

Guest Editorial

Soft computing and intelligent systems: Techniques and applications

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This special issue is composed of a collection of selected papers presented at the Fifth International Symposium on Intelligent Systems Technologies and Applications (ISTA'19) that was organized in association with Springer, Germany and IOS-Press, Netherlands. ISTA'19 was co-affiliated with the International Conference on Applied Soft computing and Communication Networks (ACN'19), held in Trivandrum, Kerala, India during December 18–21, 2019. The Symposium brought together researchers in related fields and provided a venue to explore and discuss various aspects and recent advances in the area of intelligent systems technologies and applications. It offered an excellent opportunity for the presentation and discussion of interesting new research results, which contributed to effective dissemination and transfer of knowledge.

Included in this special issues are 50 selected papers covering topics pertaining to the application of soft computing and computational intelligence techniques to a wide spectrum of issues in the areas of image processing and computer vision, natural language processing, pattern recognition, biometric identification, security systems and data encryption, cloud computing, control systems, and network design.

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Several papers in this special issue have addressed natural language processing. Contribution [1] describes a technique for solving the word sense disambiguation using combinatorial particle swan optimization. A multi-document summarization technique proposed in [2] is based on the integration of regression and topic-based models to improve the reported results. Sentiment analysis of social media data is an evolving area in natural language processing in recent years. Several machine learning algorithms [3] are compared for imbalanced learning of sentiment polarity as a tool to understand the opinions of participants in social media. An automated genre-based sentiment lexicon is proposed in [4] to address the challenge due to variation in sentiments across multiple domains. Another important related area due to the explosive growth of online information is using recommendation systems to filter information in activities such as watching videos and movies, tourism and traveling, as well as food and restaurants. In [5], the researchers developed a system that combines social factors such as trust and reputation to determine influential users in cross domain group recommender systems.

Another vital area is pattern recognition and visual computing. A computationally and storage efficient method is presented in [6] for recognizing human activities from depth videos. A more accurate, time and cost-effective ensemble machine learning is proposed in [7] for recognition of coal category from

66 microscopic images. The identification of landmark
67 features in retinal fundus photograph such as optic
68 disc (OD) is of high prognostic significance in diag-
69 nosing various ophthalmic diseases. In [8], a fully
70 convolutional neural network framework is proposed
71 for the localization of optic disc based on the under-
72 lying architecture of YOLOv3. Automatic separation
73 and classification of tumors in ultrasound images is
74 difficult due to the noisy and low contrast nature
75 of the image. A proposed evolutionary intelligence
76 method [9] is invariant to scale changes and does not
77 require an operator defined initial region of interest.
78 A layered approach is described in [10] for deploying
79 live video surveillance with a deep learning strat-
80 egy to detect elephants and mitigate the problem
81 of human-elephant conflict in rural areas of India.
82 A study in [11], proposed to develop a system to
83 support a psychologist to understand the participant
84 performance in a trail making test, which is a cog-
85 nitive impairment test used for understanding the visual
86 attention during a visual search task. Another prob-
87 lem addressed in this special issue related to scene
88 understanding and exploration is the target search
89 problem using a fuzzy-based system to predict the
90 salient locations in an image for visual attention [12].
91 The algorithm described in [13] aims to detect local-
92 ized edges in noisy images without duplicate and
93 integrating them into meaningful object boundaries.

94 Signal processing and speech analysis are active
95 fields that have received great interest in many appli-
96 cations. In [14], the authors utilized speech cues
97 represented by excitation source features, voice qual-
98 ity features, and prosodic features to identify patients
99 affected by a vital neurodegenerative condition of
100 Parkinson disease (PD) from healthy individuals
101 who have no history of such disorder. Two machine
102 learning classification techniques (random forest and
103 support vector machine) have been evaluated using
104 a Parkinson's database from the University of Cali-
105 fornia Irvine (UCI) Machine Learning repository. A
106 cascade of two deep-learning architecture is proposed
107 in [15] for accent identification. The model has been
108 developed and tested on common voice datasets with
109 five popular English accents: India, Australia, US,
110 England, and Canada. In [16], a random kitchen sink
111 based approach is proposed for music-speech classi-
112 fication using temporal and spectral features achiev-
113 ing scores comparable to other methods reported in the
114 literature. Acquiring and processing brain signals to
115 understand students concentration may have a great
116 impact on education. A case study presented in [17]
117 analyzes the influence of practicing Yoga on the

