

Guest Editorial

Soft computing and intelligent systems: techniques and applications

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This special issue is a collection of selected papers from those presented at the Fourth International Symposium on Intelligent Systems Technologies and Applications (ISTA' 18), which is organized in association with Springer, Germany and IOS-Press, Netherlands, and is co-affiliated with the International Conference on Applied Soft computing and Communication Networks (ACN' 18), held in Bangalore, India, during September 19-22, 2018. This International Symposium aims to bring together researchers in related fields and provides a venue to explore and discuss various aspects and recent advances of intelligent systems technologies and applications. It provides excellent opportunities for the presentation and discussion of interesting new research results, which contributes to effective transfer of knowledge and dissemination of innovative ideas.

Included are 50 papers covering topics pertaining to update-to-date issues, findings, challenges and developments on image and signal processing, intelligent controllers, natural language processing, networked systems, optimization and nature-inspired techniques, soft computing techniques and applications. Deep learning has attracted the attention of many researchers as a prominent machine learning

paradigm mimicking the layers of the neocortex of the cerebral cortex for higher brain functions.

The first 23 papers are related to image and signal processing. In [1], the authors address the challenge of extracting interesting videos from huge video repositories. They present a novel method for domain-independent static video summarization that captures essential content of a video. This method is based on the application of Histogram of Oriented Gradients (HOG) of Gabor maps of input video frames, sparse auto-encoders (SAE), and K-means clustering. Object detection and tracking is an important research problem in image and video processing. In [2], an open-source web-portal platform is described for high speed tracking in images. It can be used to assist beginners in computer vision to gain understanding of the object detection problem. It also provides a model for detecting ground vehicles from aerial images and another model to detect 37 classes of everyday objects in normal images. Paper [3] addresses an essential problem in video surveillance, which is detecting anomalous activities from crowd images. The proposed solution is based on a pre-trained convolutional neural network (CNN). The performance is verified on two standard benchmark datasets for anomaly detection and compared with other existing deep learning approaches. The work in [4] explores three different CNN models to detect the driver's consciousness state from facial features which consist of 68 attributes from RGB

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videos. Then, a feature fused architecture (FFA) is proposed. Though deep learning has gained immense potential in pattern recognition and computer vision, model tuning and optimal parameters determination is a hassle since it takes long time to retrain the model. In [5], an unsupervised pair-wise training strategy is proposed to find the optimal model parameters while reducing the training time and complexity of a convolutional autoencoder without compromising its accuracy. Autoencoders, a type of deep artificial neural networks, are very popular in learning efficient representations of unlabeled data while performing dimensionality reduction.

Deep learning has some successful applications in ecology and ecosystems. In [6], a plant recognition system is introduced using traditional feature extraction and deep learning methods. Recognizing plants from images or videos is a challenging task due to several factors such as diversity of plants, variation in orientation, viewpoint, and background clutter. The proposed approach is evaluated using three standard datasets (Folio, Swedish leaf and Flavia) and one real-time dataset (Leaf12), with higher accuracy achieved when using CNN. The authors of [7] proposed a CNN architecture in order to manage the human-elephant conflicts by preventing elephants from entering human living areas. These conflicts can arise in different forms such as destruction of fields by elephants, elephants being runover by trains or getting electrocuted, etc.

The medical field is a rich area that attracts growing attention of many researchers in image processing and machine learning. Three applications are addressed in the special issue. The first one concentrates on medical diagnosis of prostate cancer based on Magnetic Resonance Imaging (MRI) to help patients and doctors avoid the painful procedure of examination of biopsies. The automation of this process is tackled in [8] using CNN and LADTree classifier. The proposed method is evaluated on PROSTATEx-2 2017 challenge dataset and demonstrated better results than the challenge winning method. In [9], the authors employ multi-texture descriptions in order to assist in predicting cardiovascular diseases such as stroke from retinal fundus images, i.e. images of the back of the eye. Features are extracted using Gabor Filter (GF), Local Binary Pattern (LBP) and Histogram of Oriented Gradients (HOG), and are concatenated. Then feature selection is conducted using ReliefF and a Naïve Bayes classifier is applied, achieving a higher accuracy than individual texture descriptors. In [10], facial expres-

sions of children are analyzed in order to identify those who may fall under autistic characteristic in the near future. Autism spectrum disorder (ASD) is a developmental disorder that affects social interaction, communication and behavior.

