## Editorial

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**Biographical notes:** Sundarapandian Vaidyanathan is Professor and Dean at the Research and Development Centre, Vel Tech University, Chennai, India. He earned his DSc degree in Electrical and Systems Engineering from Washington University, St. Louis, USA in 1996. His current research focuses on linear and nonlinear control systems, chaotic and hyperchaotic systems, chaos control and synchronisation, FPGA, backstepping control, sliding mode control, intelligent control, mathematical models of biology, computational science and robotics. He has published three textbooks on Mathematics and six research books on Computational Intelligence, Chaos and Control Systems. He has published over 230 Scopus-indexed research publications. He has delivered plenary lectures on Control Systems and Chaos Theory in many international conferences around the world. He has also conducted many workshops on Computational Science using MATLAB and SCILAB.

The second International Conference on Automation, Control, Engineering and Computer Science (ACECS-2015) was conducted during 22–24 March 2015 at Sousse, Tunisia. The conference provided an excellent forum for professionals, academics, and researchers to share knowledge and results on automation, control, engineering, computer science and information technology. Broad areas of ACECS-2015 were classified as Computer Science & IT, Signal Processing & Communication, Robotics, Control & Instrumentation, Engineering & Automation, and Innovation & Engineering Management.

Signal processing encompasses the basic theory, applications, algorithms, and implementations of processing or transferring information contained in many different physical, symbolic, or abstract formats broadly designated as signals. Signal processing uses mathematical, statistical, computational and heuristic techniques for representation, modelling, analysis, synthesis, recovery, sensing, acquisition, extraction, learning and security issues with signals.

Image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame and the output of image processing may be either an image or a set of characteristics or parameters related to the image.

In this special issue of the *International Journal of Signal and Imaging Systems Engineering (IJSISE)*, we are delighted to select 13 research papers reporting on recent advances in automation, systems modelling and control. These papers presented in the ACECS-2015 have been expanded in line with the reviewer recommendation and audience questions.

It is hoped that this special issue will provide a useful reference for informing recently developed technologies in

signal and image processing with engineering applications. The contents of the selected 13 papers are described briefly as follows.

The paper titled 'Novel extraction and tumour detection method using histogram study and SVM classification' by Sara Sandabad, Achraf Benba, Yassine Sayd Tahri and Ahmed Hammouch proposes a new method for detecting and segmenting brain tumour regions in the MRI images in T1 (with contrast). The proposed method consists of three main stages viz. (i) extracting the region of interest (brain) using EMBE method, (ii) study and histogram analysis of the MRI image to create learning and initialise the classification algorithm that will be applied later to retrieve and locate the tumour and (iii) tumour detection and classification using SVM into two classes: tumour class and no-tumour class. The segmentation of brain tumours in the MRI images has good applications in science and engineering.

The paper titled 'A microphone array beamforming-based system for multi-talker speech separation' by Adel Hidri and Hamid Amri presents a Multi-Channel Speech Separation system (MCSS) based on new Beamforming frequency domain method. The Beamformer exploits the spatial properties of the source signals using a microphone array. Thus, it is based on a prior knowledge of the position of the speakers relative to the array. The proposed Beamformer is defined with two processing steps, viz. (i) to keep a unit gain of the desired signal and (ii) to block the wanted signal and minimise the output power of the interferences within only one-step. In order to separate multiple speakers, multiple Beamformers are used simultaneously, where a Beamformer is computed for each source considering the remaining sources as interferers. test The proposed MCSS has been tested and evaluated on real recording mixtures extracted from

'Multichannel In-Car Speech Database'. The experimental results proved the effectiveness of the proposed system in terms of speech separation.