118 concentration levels of engineering students. Under-
119 water acoustics poses several challenges that attracted
120 increasing attention to address problems such as sen-
121 sors sensitivity, sound intensity measurement, and
122 target localization. The authors of [18] propose to
123 enhance the fiber optic hydrophone sensitivity by
124 varying parameters as demonstrated through analyti-
125 cal results. Another interesting problem is addressed
126 in [19] where a hybrid architecture that performs mul-
127 tiple transforms of digital signals such as Discrete
128 Fourier Transform (DFT), Discrete Cosine Trans-
129 form (DCT), Discrete Sine Transform (DST), and
130 Discrete Wavelet Transform (DWT) was proposed.
131 The designed architecture produces output of trans-
132 form sequence in order and may be used to handle
133 large sized transforms by repeatedly using fixed size
134 architecture for a large number of points without
135 increasing the number of processing elements.

136 Security and digital forensic represent several
137 challenges that have attracted significant research
138 efforts. With the availability of powerful image
139 editing tools, manipulating images to change their
140 content is becoming a concern. Image integrity and
141 forgery detection are addressed in [20] using deep
142 textural features from Local Binary Pattern (LBP)
143 map. Benchmarking the proposed methodology is
144 reported using four datasets (CASIA v1.0, CASIA
145 v2.0, CUISDE, and IFS-TC). Information hiding in
146 digital images is another important issue in data secu-
147 rity. A novel technique with high payload is presented
148 in [21] for hiding confidential messages in encrypted
149 images while enabling separate image recovery and
150 information extraction. The test results show high
151 embedding capacity with 100% restoration of cover
152 images and extraction of secret information. Biomet-
153 ric identification is addressed in [22, 23]. In [22],
154 the authors propose a deep learning approach for an
155 emerging biometric trait using tongue print identifica-
156 tion based on the remarkable success of convolutional
157 neural networks for feature extraction and pattern
158 recognition. A dataset is also created for testing the
159 proposed approach. The approach in [23] targets
160 face recognition in unconstrained environment where
161 images are affected by various types of occlusion.
162 A multi-biometric cryptosystem is presented in [24]
163 for safe and secure cloud authentication mechanism.
164 Outsourcing data and computation to the third-party
165 cloud servers brings multifarious security and privacy
166 challenges. In [25], an improved algorithm is pro-
167 posed for secure outsourcing of matrix multiplication
168 to minimize the execution burden without sacrific-
169 ing the confidentiality and integrity of the inputs and

170 outputs. The theory of algebraic hyperstructures has
171 many application including cryptography. In [26],
172 the authors propose the concept of fuzzy hyperlattice
173 ordered group.

174 Transferring digital images over the network is
175 susceptible to various types of attacks including
176 cropping, JPEG compression, median filtering, Gaus-
177 sian blur noise, rotation, and salt & pepper noise.
178 In [27], the researchers propose a method for digital
179 image watermarking based on a combination of arti-
180 ficial neural networks and advanced encryption and
181 decryption technique to provide copyright protection
182 and security to digital bank cheque images. Wire-
183 less sensor networks are widely deployed in many
184 applications for monitoring environments. A major
185 concern in such networks is the secure and accu-
186 rate communication of aggregated data. In [28], a
187 cluster based method is proposed for confidential-
188 ity and integrity of concealed data aggregation in
189 wireless sensor networks. The proposed method uses
190 Elliptic Curve Cryptography-based Elgamal addi-
191 tive homomorphic encryption scheme for providing
192 confidentiality and integrity. A nonce reuse/misuse
193 resistance authentication encryption technique for
194 better security bounds on modern TLS Cipher Suites
195 and QUIC (Quick UDP Internet Communications)
196 based Web Servers was used in [29]. Exploration of
197 sensitive information retrieved from cloud databases
198 is addressed in [30] where the authors present
199 a homomorphic encryption approach that allows
200 cloud servers to respond to queries while preserving
201 privacy.