Three papers in the special issues deal with special conditions in image processing to enhance the performance. In [11], the authors describe an effective image descriptor method ILBP, which is an improvement of the Local Binary Pattern (LBP), to overcome its sensitivity to noisy, blurred and low pixel valued images. The experimental results show that the proposed method outperformed basic LBP and other edge detection techniques such as HLBP, Canny and Sobel methods. Another paper addresses a special problem in processing facial images. Human eyes carry vital information that has great applications in Human-Computer Interaction systems and biometrics identification. However, one of the challenging problems facing such as applications is people wearing spectacles causing ill-effects such as glare and secondary reflection formation. An alleviating solution for the spectacle problem removal from facial images is proposed in [12] based on detail preserving filtering schemes by employing a two-image based data fusion approach. Denoising is a fundamental prerequisite in image processing applications such as classification and object detection. In [13], three denoising methods are compared, which are Vectorized Convolutional Neural Network (VCNN), kernel based Support Vector Machine (SVM) and Grand Unified Regularized Least Squares (GURLS) classifiers. The comparisons are conducted on three standard Hyper-Spectral Image (HSI) datasets.

Other applications include understanding the whole area using portions periodically captured by Unmanned Aerial Vehicles (UAVs) [14]. This work is a hybrid approach of various feature descriptors and feature matching techniques integrated into the mosaicking system. In [15], a real-time system is described to track the postures of occupants in the vehicle cabin to mitigate the risk of injuries during abrupt braking. In [16], a method using SVM is proposed to reduce time complexity of the Rough Mode Decision (RMD) adopted in the High Efficiency Video Coding (HEVC) standard. A new dimension in image processing is code generation of mathematical expressions from captured images. In [17], the authors describe an Android application that captures mathematical equations using a built-in camera, converts it to java code, and displays a basic plot of the function. Currently this application supports poly-

nomial, logarithmic, trigonometric and exponential functions with up to four variables.

An eminent approach for improving human activity recognition is presented in [18] by analyzing the data obtained from an Environment Monitoring System (EMS) and a Personalized Position Detection System (PPDS) using machine learning techniques and Dempster-Shafer Theory (DST)-based complete sensor data fusion. Using a real-world dataset from the UCI machine learning repository, the proposed framework is evaluated and better results are attained in terms of reliability, efficiency, and accuracy. Another interesting problem is addressed in [19]. It compares the impact of two denoising algorithms (DWT and FMH) on the classification of hand motions from surface electromyogram (sEMG) signals. sEMG is an invasive way to indirectly measure electrical potential produced during muscle contractions using electrodes on the skin regions above the muscle tissue. This problem is popular among sport scientists and physiotherapy specialists and recently has attracted the interest of machine learning and pattern recognition community. An optimal model parameter selection algorithm for behavioral modeling of Radio Frequency (RF) Power Amplifiers is presented in [20]. This approach employs Particle Swarm Optimization (PSO) along with Information Criterion (IC) based cost functions.

Two applications in speech processing are addressed in this special issue: affect (emotion) recognition and speaker verification. Affective computing is an increasingly growing field aiming to develop systems that can detect, recognize, interpret, process, and simulate human emotions. In [21], the authors apply machine learning to detect six affective states (Fear, Anger, Disgust, Sad, Happy, and Surprise) of the speaker using 13 bispectral features extracted from the audio signal segments. Using the eNTERFACE speech corpus, the results showed considerable improvements in the recognition rate between 8.46% - 27.6% compared to existing approaches. On the other hand, speaker verification is the process of accepting or rejecting an identity claim based on comparing two speech samples of the speaker: one during enrollment (reference sample) and one during verification (test sample). When both the reference and test samples are for a pre-defined sentence or phrase, this process is known as text-dependent, otherwise it is text-independent. In [22], the authors applied Dynamic Time Warping (DTW) with local scores derived from the speaker-identity-rich regions to improve the text-dependent

speaker verification as demonstrated by the experimental results using Part1 of RSR2015 database.