The paper titled 'Multi-level fractional order PSO new paradigm algorithm for image segmentation' by Faycal Hamdaoui, Anis Ladgham, Anis Sakly and Abdellatif Mtibaa deals with the multilevel segmentation of benchmark images. The proposed multi-level segmentation method is used to separate the original image into regions with common characteristics of an interesting viewing quality and a fast time execution. The purpose is to automatically determine the optimal threshold values based between-class variance maximisation. The choice of the already used method essentially depends on the quantitative characteristics. The main aim of this paper is to propose a new PSO algorithm for multilevel segmentation based on a novel fitness function and modified inertia component to find the optimal thresholds. Experimental results applied on a set of benchmarks images have been proven efficiencies and advantages in multilevel compared to other meta-heuristics such as Genetic Algorithms (GA), Otsu method, Conventional PSO and Fractional-Order Darwinian PSO (DPSO).

The paper titled 'An extended Mumford-Shah model for shape partitioning' by Habiba Nabi and Ali Douik proposes 3D mesh segmentation method based on the Mumford-Shah model, which is composed by two terms: (i) data fidelity and (ii) regularisation term. The minimisation of these ones is performed with the primal dual algorithm, by alternating a gradient descend in the primal variable and a gradient ascend in the dual variable. The estimation of the partition numbers is a potential step in the segmentation process. In this paper, the authors have proposed a new method for automatic computation of the optimal partitions number by analysing the behaviour of the second order difference of eigenvalues obtained from the dual Laplacian spectrum. By applying these partitions numbers in mesh segmentation, the paper exhibits good results for the values of the Rand Index metric.

The paper titled 'Auto-connected transformer with 40° phase shifting for harmonic elimination' by Arafet Ben Ammar and Faouzi Ben Ammar describes the design, analysis and experimental setup of a delta-connected autotransformer based 18-pulse ac-dc converter with 40° phase shifting to decrease the harmonics pollution in the network side. The simulation results show that autotransformer configuration 18-pulse capable to suppress harmonics of the order less than 18th  $n \pm 1$ . This design gives a better THD current compared with the two configurations, 6-pulse and 12-pulse. Moreover, a prototype of the proposed autotransformer based 18 pulse ac-dc converter is developed and test results are presented to validate the developed design procedure and simulation models of this ac-dc converter.

The paper titled 'Combining watermarking and encryption algorithm for medical image safe transfer: method based on DCT' by Sondes Ajili, Mohamed Ali Hajjaji and Abdellatif Mtibaa proposes a novel method for watermarking and encryption of medical image based on the Discrete Cosine Transform domain (DCT). Medical data, such as the patients' private information is embedded into the corresponding medical image. After that, the watermarked medical images are encrypted by using the Advanced Encryption Standard (AES) and the RSA encryption Algorithm to increase the robustness. The proposed method uses the standard JPEG compression for the embedding of patients' private data. The insertion block is inserted just after the DCT phase. To control identification and eventually the correction (if possible) of the watermark, after application of different attacks, it should be noted that we used the serial turbo code to recover the data inserted. The proposed system is tested against several attacks, such as compression, noise, filtering and geometric transformation attacks. The simulation studies are applied on MRI, Echographic and Radiographic medicals images. Experiments and analyses show that low distortion and high robustness have been achieved in the process of watermarking, and, at the same time, elevated security has been acquired in the encryption phase.

The paper titled 'Fuzzy linear projection on combined multi-feature characterisation vectors for facial expression recognition enhancement' by Mohammed Saaidia, Narima Zermi and Messaoud Ramdani proposes to provide a new facial expression recognition technique based on combined vectors of multi-feature characterisation of the face. Thus, the face within an image is firstly localised using a simplified method and then it will be characterised in three different ways, viz. (i) by obtaining its Zernike moments feature vectors, known to compact geometric characteristics of the image, (ii) by compiling AR model, supposed to be a representation of its spectral source model and (iii) a statistical distribution analysis of the luminance information is performed through the LBP method. Obtained feature vectors were used to train neural network classifiers (NNC) in different manner. To demonstrate the effectiveness of the proposed technique, recognition rates are recorded and compared for NNC trained with each type of feature vector firstly, then for NNC trained with directly combined feature vectors and finally for NNC trained with composite feature vectors which underwent a fuzzy linear projection operation. Experiments have been performed on the JAFFE and Yale database and discussed.

