognition, they may not be of practical use in specific configuration of smart homes. In this paper, we therefore propose a method that evaluates the feasibility of cognitive APIs for the home context sensing. In the proposed method, we exploit document similarity measures to see how well tags extracted from given images characterize the original contexts. Using the proposed method, we evaluate practical APIs of Microsoft Azure, IBM Watson, and Google Cloud for recognizing 11 different contexts in our smart home.

pp. 5-8

Fetal ECG Extraction Using Independent Components and Characteristics Matching

Mohanad Alkhodari (American University of Sharjah, United Arab Emirates); Abdelrahman Rashed (Abu Dhabi University, United Arab Emirates); Meera Alex (American University of Sharjah, United Arab Emirates); Nai-Shong Yeh (AUS, United Arab Emirates)

In this paper, further investigations into a simpler automated use of Independent Component Analysis in the process of Fetal ECG extraction are performed. Extracting FECG signals through abdominal electrodes helps clinicians in diagnosing the overall health of the fetus non-invasively. In the ICA technique, FECG signals are separated from Abdominal ECG mixtures containing maternal and noise signals. 300,000 Data samples of three AECG recordings are obtained from PhysioNet database at 1 kHz sampling frequency. Data are pre-processed through MATLAB software by centering, whitening, and filtering techniques. Then, a simpler Fast ICA algorithm is developed and used to smoothly distinguish between AECG components through automatic signal characteristics matching. Moreover, further analysis of the extracted FECG signal is performed to determine the fetus heart rate. Results successfully show efficient automatic separation between the FECG, Maternal ECG, and noise from the AECG recordings. In addition, the developed characteristics matching algorithm automatically identified the fetus signal and smoothed it to be ready for further fetal health observations. The integration of AECG signal characteristics as a prior information into the ICA algorithm promises to assist clinicians in decision making when diagnosing fetal health conditions non-invasively.

pp. 9-12

An Ensemble Approach to Transfer Learning for Classification of Habitat Mapping

Prajowal Manandhar (Khalifa University, United Arab Emirates); Prashanth Marpu and Zeyar Aung (Khalifa University of Science and Technology, United Arab Emirates)

The Environment Agency- Abu Dhabi developed extensive habitat, land cover, land use maps in 2015 using a very high resolution satellite imagery acquired between 2011 and 2013. This map can be used as a baseline map to allow efficient monitoring. In this work, we aim to establish a framework for short term updates to the maps to quickly enable efficient planning. With the availability of multi-spectral images, various spectral bands apart from visible (Red, Green and Blue) bands can be used in habitat mapping. This paper presents the work of land cover classification in the region of Abu Dhabi, UAE using a Worldview-2 satellite image. The proposed approach makes use of Random Forest algorithm, applied on the Fully-Connected features obtained from AlexNet framework using a 20% training samples on a 3-band input. Then, ensemble of outputs of Random Forest over different 3-bands combination is used to make the final prediction. The results are validated against the ground truth obtained from Environment Agency, Abu Dhabi. Eventually, our aim is to develop a robust classification approach and then adapt automatic change detection approaches to temporally update the baseline maps.

pp. 13-16

Deep Learning Approach to Update Road Network Using VGI Data

Prajowal Manandhar (Khalifa University, United Arab Emirates); Prashanth Marpu and Zeyar Aung (Khalifa University of Science and Technology, United Arab Emirates)

In our earlier work, we worked on extraction of the total width of road by agents traversing in the direction guided by Volunteered Geographic Information (VGI). The only downfall of VGI approach is its inability to update the new road developments. In this paper, we introduce deep learning approach to update the road network. We make use of the output of our previous work which forms as an input to train the Convolutional Neural Network (CNN). Then, further post processing is performed to remove non-road segments (such as buildings, vegetation, etc) on the output of CNN and finally, obtain the updated road map.

pp. 17-20

Autonomous Building Detection Using Region Properties and PCA

Nour Abura'ed, Alavikunhu Panthakkan and Husameldin Mukhtar (University of Dubai, United Arab Emirates); Wathiq Mansoor (Universithy OF Dubai, United Arab Emirates); Saeed Al Mansoori (Mohammed bin Rashid Space Centre, United Arab Emirates); Hussain Al-Ahmad (University of Dubai, United Arab Emirates)