The design of a power system stabilizer has changed over the past few decades. With the help of artificial intelligence, more effective controllers are built to handle complex situations of power system perturbations. In [23], the authors suggest and demonstrate that using state-of-art fractional order controller in conjunction with existing power system stabilizer can enhance the performance in terms of damping electro-mechanical oscillations. The work in [24] analyzes the optimization of duty cycle using a hybrid standard multi-verse optimization (MVO) for efficient operation of maximum power point tracking (MPPT) controllers in order to minimize the inadequacies occurring in conventional controllers. Another research idea is addressed in [25] for the combination of conventional brakes with eddy current brake to achieve superior braking performance at high speed. The paper discusses the hardware model development, analysis and control of a multi-disc eddy current braking system using different intelligent controllers. A novel Linguistic Lyapunov based Fuzzy Controller (LLFC) is proposed in [26] in order to improve the trajectory tracking performance of parallel manipulator and provide a stable control action. NSGA-II is used to evaluate the optimal values of controller parameters and its performance is evaluated on Maryland manipulator and compared with PID, Fractional order PID (FOPID) and Fractional order fuzzy pre-compensated fractional order PID (FOFP FOPID) controllers.

Over years, Natural Language Processing has attracted a growing attention and inspired several applications for improving communication between humans and machines. In [27], using acoustic features a language identification system is proposed for Indian languages. The languages are pre-classified into tonal and non-tonal categories then individual languages are identified from the respective category. The proposed system is based on deep residual networks (ResNets) and its performance is compared compared with the performances of other deep neural network architectures including CNN, cascade CNN-long short-term memory (LSTM) and shallow architecture of artificial neural networks (ANNs). The study in [28] is related to Cross-Lingual Information Retrieval (CLIR), where a user can submit a query in a language different from the target documents languages. The focus of the paper is on proposing a translation induction algorithm, which incorporates the refined stop-words list, morphological variants

solutions, and translates the words based on the contextual words. The experimental analysis is carried for the Hindi-English CLIR systems. With the prevalence of social media in our lives, the analysis of unstructured textual data for various purposes has become an active area of research. In [29], a novel method for topic modeling of Twitter data is proposed by extending a user relationship graph based on the contextual information like hashtags, user mentions and replies.

With the growing field of data mining, hybrid feature selection approaches play significant roles in a substantial number of studies. For example, the DNA microarray data containing gene expression profiles are potentially excellent diagnostic tools in the medical field. However, the accuracy of extracted information depends on the number of samples accessible in the dataset compared to the large number of features available. The authors of [30] propose a model that employs a hybrid feature selection technique (Information Gain and micro Genetic Algorithm) to effectively classify microarray cancer data. The work in [31] analyzes the shortcomings of individual filter and wrapper feature selection methods. Then a new hybrid feature selection approach is proposed based on a conjunction of a filter method (conditional mutual information maximization) and a wrapper method (genetic algorithm) to enhance the overall classification performance and speed up the search process to identify the essential features. Bootstrap aggregating (Bagging) has been proven to be a successful ensemble machine learning technique for improving the results of many classification problems. The work in [32] proposes an ensemble technique utilizing the basic bagging meta-algorithm on a hybridization of two base learners, namely Naïve Bayes and Decision Tree. Paper [33] designs a cascade control technique for optimal drug scheduling to regulate the drug concentration and toxicity in cancer chemotherapeutic treatment. The authors used the multi-objective optimization NSGA-II (Non dominated Sorting Genetic Algorithm-II) to optimally tune the controller parameters. Symmetric Traveling Salesman Problem (STSP) is one of the recurrent problems in combinatorial optimization. In [34], a deterministic algorithm is proposed for approximating the solution of STSP using a multi perfect matching and partitioning technique.