The paper titled 'Hardware implementation of Gabor filter for MRI using XSG' by Anis Ladgham, Anis Sakly and Abdellatif Mtibaa proposes hardware architecture for the extraction of textural features from Magnetic Resonance Imaging (MRI) based on Gabor filter. The strength of Gabor filters in image processing is the similarity of their frequency and orientation representations to those of the human visual system. They are appropriate for texture representation and discrimination. The present architecture is developed using the Xilinx System Generator (XSG) and is implemented on Virtex-V Field Programmable Gate Array (FPGA). The implementation of the proposed method on FPGA gives it the advantages of portability and real time extraction. The performances of the proposed method are demonstrated using a set of medical images.

The paper titled 'Fault analysis and control of grounding power transformer' by Asma Meddeb and Souad Chebbi presents the considerations regarding the problems of grounding system. The theoretical and simulations studies allowed the control of the neutral grounding to avoid the

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insulation deterioration or accidental grounds in the transformer winding and avoid the distribution of zerosequence current. Thus, there is great interest in research in developing a new mathematical model to study the impact of neutral grounding transformer during a single-phase to ground fault, the fault resistance effect and also the impact of the distance separating a fault point to the power generators. The main focus of this paper is on the control of the level of single-phase short-circuiting current on the faulted distribution network analysis. In order to do the analysis, the IEEE 14-bus standard system is proposed and a program is developed to calculate fault current depending of neutral grounding system under MATLAB environment.

The paper titled 'A content-based image retrieval using PCA and SOM' by Marouane Ben Haj Ayech and Hamid Amiri proposes an approach to build an efficient visual vocabulary for content-based image retrieval. First, the feature space composed of SIFT descriptors is transformed into a lower-dimensional space using the Principal Component Analysis (PCA). Second, the resulting feature space is clustered using the Self Organising Map (SOM) and it results in a map of visual words. The proposed model, called PCA-SOM, is evaluated using a dataset of vehicule images from Pascal VOC 2007 benchmark and the experiments show good results.

The paper titled 'Text classification using scores based k-NN approach and term to category relevance weighting scheme' by Ahmed Ben Afia and Hamid Amiri proposes a text classification (TC) scheme using scores based k-NN approach and term to category relevance weighting scheme. The proposed TC system includes two basic stages, where the first stage consists on features extraction using a term weighting scheme, and the second stage is the classification using a machine learning algorithm. After proposing the TC system with a new term to category relevance weighting

scheme, called TF.IDF.TCR, a k-NN based approach using scores calculation is suggested in order to resolve the problem of unknown category.

The paper titled 'An embedded e-voting machine with smart card' by Karima Dichou, Victor Tourtchine and Fayçal Rahmoune proposes an electronic voting machine that merges the two existing (actual) e-voting machines which take into account the benefits from each one of them. The authors demonstrate that the proposed e-voting machine has several advantages over the traditional way of voting as it is faster and more secure by using a biometric authentication associated with the smart card and RSA encryption to provide more security.

The paper titled 'QRS detection combining entropic criterion and wavelet transform' by Sawsan Rekik and Noureddine Ellouze introduces a new method for QRS wave's locations using the local entropic criterion applied to the signal split on different successive scales, that is based on Gonon and Djafari approach's which offers a local estimator for segmenting of a signal based on entropic criteria and on the work of Mallat and Hwang for singularity detection using local maxima of coefficients wavelet resulting from the decomposition of a signal. The R wave corresponds to two modulus maximum lines with opposite signs (min-max). The authors have evaluated the algorithm on manually annotated databases QT.

The Guest Editor would like to thank all the authors for submitting their manuscripts in this special issue. We would want to acknowledge the reviewers for their contributions in reviewing the papers and providing constructive comments to the authors. Finally, the Guest Editor would like to specially thank the Journal Manager, Liz Harris, of Inderscience Publishers, for her great help and support in organising and coordinating the publication of this special issue.