This paper proposes an algorithm for autonomous building detection in remote sensing images. The basis of the algorithm relies on the fact that each RGB channel conveys different information. Furthermore, region properties and Principal Component Analysis (PCA) are used to distinguish between buildings and other regions in order to reduce false positive cases. The images that are used to test the proposed algorithm are obtained from DubaiSat-2, which offers multispectral images with 1-m accuracy. The results of the algorithm indicate high accuracy and robustness against shadow effects.

pp. 21-24

Wednesday, November 7 15:00 - 15:30

CB: Coffee Break

Room: Conference Room

Wednesday, November 7 15:30 - 17:00

S2: Session 2

Room: Conference Room

Chair: Husameldin Mukhtar (University of Dubai, United Arab Emirates)

On the Performance of DF-based Power-Line/Visible-Light Communication Systems

Waled Gheth, Khaled M. Rabie and Bamidele Adebisi (Manchester Metropolitan University, United Kingdom (Great Britain)); Muhammad Ijaz (Manchester Metropolitan University, Manchester, United Kingdom (Great Britain)); Georgina Harris (The Open University, United Kingdom (Great Britain))

Hybrid communication systems are used to provide better mobility to end users as well as improving the system reliability. This paper presents a comprehensive performance analysis of an integrated indoor power line communication (PLC)/visible light communication (VLC) system with the presence of a decode-and-forward (DF) relay. Using the existing indoor power line networks gives the advantage of such cables as the backbone for VLCs. The performance of the proposed system is evaluated in terms of the average capacity and the outage probability. A new unified mathematical method is developed for the PLC/VLC system and analytical expressions for the overall capacity and outage probability are derived. Monte Carlo simulations are provided throughout the paper to verify the correctness of the analysis. The results reveal that the performance of the proposed system deteriorates with increasing the end-to-end distance and improves with increasing the relay transmit power. It is also shown that the outage probability of the system under consideration is negatively affected by the vertical distance to user plane.

pp. 25-28

Analysis of Space Debris Re-Entry over the Arabian Peninsula (2004 to 2018)

Abdollah Darya (University of Sharjah, United Arab Emirates); Ilias Fernini (University of Sharjah & Sharjah Center for Astronomy and Space Sciences, United Arab Emirates)

As a result of the ever-increasing number of space debris, space agencies all over the world are developing their own space debris monitoring and tracking systems. Due to the lack of any formal study of this nature in the Arabian Peninsula, this paper aims to remedy this by performing a study into space debris re-entry over the Arabian Peninsula for the last 15 years (2004-2018) using data provided by the Joint Space Operations Center (JSpOC). JSpOC provides information produced using radar measurements and various computational techniques that establish it as the leading provider of space debris data. The rate of space debris re-entry has been found to be accelerating during the study period, with growth rate increasing every 5 years. This study serves as a precursor to a more comprehensive analysis of debris re-entry over the Arabian Peninsula and the creation of a system to fulfill the regional need for space debris tracking.

pp. 29-32

Improving the Detection Accuracy of Frequency Modulated Continuous Wave Radar

Aamna Al Teneiji (Khalifa University, United Arab Emirates); Muhammad Saeed Khan (ETIC, United Arab Emirates); Nazar Ali (Khalifa University of Science and Technology, United Arab Emirates); Ahmed Altunaiji (Khalifa University, United Arab

Emirates)

Frequency modulated continuous wave radar is used to measure the target's distance and velocity. This paper presents a comparison of different signal processing algorithms that improve FMCW radar detection. The algorithms are studied and validated by simulation. The radar is simulated to detect stationary targets at different considerable distances in order to prove the validity of the algorithms. Signal processing algorithms used in this paper are based on Fast Fourier Transform, windowing, zero-padding, Chirp-Z transform and Jacobsen's frequency estimator. The paper shows the results found using each algorithm and offers a comparison among them.

pp. 33-36

Robust Localization of a Wireless Device by a Network of Unsynchronized Anchors

Qasim Chaudhari and Wayne Rowe (RMIT University, Australia)

