Editorial

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Biographical notes: Dilip Kumar Pratihar is a Professor at IIT Kharagpur, India. He received his PhD from IIT Kanpur, India, in 2000. He is recipient of University Gold Medal, A.M. Das Memorial Medal and Institution of Engineers' Medal. He completed his post-doctoral studies in Germany under the AvH Fellowship Programme. His research areas include robotics, soft computing and manufacturing science. He has published more than 100 papers. He is author of book *Soft Computing* and editor of *Intelligent and Autonomous Systems*. He is in the editorial board of five international journals. He has been elected as an FIE and MIEEE.

Most of the real-world problems are complex, ill-defined, and thus, difficult to model mathematically. They are generally associated with imprecision and uncertainty also. Therefore, conventional mathematical tools (come under the umbrella of hard computing) may not be able to solve these problems efficiently. Soft computing, a big family consisting of tools like genetic algorithms, fuzzy logic technique, neural networks, and others, may provide some feasible solutions to these problems. In order to solve real-world problems effectively, it may be necessary to use either two/three soft computing tools or one soft computing tool along with a hard computing tool together, which are known as hybrid computing schemes. In this special issue, six papers related to hybrid computing schemes in various fields of applications have been included.

In the first paper, a hybrid computing scheme has been proposed. Here, softwares related to Computational Fluid Dynamics (CFD), such as Gambit for mesh generation and Fluent for carrying out hydro-dynamic analysis, have been combined with an optimisation tool, namely Genetic Algorithm (GA). In this hybrid computing scheme, the GA and CFD softwares have been combined seamlessly and data transfer takes place without any manual intervention. The shapes of 2D symmetric nozzle have been optimised using this hybrid computing scheme. Corresponding to optimal shapes of the nozzle, streamline patterns have been developed and variations in pressure loss factors have been studied.

The second paper introduces a Particle Swarm Optimisation (PSO)-based image denoising approach, which is found to be faster than Wavelet Transform-based Thresholding Neural Network (WT-TNN). Moreover, it yields better performance of denoising as compared to WT-TNN approach. The proposed approach with bior6.8 wavelet filter is found to outperform the WT-TNN approach, in terms of computational efficiency and edge preserved image enhancement.

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The third paper deals with design and stability analysis of neuro-fuzzy sliding mode controller, which consists of two parts: fuzzy logic system and neural network. The fuzzy logic system is used to control reaching phase dynamics and a feed-forward neural network is utilised to keep the system states on the sliding surface. Initially, the fuzzy logic system dominates over the other and as the system moves from reaching phase to sliding phase, the neural network becomes more active and consequently, a hybrid scheme is obtained. The performance of the developed controller is tested to regulate a second-order nonlinear uncertain system through computer simulations. It is found to reduce chattering and improve transient response.

Radial Basis Function Neural Networks (RBFNNs) to model input-output relationships of Metal Inert Gas (MIG) welding process in both forward and reverse directions have been developed in the fourth paper. The structure of a RBFNN is decided by the number of its hidden neurons, as those of input and output neurons are known beforehand. The number of hidden neurons has been kept the same with that of clusters made in the dataset. As the performance of a clustering algorithm depends on some parameters, a GA has been used to obtain the optimal number of clusters. Moreover, a back-propagation algorithm has been utilised to optimise the parameters of neural networks. Thus, a hybrid computing scheme has been developed, which is found to give better performance compared to a single GA.

A data mining framework has been proposed in fifth paper for prediction of disease outcome. It consists of two stages: clustering and classification. For clustering of the data, *k*-means algorithm has been utilised, and two clusters are obtained, namely cluster-0 and cluster-1. Instances in cluster-0 do not have disease symptoms and cluster-1 consists of instances with disease symptoms. Incorrectly classified instances are deleted and the remaining instances are utilised to build the classifier using C4.5 decision-tree algorithm with *k*-fold cross-validation method. The performance of the proposed framework has been tested on eight datasets in terms of its accuracy, sensitivity and specificity measures, and it is found to perform better than some existing techniques available in the literature.

An intelligent hybrid computing scheme has been developed in the last paper using wavelet transform and Probabilistic Neural Network (PNN), and its effectiveness has been tested for recognition of Hindi Paired Word (HPW). This network is a combination of radial basis layer and competitive transfer function layer, which picks up the maximum probabilities as a final result. The collected data related to HPW have been pre-processed using accurate endpoint detection algorithm. Wavelet transform has been utilised for feature extraction of the samples. The PNN has been used as a classifier. The proposed hybrid computing scheme is found to produce good recognition rate.

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