

Guest Editorial Preface

Special Issue on Concepts, Modelling, and Applications of Fast Learning Using Soft Computing

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Soft Computing has numerous real-world applications in domestic, commercial, and industrial scenarios. It enables solutions for the problems that are either unsolvable or are too time-inefficient to solve with the hardware platforms. Soft computing amalgamates mathematical and computer science concepts; sometimes referred to as Computational Intelligence. It covers the fundamentals of neural networks, fuzzy logic, rough sets, and genetic algorithm. This in turn offers the superiority of human-like problem-solving capabilities.

This special issue, “Concepts, Modelling, and Applications of Fast Learning Using Soft Computing,” conducts extensive research of concepts, algorithms, models, and applications that contribute towards soft computing. The objective is to provide a mechanism that fosters the learning capabilities of soft computing while including competent fields of study, inclusive of- fuzzy logic, machine learning, probabilistic reasoning, evolutionary computation, perceptron learning, differential algorithm, meta-heuristics, swarm intelligence, ant colony optimization, particle optimization, bayesian networks, artificial neural networks, and expert systems.

This special issue of the *International Journal of Fuzzy System Applications* (IJFSA), IGI Global, has received a total of 26 articles, out of which 10 articles have finally been accepted that cover a range of aspects of Soft Computing. Each of these articles has undergone a rigorous double-blinded peer-review process, prior to being accepted for the special issue.

The first paper is “COVID-19 Lesion Segmentation and Classification of Lungs CTs Using GMM-Based Hidden Markov Random Field and ResNet 18” by Rajeev Kumar Gupta, Pranav Gautam, Rajesh Kumar Pateriya, Priyanka Verma, and Yatendra Sahu. The authors covered that one of the most extensively utilized methodologies for diagnosing and detecting the presence of the COVID-19 virus is Reverse Transcription-Polymerase Chain Reaction (RT-PCR). However, some limitations are associated with the RT-PCR that can be solved using the radiology imaging-based concept. To detect Covid at the earlier stage, this work introduces a methodology based on Computed Tomography (CT), segmentation of lung CT techniques using medical imaging. It is the initial step to segment the infection caused by the virus in the lungs and then analyze the lungs CT. This study offers a novel Hidden Markov Random Field based on the Gaussian Mix Model (GMM-HMRF) for

binary classification, combined with a modified ResNet18 based deep architecture to achieve better performance.

K Susheel Kumar and Nagendra Pratap Singh have presented retinal images over DRIVE dataset that contain information about the retina's blood vessel structure to predict retinal diseases such as diabetics, obesity, and glaucoma in the paper "Retinal Blood Vessel Segmentation Using a Generalized Gamma Probability Distribution Function (PDF) of Matched Filtered." Segmentation of accurate retinal blood vessels is a challenging task in the low background of retinal images. Therefore, the authors have proposed a Generalized Gamma Distribution Probability Distribution Function to extract the accurate vascular structure on the retinal images. The approach is divided into pre-processing, generalized gamma distribution kernel, and post-processing steps. The conversion of a colored retinal image into a grayscale image using PCA is followed by the CLAHE method and the Toggle Contrast method to enhance grayscale images of the retina. The proposed matched filter of generalized gamma distribution generates the MFR images. The post-processing step extracts the thick vessels and thin retinal blood vessels using the optimal threshold technique.

In "Influence Maximization for MOOC Learners Using BAT Optimization Algorithm," Kirti Aggarwal and Anuja Arora have discussed the ubiquitous behaviour of Massive Open Online Courses (MOOCs) for online learning that has proven its importance specially in the Covid period. These platforms facilitate learners for peer support by communicating through the discussion forum. The objective of this research is to analyse learners' social network to find the seed learners that maximizes the influence spread in the network and avoid the influence maximization process of getting stuck in local optima. Henceforth, extensive experiments are performed using social network topological characteristics to build an effective objective function for the influence maximization problem, and BAT optimization algorithm is employed to achieve global optimum results to find out top influence spreader in course communication network. Efficient results are obtained by the proposed approach which will help MOOC portals for substantial performance identification of influential learners as compared to ego-centric influential learner identification outcome.

Arjun Singh, Surbhi Chauhan, Sonam Gupta, and Arun Kumar Yadav, in their paper, "Intrusion Detection System Using Deep Learning Asymmetric Autoencoder (DLAA)," have explored that existing intrusion detection technology is unable to manage today's complex and volatile network abnormal traffic without taking into account the detection technology's scalability, sustainability, and training time. A new deep learning method is presented to address these issues, which has used an unsupervised non-symmetric convolutional autoencoder to learn the dataset features. Furthermore, a novel method based on a non-symmetric convolutional autoencoder and a multi-class SVM is proposed. The KDD99 dataset is used to create the simulation. In comparison to other approaches, the experimental outcomes suggest that the proposed approach achieves good results, which considerably lowers training time and enhances the IDS detection capability.