The infrastructure available to the mobile phones is too costly to deploy for localizing small wireless devices in an Internet of Things (IoT) framework. Among available RF solutions, those based on the time of arrival measurements at a network of unsynchronized anchors suits quite well to this application. In this paper, we consider a wireless device moving at a pedestrian speed within such a network of unsynchronized anchors and track its position using time of flight measurements that are processed through an Extended Kalman Filter (EKF). The system dynamics here come from the uniform speed of the mobile as well as the skew of the clocks involved. The purpose is to compare the results with Time Difference of Arrival (TDoA) and Differential Time Difference of Arrival (DTDoA) measurements that act as a lower and upper bound for this system, respectively.

pp. 37-40

Low Complexity Receivers for Massive MIMO Cloud Radio Access Systems

Khawla Alnajjar, Saeed Abdallah, Mohamed Saad and Ali A. ElMoursy (University of Sharjah, United Arab Emirates)

In this work, we consider uplink receiver design for cloud radio access networks (C-RANs) employing massive multi-input multi-ouput (MIMO). Considering joint detection at the base band unit pool for user ends from multiple remote radio heads, we propose a low complexity C-RAN version of the Vertical Bell Laboratories Layered Space-Time (C-RAN-BLAST). The C-RAN versions of the zero-forcing (ZF) and minimum mean-squared error (MMSE) receivers are employed for comparison. The C-RAN-BLAST offers similar performance to the ZF receiver, at much lower complexity. The MMSE receiver performs somewhat better, at the cost of higher complexity, and requiring more detailed channel state information.

pp. 41-44

On the Performance of Two-way Relays in the Presence of Frequency Offsets

Saeed Abdallah, Ahmed Salameh and Mohamed Saad (University of Sharjah, United Arab Emirates)

In this paper, we present a novel pilot-based Maximum Likelihood (ML) estimation scheme for the channel and carrier frequency offset (CFO) in amplify-and-forward (AF) two-way relay networks (TWRNs). We develop an estimator for two separate channel scenarios, reciprocal and non-reciprocal. We use simulations to plot the mean-squared error (MSE) performance of the proposed scheme and show that it converges to the corresponding Cramer-Rao bound (CRB) in both cases.

pp. 45-48

Wednesday, November 7 19:00 - 21:00

D: Dinner

Room: Conference Room

Thursday, November 8

Thursday, November 8 9:30 - 10:00

KN3: Keynote Speech: Secure Application Execution on Embedded Devices

Prof. Konstantinos Markantonakis (Royal Holloway, University of London, UK)

Room: Conference Room

Abstract: It is evident that day-to-day mundane tasks involve a number of embedded systems. These include smart cards, sensors in vehicles, industrial automation systems and even drones. The requirement for trusted, reliable and secure embedded devices is strengthened further by the potential advent of the Internet of Things and Cyber-Physical Systems. As our reliance on these devices is increasing, the significance of potential threats should not be underestimated, especially as a number of embedded devices are built to operate in malicious environments. In this talk, we examine the concepts of the security and trust of embedded devices, from the hardware design, reliability and trust of the run-time environment to the integrity and trustworthiness of the executing applications. We also highlight a few notable prevention mechanisms along with providing directions for further research.

Thursday, November 8 10:00 - 10:30

CB: Coffee Break

Room: Conference Room

Thursday, November 8 10:30 - 12:00

S3: Session 3

Room: Conference Room

Chairs: Alexander Giehl (Fraunhofer AISEC, Germany), Sami Miniaoui, SM (University of Dubai, United Arab Emirates)

Implementing a Performant Security Control for Industrial Ethernet

Alexander Giehl and Sven Plaga (Fraunhofer AISEC, Germany)

Security is an increased concern in smart manufacturing, however, is often met with concerns from OT operators. Performance is paramount in operational technology (OT) communication and, thus, a higher risk is currently deemed acceptable. However, the probability for cyber attacks is rising as recent, successful attacks on factory communication demonstrate. In this work, we present a performant security protocol extension for usage in OT networks. It enables message authentication and data integrity while keeping the protocol overhead within real-time constraints. The protocol extension protects against attacks targeting communication of cyber-physical systems in a smart manufacturing environment. The availability of OT operations facing these attack vectors is, thus, guaranteed.

