Editorial

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Biographical notes: Huaguang Zhang, IEEE Senior Member, is a Full Professor in the College of Information Science and Engineering, Northeastern University, Shenyang, PR China. He received his BS and MS degrees from Northeastern Electric Power University, Jilin, PR China, in 1982 and 1985, and the PhD degree from Southeast University, Nanjing, PR China, in 1991, respectively. He has authored and coauthored over 300 journal and conference papers, four monographs and co-invented nine patents. He is currently an Associate Editor of both IEEE Transactions on Systems, Man, Cybernetics-*Part B* and Neurocomputing. His main research interests are neural networks-based control, fuzzy control, chaos control, non-linear control, signal processing and their industrial applications. He was awarded the 'Excellent Youth Science Foundation Award', nominated by China Natural Science Foundation Committee, in 2003. He was named the Changjiang Scholar by China Education Ministry in 2005.

Shuzhi Sam Ge, IEEE Fellow, is a Full Professor in the Department of Electrical and Computer Engineering, the National University of Singapore. He received his BS degree from Beijing University of Aeronautics and Astronautics (BUAA), Beijing, PR China, and PhD degree and the Diploma of Imperial College (DIC) from Imperial College of Science, Technology and Medicine, University of London, London, UK in 1986 and 1989, respectively. He has authored and co-authored three books *Adaptive Neural Network Control of Robotic Manipulators* (World Scientific, 1998), *Stable Adaptive Neural Network Control* (Kluwer, 2001) and *Switched Linear Systems: Control and Design* (Springer-Verlag, 2005) and over 300 international journal and conference papers. His current research interests are adaptive control, hybrid systems, sensor fusion, intelligent systems and system development.

The field of neural networks is now extremely vast and inter-disciplinary, drawing interests from researchers in many different areas such as engineering, mathematics, physics and computer science. Neural networks provide an intelligent approach for solving complex problems that might otherwise not have a tractable solution. Applications of neural networks include associative memory, function approximation,

combinatorial optimisation and non-linear system modelling and control. Neural networks themselves are typically non-linear, and many different kinds of neural network models have already been proposed for solving different problems. Researches on dynamics of neural networks and neural networks-based control in non-linear control system still attract much attention from the academic community.

Recently, rapid progress in the research community has generated many new results and powerful tools. The objective of this special issue is to present state-of-the-art results in dynamic modelling, control and applications and dynamics of neural networks. The idea is to consolidate the recent advances and to move on to the next level for future development.

The call for papers for the special issue was well received, and a total of 23 papers were submitted. The papers were reviewed by experts in the area and eight of these papers are appearing in this issue. The topics have covered a broad range, from the dynamics of neural networks, modelling and control of a class of non-linear systems to such areas as algorithm researches for neural networks. The papers in the special issue present just a selection of interesting new work in neural network and we hope that they inspire yet more. We describe these papers in this issue briefly below.

Two papers deal with the stabilisation/stability problems of neural networks.

X. Lou and B. Cui: Stabilisation of cellular neural networks with time-varying delays and reaction-diffusion terms.

This paper by X. Lou and B. Cui from PR China deals with the stabilization problem of a class of cellular neural networks with time-varying delays and reaction-diffusion terms. By designing a controller based on the feedback response and constructing proper Lyapunov functionals with respect to the space variables, the stabilisation conditions of delayed cellular neural networks with reaction-diffusion terms are derived. The results make a preparation for the research about stabilisation of delayed recurrent neural networks.

Z. Wang, G. Chen and J. Feng: Global stability of a class of Cohen-Grossberg neural networks with delays.

This paper by Z. Wang, G. Chen and J. Feng from PR China is concerned with the global asymptotic stability of a general class of Cohen-Grossberg neural networks with both multiple time varying and distributed delays. The characteristic of the method used in this paper is to suitably construct a Lyapunov functional dealing with the distributed delay instead of using the well-known Jensen inequality, which leads to a less conservative stability result. Some stabilisation problems of neural networks can be similarly dealt with using the present method.

Three papers are in the algorithm improvements and implementations of neural network.

X. Meng, J. Wang, Y. Pi and Q. Yuan: A novel Artificial Neural Network training method combined with Quantum Computational Multi-Agent System theory.

