
Editorial

Nian Zhang

Department of Electrical and Computer Engineering,
University of the District of Columbia,
4200 Connecticut Avenue, NW 20008,
Washington DC, USA
E-mail: nzhang@udc.edu

Haibo He

Department of Electrical, Computer, and Biomedical Engineering,
University of Rhode Island,
Kingston, RI 02881, USA
E-mail: he@ele.uri.edu

Biographical notes: Nian Zhang is currently an Assistant Professor in the Department of Electrical and Computer Engineering at the University of the District of Columbia, Washington DC. Her research interests include computational intelligence, neural networks, and renewable energy. She is an Associate Editor of the *IEEE Transactions on Neural Networks*, and Co-Editor of the *Advances in Neural Networks – ISNN2009*. She has served on the organising committees and program committees of many international conferences.

Haibo He is currently an Assistant Professor in the Department of Electrical, Computer, and Biomedical Engineering at the University of Rhode Island. His research interests include computational intelligence and their applications in critical engineering fields. He has served regularly on the organising committees and program committees of many international conferences. He has also served as a Guest Editor for several international journals. He is an Associate Editor of the *IEEE Transactions on Neural Network* and *IEEE Transactions on Smart Grid*, and also serves on the Editorial Board of several journals. He received the National Science Foundation's CAREER Award in 2011.

The Sixth International Symposium on Neural Networks (ISNN'09) was held from May 26 to 29, 2009 in Wuhan, China. This symposium was a great success and provided a high-level international forum for researchers and educators to present the state-of-the-art research in neural networks and related fields. To highlight the success of this conference, we edited this special issue for the *International Journal of Systems, Control and Communications* (IJSCC). We chose nine papers from over 1000 papers submitted to the ISNN'09, as these papers clearly reflect the high quality of the presentations at the conference while capturing the spirit of our theme, 'Pattern Recognition and Intelligent Systems and Control', for this special issue.

The focus of this special issue is to present the latest development in pattern recognition and intelligent systems and control. The occurrence of large amounts of hyperspectral data brings important challenges to storage and processing. It has become critical to develop new spectral imaging techniques based on reducing the dimensionality of the data and clustering the result in moving toward classification of the data. On the other hand, the brain-machine-interface systems have received increased attention to control the artificial devices in recent times as a means to overcome complicated temporal signal modelling concerns. This calls for intensive investigation of the structure, capabilities, and constraints of contemporary distributed control systems, as well as the development of new systematic design and analysis tools that stem from the fusion of concepts from control, immune network, and optimisation. Furthermore, flexible robot research is an emerging area, which can imitate an ever increasing number of human functions. The recent proliferation of flexible robots technology, and the inherent deformation challenges has resulted in a need for advanced dynamic control model and fuzzy logic controllers for effective control strategies for numerous emerging distributed control systems. We hope that this special issue will foster further development of ideas that unite concepts from the fields of pattern recognition, control, intelligent systems and control, and will increase the common ground for researchers in these areas.

The aim of this special issue is to compile a coherent collection of recent results rooted in multiple disciplines, so that it can inspire further work in pattern recognition and intelligent systems and control. Topics of interest range from clustering of hyperspectral data to feature-based hybrid categorisation and moving object detection, to adaptive immune network intrusion detection model, and to dynamic robots model and fuzzy logic controllers for robot navigation.

The selected paper can be organised into the following three coherent sections.

First, since feature extraction is an important part for pattern recognition, we selected four papers on this topic. Specifically, the paper by Xu et al. proposes to investigate the performance of reducing the dimensionality with diffusion maps and clustering the lower dimensional data on real hyperspectral image data. The clusterings obtained from k -means and fuzzy ART on the lower dimensional representation of the data are compared to the clustering produced by Anglo's proprietary method. Detailed simulation analyses based on several benchmarks have provided important suggestions that the proposed methods are promising in addressing the complicated hyperspectral data and identifying the minerals in core samples. In another paper, Cui et al. present a computationally cost-effective moving object detection method based the cloud model and background subtraction. A background difference is used for detecting fast moving object in the outdoor condition. The paper by Shukla et al. proposes a hybrid neural-fuzzy and genetic algorithm for image learning. The use of clustering is to reduce the training data into manageable number. A varied neural network method is adopted to find out the most efficient combination of the various parameters that gives the maximum efficiency of the fuzzy logic. The mixture use of genetic algorithm further optimising the parameters of the fuzzy logic by mixing the best possible values and optimise the solution. Irfan et al. propose a feature-based hybrid methodology that combines projected clustering and weighted linear model for supplier categorisation in supply base management. Unlike nonparametric models, decision makers only rank the relative importance of criteria, rather than specifying the degree of relativity. This is implemented by giving weights to the criteria, with the largest weight indicating the highest meaning and importance.

Second, there are three papers which represent different important avenues of research in intelligent system and control. Among these, Zhang and Fu propose a present adaptive immune network intrusion detection, a method for online detecting intrusion model which demonstrates adaptability to continuously changing environments, dynamically learning fluid patterns of ‘self’ and predicting new patterns of ‘non-self’. The paper by Huang et al. investigated the relationship between the spike trains and arm’s movement stance will be identified using the new computing model of a newly developed computational model called Liquid State Machine (LSM). Simulation results show that this improvement is suitable for LSM to the modelling of spiking signals with continuous output and it can act more robust in harsh cases, such as the Pathological Synchrony and Over-Stratification. One of the advantages of using the extended LSM is to transfers low dimensional irregular input spike data to the high dimensional regular data conveniently. Secondly it can conveniently extract the temporal information hiding in the spikes under a frame of parallel computations. The paper by Figueroa et al. studied the structure at infinity for control of linear systems with delays writing the transfer function of the system like a quotient of quasypolynomials. Various simulation studies on the disturbance decoupling problem are conducted in this work to demonstrate the improved performance.

Third, robotics and automation has become a major topic within the AI community for a very long time. In this special issue, we selected two related papers to highlight some of the recent developments along this direction. The paper by Park and Zhang proposes an approach for the robot to follow the edge of obstacles only until finding the exit to the challenging scenarios, such as U-shape obstacles. Simulation results show that our approach beats the traditional fuzzy logic controller in both escaping ability from U-shaped obstacle and steering ability. In the other paper, Zhao and Ruan propose a dynamic control model for a flexible two-wheeled self-balancing robot based on Lagrange’s equation and the theory of dynamics and mechanics. One new aspect is that the robot uses a spring to imitate the human lumbar with particular emphasis on the flexible joints and steel body structure of the robot. An improved Boltzmann machine is presented which combines the best characteristics of the Hopfield network and Boltzmann machine. The experimental results show that the system is stable and effective and the real robot can be said to exhibit human like balance control.

In summary, the selected nine papers in this special issue are highly representative in their coverage of the wide range of critical problems toward the goal of developing natural intelligent systems for pattern recognition and intelligent system control, and we hope that they can showcase the latest research achievements as presented at the conference, motivate future research directions, and inspire young scholars to do collaborative, groundbreaking, and interdisciplinary work in AI research from both theoretical and applied perspectives.

Before closing this editorial, we would like to express our deep gratitude to many reviewers who helped us in the peer-review process for this special issue. We received many worthy papers but unfortunately we could not accommodate all of them, also due to time and scheduling considerations. We would also like to thank Dr. Ge Guo, Editor-in-Chief of the *International Journal of Systems, Control and Communications* (IJSCC), who gave us the opportunity to edit this Special Issue and ensured that the process is kept under control with his guidance and prompt response to each of our requests.