pp. 49-52

Modelling Access Control for CIM Based Graph Model in Smart Grids

Ivana Kovacevic (Faculty of Technical Sciences & Schneider Electric DMS NS, Serbia); Aleksandar Erdeljan (University of Novi Sad, Serbia); Miroslav Zaric (Faculty of Technical Sciences, Serbia); Nikola Dalcekovic (Faculty of Technical Sciences & Schneider Electric DMS NS, Serbia); Imre I Lendák, IV (University of Novi Sad & Faculty of Technical Sciences, Serbia)

Consumption of electricity has grown, and that tendency will continue according to Energy Information Administration (EIA). Most modern distribution networks, evolving into Smart Grids, are managed through sophisticated software, such as advanced distribution management systems (ADMS). Their operations are based on gathering, analysis and transformation of data coming from the different devices in distribution network. Data volume in Smart Grids is increasing rapidly. Therefore, handling that growing amount of data may pose significant challenges for relational databases in the future, as they may struggle with demand for execution of complex queries. In some cases, like in modeling power system network, the data model is naturally represented by a graph, hence graph databases could provide viable, more efficient alternative. The paper is proposing an approach to include sensitive data access permissions in a graph oriented database - enabling us to decide who can access the sensitive data and who cannot. We have performed analysis on security controls to limit the access to personal data using a realistic data model derived from an existing network model of power distribution utility based in Europe, but described approach is also applicable to other sensitive data. We concluded that the proposed approach would provide ability for implementing access management security controls, while each approach would differently affect the levels of overall system performances.

pp. 53-56

Data Analytics Methods for Anomaly Detection: Evolution and Recommendations

Iman Abu Sulayman (Taif University & University of Western Ontario); Abdelkader Ouda (University of Western Ontario, Canada)

Big Data-based applications have been increased especially those which utilize anomaly detection techniques. This paper puts a new insight into the anomaly detection techniques, suitable for Big Data applications. This study is supported by novel classifications and practical based implementation. Three classifications are proposed for anomaly detection techniques that are aligned with Big Data characteristics and powered by several applications of the machine learning techniques, such as Support Vector Machine SVM and neural network. These classifications have helped to evaluate and recommend for the best practices in anomaly detection and hence a new implementation has been provided.

pp. 57-60

Innovating Plant-Care Applications by Combining QR-Technology & Image Search

Sami Miniaoui, SM and Sudad Muammar (University of Dubai, United Arab Emirates); Shadi Atalla (University of Dubai & University of Dubai, United Arab Emirates); Kamarul Faizal Hashim (University of Dubai, United Arab Emirates)

This paper is proposing an innovative application (e-Pot) which uses QR Code technology along with a Web application for helping plant-fans manage, maintain and share practices using their mobile phones. Sharing experiences of growing a specific plant or identifying its requirements in terms of sunlight, temperature, recommended soil with other members can help in answering the crucial question which is: "Why would you want to own this plant?" The application is providing Facebook users with commenting option and notify them about any updates. Additionally, by leveraging mobile phones' capabilities, this application provides users with a "search by image" feature by just picturing any plant "on the go" then searching among the recorded plants (Plantopedia) as well as Google image database. The e-Pot system is also allowing its members to maintain an account whereby they can register their own plants so the system can remind them through e-mail about convenient irrigation times according to the best practices.

pp. 61-64

Smart Happiness Meter

Nadiya Dilshad and Kamarul Faizal Hashim (University of Dubai, United Arab Emirates); Shadi Atalla (University of Dubai & University of Dubai, United Arab Emirates); Sami Miniaoui, SM (University of Dubai, United Arab Emirates)

The main objective of this paper is to discuss the implementation of a Smart Happiness Meter (SHM) prototype that adopts a face detection and recognition approach to provide a real-time statistic on customer satisfaction. This prototype does not only detect and recognize images but also determine customer emotion using sentiment analysis technique. The development of this prototype provides an alternative methodology to existing approach of measuring customer's happiness which rely heavily on manual surveys using mobile applications. This paper discusses about the design and development methodology, its use-case diagrams and demonstrates the deliverables of the prototype in general.

pp. 65-68

Using Virtual Agent for Facilitating Online Questionnaire Surveys

Daiki Takatsuki, Masahide Nakamura and Sachio Saiki (Kobe University, Japan)

