SPECIAL ISSUE ON
SOFT COMPUTING FOR MODELING AND SIMULATION

AJITH ABRAHAM[1] AND CRINA GROSAN[2]

[1]IITA Professorship Program, School of Computer Science and Engineering
Chung-Ang University, Seoul 156-756, Korea
[2]Department of Computer Science
Babes-Bolyai University, Cluj-Napoca, 3400, Romania

It is well known that the intelligent systems, which can provide human like expertise such as domain knowledge, uncertain reasoning, and adaptation to a noisy and time varying environment, are important in tackling practical computing problems. In contrast with conventional artificial intelligence techniques which only deal with precision, certainty and rigor the guiding principle of soft computing is to exploit the tolerance for imprecision, uncertainty, low solution cost, robustness, partial truth to achieve tractability, and better rapport with reality [Zadeh, 1998]. Soft computing is a consortium of technologies involving approximate reasoning, function approximation, learning capabilities, and a methodology for systematic random search and optimization. These capabilities are combined in a complementary and synergetic fashion. Soft computing has evolved not only from a theoretical point of view but also with a large variety of realistic applications to consumer products and industrial systems. Applications of soft computing have provided the opportunity to integrate human-like vagueness and real-life uncertainty into an otherwise hard computer programs.

The fourth International Conference on Hybrid Intelligent Systems (HIS'04) gathered individual researchers who see the need for synergy between various intelligent techniques. This special issue comprising of eight papers is focused on using advanced soft computing tools for modeling and simulation. The papers are organized as follows.

In the first paper, *Figueiredo et al.* propose a novel hybrid neuro-fuzzy model for automatic learning of actions taken by agents. The main objective of this new model is to provide an agent with intelligence, making it capable, by interacting with its environment, to acquire and retain knowledge for reasoning. This new model, named Reinforcement Learning Hierarchical Neuro-Fuzzy Politree (RL-HNFP), and its improved version (RL-HNFP+) applies binary hierarchical partitioning methods, together with the Reinforcement Learning (RL) methodology. The RL-HNFP model and its extension (RL-HNFP+) are evaluated in a well known benchmark application in the area of autonomous agents. The results obtained demonstrate the potential of these models, which operate without any prior information, such as number of rules, rules specification, or number of partitions that the input space should have, providing good performance and demonstrating the agent's autonomy.

Unpredictable response time is a common problem in contemporary web servers. Long response delays substantially cut company revenues owing to the large number of aborted e-commerce transactions. In the second paper, *Huang et al.* present an admission control model and a traffic scheduler scheme of the web server under a proportional differentiated service, embedding a time series predictor to estimate the traffic load of the client in the next measurement time period. The experimental results indicate that the proposed models can effectively realize proportional delay differentiation service in multiclass Web servers.

Protein Folding Prediction (PFP) is essentially an energy minimization problem formalised by the definition of a fitness function. Several PFP models have been proposed including the Hydrophobic-Hydrophilic (HP) model, which is widely used as a test-bed for evaluating new algorithms. The calculation of the fitness is the major computational task in determining the native conformation of a protein in the HP model. In the third paper, *Hoque et al.* present a new efficient search algorithm (ESA) for deriving the fitness value requiring only $O(n)$ complexity in contrast to the full search approach, which takes $O(n^2)$. The improved efficiency of ESA is achieved by exploiting some intrinsic properties of the HP model, with a resulting reduction of more than 50% in the overall time complexity when compared with the previously reported *Caching Approach,* with the added benefit that the additional space complexity is linear instead of quadratic.

A-scan ultrasound biometry, commonly referred to as an A-scan, is routine type of diagnostic test. A-scans from ultrasonic testing of long shafts are complex signals. The discrimination of different types of echoes is of importance for non-destructive testing and equipment maintenance. *Lee and*

Estivill-Castro in the fourth paper propose an ensemble of classifiers to achieve better discrimination accuracy. Authors explored diverse possibilities of heterogeneous and homogeneous ensembles, combination techniques, feature extraction methods and classifiers types to determine guidelines for heterogeneous combinations that result in superior performance.

The Vehicle Routing Problem with Time Windows (VRPTW) is a hard combinatorial problem that has received a lot of attention recently. This interest is due, on one hand to, its wide applicability in real-world cases and practical settings, and on the other hand to its NP-hard aspect. Several models and solving methods, essentially centralised, have been proposed for this problem. *Boudali et al.* in the fifth paper exploited the distributed aspect of VRPs and modelled the problem which proceeds by the interaction between agents. The objective is to dynamically generate coalitions where each coalition corresponds to a vehicle's route. The resulting model is validated using the Solomon's benchmark.

