Editorial

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Computational intelligence (CI) usually refers to the ability of a computer to learn a specific task from data or experimental observation. The principal constituents of CI are Fuzzy Logic (FL), Evolutionary Computation (EC), Machine Learning (ML) and Probabilistic Reasoning (PR), etc.

The development of CI systems was inspired by observable and imitable aspects of intelligent activity of human beings and nature. The essence of the systems based on CI is to process and interpret data of various nature so that CI is strictly connected with the increase of available data as well as the capabilities of their processing, mutually supportive factors. Without them, the development of this field would be almost impossible, and its application practically marginal. That is why these techniques have especially developed in recent years. Developed theories of CI have been quickly applied in many fields of engineering, data analysis, forecasting, biomedicine and others. They are used in image and sound processing and identifying, signal processing, multidimensional data visualisation, steering of objects, analysis of lexicographic data, requesting systems in banking, diagnostic systems, expert systems and many other practical implementations.

This special issue focuses upon the latest developments, trends, research solutions and applications of CI to modelling and engineering problems with effective use of fuzzy logic control, neural networks, biology inspired optimisation techniques, etc.

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

The contents of the selected seven articles are described briefly as follows.

The paper titled 'Intelligent system for feature selection based on rough set and chaotic binary grey wolf optimisation', by Ahmad Taher Azar, Ahmed M. Anter and Khaled M. Fouad, proposes a robust hybrid dynamic model for feature selection called RS-CBGWO-FS, which is a combination of rough set (RS), chaos theory and binary grey wolf optimisation (BGWO). GWO parameters are estimated and tuned by using ten various chaotic maps. Five complex medical datasets are used in the evaluation experiments. The selected datasets have various uncertainty attributes and missing values. The overall result indicates that RS-CBGWO-FS with the Singer and piecewise chaos maps provide better effectiveness, minimal error, higher convergence speed and shorter computation time.

The paper titled 'Time-sensitive clustering evolving textual data streams', by Mohamed Ammar, Adel Hidri and Minyar Sassi Hidri, proposes a new document clustering approach adapted to a stream of text data and tests it on news articles datasets. A distributed representation of words is used, and a bottom-up approach is taken to represent documents as vectors on a unit hyper-sphere. The proposed approach gains its roots from the SPherical K-Means (SPKM) algorithm and its underlying mixture of von-Mises Fisher (vMF) distributions. The proposed approach yields comparable results to baseline batch algorithm for stable data streams and superior results for rapidly evolving data streams.

The paper titled 'An efficient binary whale optimisation algorithm with optimum path forest for feature selection',

by Ahmed Samy, Khalid M. Hosny and Abdel-Nasser H. Zaied, proposes a new binary whale optimisation algorithm for feature selection. This optimisation algorithm is based on the behaviour of the whales. The optimum-path forest (OPF) technique is used as an objective function. This function is much faster than the other classification techniques. The proposed algorithm binary whale optimisation algorithm is evaluated using five well-known datasets of colour images. The proposed algorithm outperforms the existing binary whale optimisation algorithms. The performance of the proposed algorithm is compared with the well-known optimisation algorithms such as Particle Swarm Optimisation Algorithm (PSOA), Firefly Algorithm (FFA), Gravitational Search Algorithm (GSA), Binary Harmony Search (BHS), Binary Clonal Flower Pollination Algorithm (BCFA), Binary Cuckoo Search Algorithm (BCSA), and Binary Bat Algorithm (BBA) where the obtained results clearly show the superiority of the proposed algorithm in terms of classification accuracy, number of selected features and execution times.

The paper titled 'An implementations method for Arabic keyword tendency using decision tree', by Hasan Hashim, El-Sayed Atlam, Ahmad Reda Alzighaibi and Malik Almaliki, introduces a new method to extract Arabic keywords from corpora based on their recurrent changes in a document over given periods of time using a decision tree. The new approach is applied on a new dataset field (computer science) which makes it different from traditionally used methods. For training data, the authors extracted the attribute values of 450 nouns that were collected from 2825 articles of Arabic Wikipedia dumps and Alhayah newspaper (2015–2017) that discussed computer science topics. For testing data, 480 proper nouns were extracted from 975 articles of Arabic Wikipedia dumps and Alhayah newspaper (2015–2018) and then classified using a decision tree approach. The comparison between the manually classified results and the evaluation of the decision tree results reveal that F-measures of decreasing, relatively constant and increasing classes were 0.188, 0.789 and 0.877, respectively, which indicates that the effectiveness of the proposed method has been achieved for the test data.