In "A Framework for Topic Evolution and Tracking Their Sentiments With Time," Rahul Pradhan and Dilip Kumar Sharma have stated that during an ongoing pandemic, people rely on online communication to remain connected as a precautionary measure to maintain social distancing. When we have no one on our side to listen and console us in a state of fear and dilemma, try to find comfort in the anonymity of social media. Tracking real-time changes in sentiments are quite difficult as it could not correlate well with human understanding and emotions, which changes with time and many other factors. Collecting sentiments from users on search results, news articles, paintings, photographs are nowadays common. This is a more robust and effective method as traditional ways do not rely on a lot of retrospectives. Here, data collected from Twitter on Covid-19 undergoes Topic Modelling to detect sentiment analysis. Results from this experiment using the proposed methodology are promising and give valuable insights.

Amanpreet Kaur, Govind P Gupta, and Sangeeta Mittal, in their paper, "Energy Efficient Node Localization Algorithm Based on Gauss-Newton Method and Grey Wolf Optimization Algorithm:

Node Localization Algorithm,” have described node localization process as a crucial prerequisite in the area of wireless sensor networks. The algorithms for the node localization process can be either range-based or range-free. Range-free algorithms are preferred over range-based ones, due to their cost-effectiveness. DV-Hop along with its variants is normally a well-liked range-free algorithm because of its straightforwardness, scalability, and distributed nature, but it has some disadvantages such as poor accuracy and high-power utilization. To deal with these limitations, the authors introduce an algorithm, called GWOGN-LA to improve accuracy by applying Grey-Wolf Optimization and Gauss-Newton method. The proposed algorithm restricts the forwarding of packets in order to limit energy consumption. Simulation results show that the given proposal outperforms other state-of-art algorithms in terms of accuracy and power consumption.

In “Optimization of Hopfield Neural Network for Improved Pattern Recall and Storage Using Lyapunov Energy Function and Hamming Distance: MC-HNN,” Jay Kant Pratap Singh Yadav, Zainul Abidin Jaffery, and Laxman Singh have proposed a multi-connection-based Hopfield Neural Network (MC-HNN) based on the hamming distance and Lyapunov energy function to address the limited storage and inadequate recalling capability problems of HNN. The Lyapunov energy function and hamming distance are used to recall correct stored patterns, corresponding to noisy test patterns during the convergence phase. The proposed method also extends the traditional HNN storage capacity by storing the individual patterns in the form of etalon arrays through the unique connections among neurons. They have achieved the average recall success rate of 100% for bit map images with a noise level of 0, 2, 4, 6 bits, which is a better recall success rate than traditional and genetic algorithm-based HNN methods, respectively.

Shikha Mehta, Mukta Goyal, and Dinesh Saini, in “Efficient Bitcoin Mining Using Genetic Algorithm based Proof of Work,” show that blockchain requires to validate the block with confirmed transactions from the unconfirmed pool of transactions through miners. Miners pick up the transactions from the pool of unconfirmed transactions approximately more than 2000 and solve the algorithmic puzzle i.e. also known as proof of work within a limited period of time. To optimize the time for blockchain mining proposes a Genetic Algorithm-based Block Mining (GAMB) approach to fetch the transactions from the unconfirmed pool of transactions in order to validate the block within a limited period of time. It is a population-based algorithm that attempts to solve the proof of work for multiple transactions in parallel. The performance of GAMB is evaluated for transactions from 1000 to 5000.

In “Comparative Study of Principle and Independent Component Analysis of CNN for Embryo Stage and Fertility Classification,” Anurag Sinha, Tannisha Kundu, and Kshitiz Sinha, have shown the applications of neural networks in clinical practice for reproduction procedure enhancement. In Embryology, fetal abnormality early-stage detection and diagnosis is one of the challenging tasks and thus, needs automation of tomography and ultrasonic imaging. Also, interpretation and accuracy in the medical imaging process are very important for accurate results. This paper applies deep convolution MultiLayer Perceptrons (MLP) for the embryo fetus classification based on the input ages for the early diagnosis, also optimized the algorithm based on the principle and independent component analysis for the optimization of the algorithm and the data set for in-depth, feature extraction and classification accuracy. The main finding is to show how optimization of data and MLP model through ICA and PCA give more accurate results independently for the fertility classification.

Resham Arya, Ashok Kumar, Megha Bhushan, and Piyush Samant, in their paper “Big Five Personality Traits Prediction Using Brain Signals” talks about the brain activity for identification of emotions that are generally influenced by the personality of an individual. Similar to emotions, there exists a relationship between personality and brain signals. These brain signals could be of a mentally healthy person or someone having psychological illness as well. In this paper, the relationship between personality and psychologically ill subjects is briefly presented. Following this, an analysis of physiological signals (EEG) is also done for more understanding of personality prediction.

ASCERTAIN – a multimodal database for implicit personality and recognition, is considered. It contains EEG recordings and self-annotated big five personality values of 58 students. Some time and frequency domain features are extracted and then put into various classifiers to predict the personality in five dimensions. This analysis will enable researchers to apply this process to patients suffering from mental illness.

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