In this paper by X. Meng, J. Wang, Y. Pi and Q.Yuan from PR China, a new Artificial Neural Network (ANN) model is constructed, which is based on multi-agent system theory and quantum computing algorithm. All nodes in this ANN are presented as quantum computational agents, and these quantum computational agents have learning ability. A novel ANN training algorithm is proposed via implementing quantum computational multi-agent system reinforcement learning. This ANN has powerful parallel-work ability and its training time is shorter than classical algorithm.

S.P. Joy Vasantha Rani, P. Kanagasabapathy and L. Suganthi: Field Programmable Gate Array based floating point hardware design of recursive k-means clustering algorithm for Radial Basis Function neural network.

This paper by S. P. Joy Vasantha Rani, P. Kanagasabapathy and L. Suganthi from India is concerned with the hardware design of Radial Basis Function neural network using the proposed k-means algorithm. Hardware implementation of this kinds of neural network will give much faster training than traditional processors and also relatively inexpensive. The design has been done with VHDL language, and tested and synthesized with the help of Virtex-II pro device.

S.N. Pandey, S. Tapaswi and L. Srivastava: Online security monitoring and analysis using Levenberg Marquardt algorithm-based neural network.

In this paper by S. N. Pandey, S. Tapaswi and L. Srivastava from India, a Levenberg-Marquardt (LM) algorithm-based feed-forward multi-layer perceptron neural network has been proposed, which uses the second order derivative for error reduction. The LM-based neural network provides a practical approach for implementing a pattern-mapping task. Since the proposed LM algorithm is extremely fast and accurate particularly during testing phase, this can be implemented for online security monitoring and analysis, without performing the contingency selection task. The effectiveness of the proposed LM-based approach for security monitoring and analysis has been demonstrated by computation of bus voltage magnitudes and voltage angles for line-outage contingencies at different loading conditions in IEEE 14-bus system.

Three papers are devoted to the control problems of a class of non-linear systems.

M. Hatti and M. Tioursi: Application of neural network approach for Proton Exchange Membrane fuel cell systems.

This paper by M. Hatti and M. Tioursi from Algeria aims at proposing a neural network model for a fuel cell system based on proton exchange membrane technology by using a Quasi-Newton method and designing a neural controller using Levenberg-Marquardt algorithm. By modelling the Proton Exchange Membrane (PEM) fuel cell system, a neural network controller is constructed to control the power under the assumption that any system of production is subjected permanently to load steps change variations. The PEM fuel cell neural network model is proposed using a Quasi-Newton method, and Levenberg-Marquardt training algorithm, activation functions and their causes on the effectiveness of the performance modelling are discussed. The Quasi-Newton neural networks control is described, and results from the analysis as well as the limitations of the approach are presented.

M. I. Solihin and Wahyudi: Sensorless anti-swing control of automatic gantry crane using dynamic recurrent neural network-based soft sensor.

This paper by M. I. Solihin and Wahyudi from Malaysia proposes a sensorless anti-swing control method for automatic gantry crane system because sensing the payload motion of a real gantry crane is troublesome and often costly. The soft sensor is designed based on dynamic recurrent neural network as a state estimator. Thus, a dynamic recurrent neural network is trained using input-output data to estimate payload swing angle from trolley acceleration and input voltage of trolley actuator. An experimental study using lab-scale automatic gantry crane is carried out to evaluate the effectiveness of the proposed sensorless anti-swing control.

Y. Luo and Q. Wei: Robust adaptive tracking controller for non-affine non-linear systems with state time-varying delay and unknown dead-zone.

This paper by Y. Luo and Q. Wei from P. R. China presents a novel neural network-based dead-zone compensation scheme for a class of non-affine Multiple-Input Multiple-Output non-linear systems with state time-varying delay. A static neural network is introduced to approximate and adaptively cancel the unknown non-linearity and unknown dead-zone of the sub-systems. The control law and adaptive laws for the weights of the hidden layer and output layer of the Neural Network are established by guaranteeing the stability of the whole closed-loop system, and the tracking error is proved to be uniformly ultimately bounded.

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