Editorial

Zhihua Cui

Complex System and Computational Intelligence Laboratory,
Taiyuan University of Science and Technology,
Taiyuan, Shanxi, 030024, China
Email: zhihua.cui@hotmail.com

Bijaya Ketan Panigrahi

Department of Electrical Engineering,
IIT Delhi, New Delhi, 110016, India
Email: bijayaketan.panigrahi@gmail.com

Biographical notes: Zhihua Cui is a Professor of Computer Science and Technology, and Director of Complex System and Computational Intelligence Laboratory at Taiyuan University of Science and Technology, China. He is a member of IEEE and ACM, and a senior member of China Computer Federation (CCF) and member of Chinese Association of Artificial Intelligence (CAAI). He received his PhD in System Engineering from Xi'an Jiaotong University, China in 2008, and BSc in Computer Science from Taiyuan Heavy Machinery Institute in 2003. He is the founding Editor-in-Chief of *International Journal of Bio-inspired Computation*. His research interest includes computational intelligence, stochastic algorithm, and combinatorial optimisation. He has published over 60 peer reviewed journal papers, 60 peer reviewed full conference papers, and five books in computational intelligence.

Bijaya Ketan Panigrahi is working as an Associate Professor in the Department of Electrical Engineering, IIT Delhi, India. He is a senior member of IEEE. He received his PhD in Electrical Engineering from Sambalpur University, Odisha, India in 2004. He is a Fellow of INAE, India. He is the Editor-in-Chief of *International Journal of Power and Energy Conversion*. His research interest includes computational intelligence, evolutionary algorithms, power system operation and planning, digital signal processing and its application to various domain of engineering. He has published more than 100 peer reviewed journal papers, 105 full conference papers, and two edited books.

Hybridisation of intelligent systems is a promising research field of modern artificial/ computational intelligence concerned with the development of the next generation of intelligent systems. A fundamental stimulus to the investigations of hybrid intelligent systems (HIS) is the awareness in the academic communities that combined approaches will be necessary if the remaining tough problems in artificial/computational intelligence are to be solved. Recently, HIS are getting popular due to their capabilities in handling several real world complexities involving imprecision, uncertainty and vagueness.

We believe that the series of works in this special issue provide a useful reference for understanding new trends on hybrid intelligent systems. In total, six papers have been

selected to reflect the call thematic vision. The contents of these studies are briefly described as follows.

In the paper, "Hybrid decision support system using PLSR-fuzzy model for GSM-based site-specific irrigation notification and control in precision agriculture", Mohapatra and Lenka propose a PLSR and fuzzy logic based hybrid smart decision support system (DSS) for crop specific irrigation notification and control in precision agriculture. The proposed DSS model can work on real-time mode using National Instruments LabVIEW. This hybrid smart DSS prediction algorithm is implemented in a test land located in Bhubaneswar, the eastern region of India. A comparative analysis is also performed by calculating RMSE, RSE, MSE, RPD and algorithm running time. Crop wise evapotranspiration is also calculated using Blaney–Criddle method. The model is attached to the DSS and crop wise required evapotranspiration is found out by considering the planting date. This technique compensates the amount of water that may be lost through evapotranspiration and many other criteria by utilising the proposed model to predict future irrigation requirements by taking weather, soil, water, and crop data into considerations.

Software defection prediction is not only crucial for improving software quality, but also helpful for software test effort estimation. As is well-known, 80% of the fault happens in 20% of the modules. Support vector machine is an advanced method in non-liner classification problems that fits the defection classification. However, studies show that the value of parameters of SVM model has a remarkable influence on its classification accuracy and the selection process lacks theory guidance that makes the SVM model uncertainty and low efficiency. Therefore, in the paper, "A model for software defect prediction using support vector machine based on CBA", Rong et al. propose a CBA-SVM software defect prediction model, which take advantage of the non-linear computing ability of SVM model and optimisation capacity of bat algorithm with centroid strategy (CBA). Firstly, the parameters of the SVM are optimised by CBA, and then use the optimised SVM to predict the defective modules of software. Through the experimental comparison with other models, CBA-SVM is proved to have a higher accuracy.

Condition monitoring of any engineering system requires various faults to be introduced into the system so as to capture the intelligence by monitoring the mechanical/electrical signals from the system. For large, complex systems like the subsystem of an aircraft, introducing faults is highly expensive and therefore not advisable. In the paper, "Scalable fault models for diagnosis of synchronous generators", Gopinath et al. check the effectiveness of our approach using 3 kVA and 5 kVA synchronous generators to emulate the behaviour of small working mode (SWM) and actual system respectively. In this work, authors linearise the features from the SWM and actual system in a higher dimensional space using locality constrained linear coding (LLC) to make them linearly separable. Subsequently, authors select the system-independent features using principal component analysis (PCA) to make the fault models robust across the systems. Support vector machine is used as a back-end classifier. The proposed LLC-PCA system outperforms the baseline system with an absolute improvement in alarm (fault) accuracy of 34.47%, 15.72%, and 18.90% for the R, Y, and B phase faults respectively.

Hazardous materials transport network optimisation is the basis of ensuring the safety of hazardous materials transport. Considering the uncertainty of much basic information in hazardous materials transport system, this paper proposes the multi-objective chance

constrained programming model for hazardous materials transport network under uncertainty optimisation theory framework. In the paper, "Optimising hazardous materials transport network based on multi-objective hybrid intelligence algorithm", Ma et al. build the multi-objective hybrid intelligent algorithm to solve the model. The algorithm applies the stochastic simulation and fuzzy simulation to simulate uncertain parameters, adopts the priority coding way to code chromosome, applies the chromosome marker selection strategy to complete the selection operation, adopts the priority index crossover operator to ensure offsprings inheritance and advantages for the parent, uses the single parent vicinal swap method to complete mutation, and applies the exclusive method to build dominating sets. Finally, the case study shows the model and algorithm are feasible.

In the paper entitled with "Shuffled frog leaping algorithm based on enhanced learning", Zhao et al. propose a new variant of shuffled frog leaping algorithm, which generates a virtual general centre frog that is related to the optimal frog of each memeplex. The algorithm can utilise the superior information of each memeplex, enhance the mutual learning and use the average centre of optimal frog. In the processing of evolution, the optimal frog of sub-memeplex learns from the general centre frog and the best frog of the whole memeplex; then it enhances the learning ability of the worst frog from general centre frog. On the one hand, the evolution increases the information share and exchange among each memeplex; on the other hand, it raises the convergence velocity. The experiment results show that the new approach has better convergence speed and searching global optimum, comparing with the standard shuffled frog leaping algorithm, PSO and other variants.

Simulated annealing (SA) algorithm is a popular intelligent optimisation algorithm, but its efficiency is unsatisfactory. To improve its efficiency, in this paper, "Swarm simulated annealing algorithm with knowledge-based sampling for travelling salesman problem", Wang et al. present a swarm SA algorithm (SSA) by exploiting the learned knowledge from searching history. In SSA, a swarm of individuals run SA algorithm collaboratively. Inspired by ant colony optimisation (ACO) algorithm, SSA stores knowledge in construction graph and uses the solution component selection scheme of ACO algorithm to generate candidate solutions. Candidate list with bounded length is used to speed up SSA. The effect of knowledge-based sampling is verified on benchmark travelling salesman problems. Comparison studies show that SSA algorithm has promising performance in terms of convergence speed and solution accuracy.

For this special issue, we received abundant responses from researchers. Among them, only six papers were accepted and are included in this special issue. Overall, we feel that these papers cover quite a spectrum of important research field.