202 With the increasing popularity of speech recogni-
203 tion applications such as Alexa, Google Home, and
204 Cortana, voice user interfaces (VUIs) are becoming
205 common to interact with smartphones and consumer
206 products. In [31] a prototype, known as GEORGIE,
207 is used to achieve novel means of interaction inspired
208 by the principles of hypnotherapy (a discrete interface
209 ensuring that end-users' privacy is not compromised).
210 Malicious software such as viruses automatically
211 evolve to evade popular anti-malware scanners. Evo-
212 lutionary algorithms are utilized in [32] to mutate
213 the timid virus with a simple code evasion strategy
214 to generate authentic variants of the malware. Dis-
215 tributed denial of service (DDoS) is one the notable
216 threats in computer and network security during the
217 past decade. It occurs when multiple machines gen-
218 erate massive amount of traffic to attach a specific
219 target. In [33], a high scalable Spark streaming-based
220 distributed and real-time DDoS detection system is
221 proposed using k-means clustering algorithm. An

222 improved method based on particle swan optimiza-
223 tion to solve the tradeoff among the conflicting
224 objectives in intrusion detection systems is described
225 in [34].

226 Several articles in this special issue have addressed
227 the design of optimal solutions for a variety of
228 applications. In [35], the authors propose a multi-
229 objective optimization model to reduce delay and
230 energy consumption in vehicular fog computing
231 (VFC). The results reveal superiority of the proposed
232 VFC framework over generic cloud platforms. The
233 approach in [36] applies unsupervised machine learn-
234 ing techniques based on fuzzy c-means++ clustering
235 algorithm for designing routing protocol in wireless
236 sensor networks with low power consumption. The
237 growing number of nodes in wireless sensor net-
238 works require that architectures maintain low-power
239 consumption per-node to comply with energy guar-
240 anty acceptable network lifetime. In [37], the authors
241 propose to optimize the length of the mobile sink's
242 traveling path to reduce the delay during data gath-
243 ering in large-scale wireless sensor networks. An
244 optimal data storage hosting model for multi-cloud
245 environments using Sugeno-type fuzzy inference sys-
246 tem that selects the appropriate storage type by
247 considering the users' purpose and nature of usage
248 in a cost-effective way was proposed in [39]. The
249 study in [40] introduces a novel and efficient L-band
250 log-periodic spiral antenna array design in radio inter-
251 ferometry for synthesis imaging.

252 An intelligent autonomous navigation system for
253 unmanned aerial vehicles (UAV) in randomly chang-
254 ing complex environments is described in [41]. Road
255 accidents in developing countries are increasing at
256 an alarming rate. A case study presented in [42]
257 develops a prediction model for road accidents in
258 the State of Haryana, India using machine learning
259 technique. Data mining and knowledge discovery has
260 significant applications using medical and biological
261 datasets. The study in [43] identifies an optimal
262 subset of relevant features by integrating ReliefF and
263 correlation feature selection techniques. Several opti-
264 mization paradigms have been inspired from nature.
265 A new modification of Moth-Flame Optimization is
266 described in [44] by adding the concept of orthogo-
267 nality in order to improve the performance for global
268 optimization. Many complex real-world problems
269 may be modeled using graphs. In [45], the authors
270 present a link prediction model using topological
271 feature extraction based on a geodesic distance mea-
272 sure. Another approach presented in [46] improves
273 the performance of nature-inspired Spotted Hyena

Optimizer through the combination of oppositional learning concept with mutation operator. In [47], the authors describe a new scalable parallel architecture to improve the performance of Galactic Swarm Optimization algorithm that was inspired from the motion of stars and galaxies under the influence of gravity. An application of meta-heuristic based Elitist Teaching Learning Based Optimization to nonlinear fractional order proportional integral derivative (PID) controller for tracking maximum power in photo-voltaic systems is presented in [48]. In [49], an improved multiverse optimization (IMVO) assisted global maximum power point tracking (MPPT) algorithm is presented for partially shaded photovoltaic system to obtain maximum power. A comprehensive review and classified list of more than 50 studies of strange behavior of nonlinear dynamic systems is presented in [50] to enable prevention of blackouts, disasters, and failures.

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