The paper titled 'A multi-functional BCI system for exigency assistance and environment control based on ML and IoT', by Mayank Kumar Singh, Indu Saini and Neetu Sood, implements a simple multifunction BCI system for the environment control and exigency assistance by just using single channel electroencephalogram (EEG). In the proposed model, environment control is achieved through Internet of Things (IoT) as a function of the cognitive state of the person while for exigency assistance served as a function of Event Related Potential (ERP) generated during oddball paradigm. Hardware was based on Arduino microcontroller (AMC) designed for controlling environment. Different Machine Learning (ML) algorithm was used and observed for training the classifiers. Weighted k-Nearest Neighbour (Wk-NN) algorithm trained classifier delivers the best result, with an accuracy of 98.3% to detect ERP and 95% accuracy for cognitive state detection. The simple, low cost prototype system was implemented in practice for environment control and exigency assistance.

The paper titled 'Arabian horse identification based on whale optimised multi-class support vector machine', by Ayat Taha, Ashraf Darwish, Aboul Ella Hassanien and Ahmed ElKholy, proposes a biometric identification approach for Arabian horse identification based on the optimised Multi-Class Support Vector Machine (MCSVM). The identification approach is performed on three phases, viz. (1) feature extraction, (2) classification, and (3) optimisation of the classification. The feature extraction phase uses Histogram of Oriented Gradient (HOG) to extract features vectors from the muzzle print image of the Arabian horses, which are then stored in the database with its labels. The second phase is the classification phase which uses MCSVM for training and testing classification. Finally, in the optimised MCSVM phase, three different swarms, viz. Particle Swarm Optimisation (PSO), Grey Wolf Algorithm (GWA) and Whale Optimisation (WO) are used to optimise MCSVM parameters to enhance the identification accuracy of the Arabian horse. The results obtained show that the polynomial kernel of MCSVM achieves high accuracy 93.2% compared with linear and Radial Basis Function (RBF) kernels and increases to 97.4% with WO algorithm, which achieves the best accuracy compared with PSO and GWA.

The paper titled 'Intelligent approach for large-scale data mining', by Khaled M. Fouad and Doaa L. El-Bably, presents an integration of three methods, viz. optimised principal component analysis (OPCA), optimised enhanced extreme learning machine (OEELM), and stratified sampling, called OPCA-EELM2SS, to provide intelligent and enhanced large-scale data mining. By using OPCA, a proper number of principal components (PCs) is achieved by using particle swarm optimisation (PSO), which is necessary to transform the high dimensional spaces into low dimensional data. OPCA provides a good representation of large-scale datasets by using the stratified sample, the sample with a perfect distribution of categories, to select the optimal components with the minimum computation time. By using OEELM, the optimal number of hidden nodes in ELM is exploited to build a single hidden layer feedforward neural network (SLFN) to obtain the optimised enhanced ELM. The proposed approach is tested by using 19 benchmark datasets. The experimental results demonstrate the effectiveness of the proposed approach by performing different experiments for classical PCA and independent component analysis, which are integrated with the enhanced ELM using different evaluation criteria. For more reliability, the proposed approach is compared with many previous methods used in the domain of selecting the optimal number of hidden nodes of ELM and in the domain of dimensionality reduction by feature selection techniques.

The Guest Editors would like to thank all the authors for submitting their manuscripts in this special issue. We also acknowledge the reviewers for their contributions in reviewing the papers and providing constructive and useful comments to the authors. Finally, we specially thank the Editor-in-Chief of *Int. J. Computer Applications in Technology* (*IJCAT*), Prof. Quan Min Zhu (University of the West of England, UK), for his great help and support in organising and coordinating the publication of this special issue.