In this paper, we present a novel system, called Formroid, which facilitates answering online questionnaire surveys with the virtual agent technology. For a questionnaire given by an investigator, Formroid commands the virtual agent to ask each question to the respondent. Through conversation with the virtual agent, a respondent can answer the questionnaire. Thus, Formroid transforms the conventional form input into a face-to-face interview conducted by the virtual agent. In this paper, we especially address the design issues of Formroid, and the implementation of prototype system. We also introduce an experiment, where Formroid is extensively used for questionnaire-based assessment of quality of life.

pp. 69-72

Thursday, November 8 12:00 - 13:30

L: Lunch

Room: Conference Room

Thursday, November 8 13:30 - 14:30

S4: Session 4

Room: Conference Room

Chair: Alavikunhu Panthakkan (University of Dubai, United Arab Emirates)

Teaming Up Pre-Trained Deep Neural Networks

Alaa Abdel-Hakim (Assiut University, Egypt); Wael Deabes (Umm Al-Qura University, Saudi Arabia)

With the rapid growth of the big data applications, the training process of deep neural networks is getting more expensive in terms of the computational cost. In this paper, we propose an algorithm that exploits the reliability of existing convolutional neural networks that has been gained during earlier training processes. We use fuzzy integrals to perform late fusion on the classification decisions taken by pre-trained classifiers. The proposed method was evaluated using the ImageNet benchmark with ten different pre-trained state-of-the-arts CNN's. The evaluation results show that the proposed fuzzy-based fusion method could achieve better performance than the best of the contributing models, in terms of recognition accuracy. The range of the accuracy improvement is between 8% and 30% than the used pre-trained classifiers.

pp. 73-76

Detection of Water-Bodies Using Semantic Segmentation

Mina Ahmed (University of dubai, United Arab Emirates); Alavikunhu Panthakkan and Husameldin Mukhtar (University of Dubai, United Arab Emirates); Wathiq Mansoor (Universithy OF Dubai, United Arab Emirates); Saeed Al Mansoori (Mohammed bin Rashid Space Centre, United Arab Emirates); Hussain Al-Ahmad (University of Dubai, United Arab Emirates)

This paper proposes a semantic segmentation technique to automatically detect water-bodies from DubaiSat-2 images. The proposed method uses a deep convolutional neural network transfer-learning model. Several evaluation metrics such as accuracy, precision, and Jaccard coefficient are used to test our proposed algorithm. The overall accuracy for the prediction of water-bodies in DubaiSat-2 image dataset is 99.86%.

pp. 77-80

Automatic Vehicle Detection from Aerial Images Using Cascaded SVM and GMM

Alavikunhu Panthakkan and Hussain Al-Ahmad (University of Dubai, United Arab Emirates); Saeed Al Mansoori (Mohammed bin Rashid Space Centre, United Arab Emirates); Shibani H (Ilahia College of Engineering and Technology, India)

This paper proposes a novel approach for automatic vehicle detection from aerial images using cascaded Gaussian Mixture Model (GMM) and Support Vector Machine (SVM) algorithm. The GMM based background removal technique eliminates the image background to achieve efficient color classification using SVM classifier. The GMM classifier followed by SVM classification to ensure better results. In the proposed algorithm, the color and local features are the main cues for vehicle detection. To evaluate the performance of the proposed vehicle detection system, the metrics such as hit rate, accuracy and precision valued are used. This paper analyses the system performance and compared it with other background removal methods and classifiers.

pp. 81-84

Hindrances in the Fitness Landscape and Remedies to Achieve Optimization

Khaled A Almejalli (SEU, Saudi Arabia)

Past several decades have witnessed a rapid increase in the nature-inspired computational techniques. Evolutionary Computation is one such group of algorithms inspired by the theory of natural selection and survival of the fittest. This paper presents some for the key problems in the fitness landscape of such algorithms that make it difficult to converge to an optimum solution. These problems not only yield poor convergence but makes the use of Evolutionary Computation techniques less effective. This work then suggests some of the remedies to overcome these hindrances while designing the problem and the objective function. If properly incorporated, the suggested countermeasures enhance the ability of these methods in reaching an optimum solution faster and without entrapment in the local optima.

pp. 85-88

Thursday, November 8 14:30 - 15:00

CB: Coffee Break

Room: Conference Room

Thursday, November 8 15:00 - 16:00

S5: Session 5

Room: Conference Room

Chairs: Shadi Atalla (University of Dubai & University of Dubai, United Arab Emirates), Rafic A. Ayoubi (University of Balamand, Lebanon)