In [35], multiset theory is applied to the filters of residuated lattices, which are frameworks with crucial bond to mathematical logic. It also presents an application for medical diagnosis via multiset filters.

The study in [36] is related to the ideology of Lattice ordered Interval-Valued Hesitant Fuzzy Soft Set (L-IVHFSS), which has been recently presented. It shows how the idea of homomorphism and isomorphism on L-IVHFSS is working and few concomitant theorems are proved. In order to maximize the utility value in future cloud computing, an automated negotiation framework based on Adaptive Neuro-Fuzzy Behavioral Learning (ANFBL) is presented in [37] to quickly reach agreement in conflicting requirements among cloud providers and service consumers. Another decision-making application of lattice-ordered multi-fuzzy soft set for forecasting is presented in [38]. In [39], a hybrid fuzzy clustering technique using Salp Swarm Algorithm (SSA) is introduced and compared to other well-known clustering algorithms. As an application, it also provides a novel hybrid Automobile Insurance Fraud Detection System in which undersampling is performed by the proposed fuzzy clustering algorithm to balance the dataset before classification.

Security is a major concern that has attracted significant research efforts. The study in [40] focuses on providing an effective security protocol for low-powered automatic identification systems. The protocol is verified to reveal its effectiveness and resiliency using SPAN security tool. Towards a generic, robust, secure and resilient intrusion detection system for Industrial Internet of Things (IIoT), the authors of [41] incorporate Roll Forward Validation and Classification and Regression Trees (CART) to find anomalies in the water treatment process. Underwater sensor network is another promising technology that can help in offshore data collection and surveillance. This enables a wide range of notable applications such as environmental monitoring, pollution detection, disaster prevention, underwater communications, assisted navigation, etc. In [42], the authors employ unsupervised learning to detect anomalies through the social behavioral correlation among sensors and long-short term memory deep learning networks. Unlike current credit-scoring system, which is based on the financial history of individual or organization, the work in [43] presents a more precise credit scoring system which incorporates legacy credit score (based on financial history) and emotional/social credit score. For healthcare systems, a new architecture based on blockchain is proposed in [44] to address the mutual trust of patients and healthcare personnel in data stores.

A number of papers address optimization in Vehicular Ad hoc Network (VANET) [45], cognitive radio

networks [46], wireless sensor network [47], and Edge Computing [48]. Paper [45] surveys routing algorithms among vehicles and presents a mobicast routing version using a genetic algorithm to establish effective communication among nodes, with great improvement in the performance. The work in [46] describes an energy efficient multi-relay cognitive radio network with focus on optimization of energy consumed during data transmission using techniques like Particle Swarm Optimization (PSO), Particle Swarm Optimization with Aging Leader and Challengers (ALCPSO), Human behavior based Particle Swarm Optimization (HPSO) and Whale Optimization Algorithm (WOA). Another intelligent clustering technique is proposed in [47] to choose the optimal position of multiple base stations in wireless sensor network to increase the lifetime with limited energy resources. In [48], a genetic algorithm based multi-site application partitioning algorithm (GGA-MSO) is presented to automatically decide which computational load can be offloaded to the edge nodes in edge computing. To address the scalability and survivability of sensors in IoT and wireless sensor network, a novel graph-based architecture design is described in [49]. In [50], a new secure and efficient scheme is proposed for location update of the mobile users in network-based localized mobility management (proxy MIPv6).

In conclusion, this special issue would not have been possible without the help of many people. As guest editors, we would like to take this opportunity to thank the authors for their contributions and the reviewers for their invaluable comments and timely responses. We would also like to thank the JIFS Editor-in-Chief and staff for their support during the preparation and production of this special issue.

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