Grosan et al. in the sixth paper propose a hybrid combination of particle swarm optimization and evolutionary algorithm for the well known class of geometrical place problems. Finding the geometrical place can be sometimes a hard task and in almost all situations the geometrical place consists of more than one single point. When compared to a direct evolutionary algorithm approach, the main advantage of particle swarm technique is its speed of convergence. The proposed hybrid method could detect the geometrical place even for difficult problems for which evolutionary algorithms required more time or the particle swarm technique assisted with few sub-populations failed to find the real geometrical place.

Road traffic accidents are among the top leading causes of deaths and injuries of various levels. Ethiopia is experiencing highest rate of such accidents resulting in fatalities and various levels of injuries. *Tibebe et al.* in the seventh paper, propose a decision tree approach to handle a real world application involving road traffic accident analysis for Addis Ababa City (Ethiopia). The research assess the potential applicability of data mining technology specifically decision tree technique to help traffic accident data analysis (accident classification and rule mining) in decision-making process at the traffic office. The reported findings are promising, making the proposed model a useful tool in the decision making process and as a good input for further in-depth research.

Model integration is one of the most important and widely researched areas in modeling decision support systems. In the last paper, Asghar et al. propose a framework for model integration of modular subroutines which has evolved from the decomposition of decision support systems for disaster management. Model integration refers to the integration of different models into a single logical composite model. The dynamic model is based on a selection technique, representation, creation of a domain base and simulation.

Reference

Zadeh, L.A. 1998, "Roles of Soft Computing and Fuzzy Logic in the Conception, Design and Deployment of Information/Intelligent Systems", *Computational Intelligence: Soft Computing and Fuzzy-Neuro Integration with Applications*, O Kaynak, LA Zadeh, B Turksen, IJ Rudas (Eds.), pp. 1-9.

Editor Biographies

Ajith Abraham currently works as a Distinguished Professor under the South Korean Government's Institute of Information Technology Assessment (IITA) Professorship programme at Chung-Ang University, Korea. He is also a visiting researcher of Rovira i Virgili University, Spain and an Adjunct Professor of Jinan University, China and Dalian Maritime University, China. His primary research interests are in computational intelligence with a focus on using evolutionary computation techniques for designing intelligent paradigms. Application areas include several real world knowledge-mining applications like information security, bioinformatics, Web intelligence, energy management, financial modelling, weather analysis, fault monitoring, multi criteria decision-making etc. He has authored/co-authored over 200 research publications in peer reviewed reputed journals, book chapters and conference proceedings of which three have won 'best paper' awards.

He is the Editor of The International Journal of Hybrid Intelligent Systems (IJHIS), IOS Press, Netherlands; Journal of Information Assurance and Security (JIAS), USA; International Journal of Computational Intelligence Research (IJCIR), Neurocomputing Journal, Elsevier Science, The Netherlands; International Journal of Systems Science (IJSS), Taylor & Francis, UK; Journal of Universal Computer Science (J.UCS), Austria; Journal of Information and Knowledge Management, World Scientific, Singapore; Journal of Digital and Information Management (JDIM), Digital Information Research Foundation, India and International Journal of Neural Parallel and Scientific Computations (NPSC), USA. Since 2001, he is actively involved in the Hybrid Intelligent Systems (HIS) and the Intelligent Systems Design and Applications (ISDA) series of annual International conferences. He was also the General Co-Chair of The Fourth IEEE International Workshop on Soft Computing as Transdisciplinary Science and Technology (WSTST05), Japan and the Program Co-Chair of the Inaugural IEEE Conference on Next Generation Web Services Practices, Seoul, Korea. He received PhD degree from Monash University, Australia. More information at: http://ajith.softcomputing.net

Crina Grosan currently works as an Assistant Professor in the Computer Science Department of Babes-Bolyai University, Cluj-Napoca, Romania. Her main research area is in Evolutionary Computation, with a focus on Evolutionary Multiobjective Optimization and applications, Genetic Programming and Particle Swarm Optimization. Crina Grosan authored/co-authored over 50 papers in peer reviewed international journals, proceedings of the international conferences and book chapters. She is co-author of two books in the field of computer science. She proposed few Evolutionary techniques for single and multiobjective optimization, a genetic programming technique for solving symbolic regression problems, digital circuits and so on. Dr. Grosan is the co-editor for a book on Swarm Intelligence for Data Mining, which will be published by Springer Verlag, Germany. She is member of the IEEE (CS), IEEE (NN) and ISGEG. She received her PhD degree from Babes-Bolyai University, Romania.