X-EYE: A Bio-smart Secure Navigation Framework for Visually Impaired People

Rabia Minhas (City University of Science and Information Technology, Peshawar, Pakistan); Ali Javed (UET TAXILA, Pakistan)

This paper presents an effective method of providing day-to-day mobility aid to visually impaired people. An android application named X-EYE using LOOXCIE wearable camera is designed for blind people to navigate safely. Existing navigation aid systems use various hardware components such as sensors that are expensive and cause health hazards. The proposed system presents an economical solution using a wearable camera and a smart phone to provide safe navigation facility to the visually impaired user. X-EYE provides the features of obstacle detection, person recognition, location tracking and sharing, SMS reader, and language translation. Audio messages are specifically generated to provide better usability to the blind/visually impaired user. The proposed system is robust to egocentric video limitations i.e. partial appearance of objects, sudden background change, jitter effects, and illumination conditions. Performance of the proposed method is evaluated on ten real-time egocentric videos. Experimental results indicate the effectiveness of our method in terms of providing safe mobility service to the visually impaired people.

pp. 89-92

A Business Card Reader Application for iOS Devices Based on Tesseract

Smitha S Kumar and Bello Dangiwa (Heriot Watt University, United Arab Emirates)

As the accessibility of high-resolution smartphone camera has increased and an improved computational speed, it is now convenient to build Business Card Readers on mobile phones. The project aims to design and develop a Business Card Reader (BCR) Application for iOS devices, using an open-source OCR Engine - Tesseract. The system accuracy was tested and evaluated using a dataset of 55 digital business cards obtained from an online repository. The accuracy result of the system was up to 74% in terms of both text recognition and data detection. A comparative analysis was carried out against a commercial business card reader application and our application performed vastly reasonable.

pp. 93-96

Characterizing and Compensating for Errors in a Leap Motion Using PCA

Hussein Walugembe, Chris Phillips, Jesus Requena Carrion and Tijana Timotijevic (Queen Mary University of London, United Kingdom (Great Britain))

This paper concerns a rehabilitation framework that makes use of a low cost ``off-the-shelf'' device. The device is a visual markerless sensor system called the Leap Motion controller (LM). However, before deploying the LM, we investigate its accuracy and limitations in measuring finger joint angles. During a rehabilitation procedure, patients will be flexing and extending their fingers and accurate feedback is a prerequisite for them to benefit effectively from the exercises. During finger joint angle error analysis, we conducted a series of experiments to assess the accuracy of the LM in terms of parameters like elevation, lateral (side-to-side) positioning, forward-backward positioning, and rotation of the hand relative to the LM. We used an ``artist's hand'' placed above the LM. The artist's hand is more accurate than a human hand in performing static hand gestures as it can maintain a fixed posture as long as is necessary. According to the results of the error analysis, we apply Principal Component Analysis (PCA) to the LM raw data to see whether the algorithm can compensate for these errors. The experimental results show that the PCA algorithm is feasible, effective and can be applied such that fairly accurate measurements can be obtained and therefore suitable feedback can be provided to the patient using the LM for hand rehabilitation purposes.

pp. 97-100

Constant Time Hardware Architecture for a Gaussian Smoothing Filter

Ghattas Akkad (ENSTA Bretagne, France); Rafic A. Ayoubi and Antoine B. Abche (University of Balamand, Lebanon)

In this paper a new and highly efficient hardware architecture for a bit-serial implementation of a 3*3 filter on FPGA is developed and presented. The concept is implemented on a Gaussian blur spatial filter and it can be extended to other filters with similar characteristics. The proposed Single Instruction Multiple Data (SIMD) architecture provides a constant operating time independent of the size of the given image while the arithmetic operations are limited to the operations of addition. The Multiple Instruction Multiple Data (MIMD) performance is achieved in a near fraction of the cost. Thus, the hardware's utilization is optimized. The total time needed to perform the filter of interest on the given image is solely dependent on the working clock frequency. The proposed design is evaluated using a small image and is implemented on two FPGA families with various sizes of an image. Also, it is compared with other architectures.

pp. 101-104