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EDITORIAL

The neural paradigm for complex systems: new algorithms and applications

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This special issue of Neural Computing and Applications includes 14 original articles, which are extended versions of selected papers from the Eighth International Symposium on Neural Networks (ISNN 2011).

ISNN 2011 provided a high-level international forum for scientists, engineers, and educators to present the state-of-the-art of neural networks research and its applications in diverse fields. The symposium featured plenary speeches given by worldwide renowned scholars, regular sessions with broad coverage, and some special sessions focusing on interesting topics for the neural networks scientific community.

Based on the recommendation of symposium organizers and reviewers, a number of authors were invited to resubmit an extended version of their conference papers for this special issue of Neural Computing and Applications. All these journal articles went through the same rigorous review procedure by at least three independent experts before being accepted for publication.

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This special issue focuses on new hot topics in the field of Neural Networks for Complex Systems including new algorithms and applications. The selected 14 articles can be indeed divided into two main groups. The first group consists of five theoretical papers dealing with some emerging and important issues regarding complex neural architectures (D. Gong et al. and Z. Wang et al.) and advanced adaptive dynamic programming schemes for optimal control (D. Wang et al., R. Song and H. Zhang, C. Song and J. Ye). The second group contains nine application papers focusing on various complex systems real-world applications and involving new computational intelligence approaches: they include power system management (T. Lan et al., D. Liu and T. Huang, Z. Liu et al., D. Qian et al.), time series prediction (H. He et al.), acoustics and artificial vision (X. Song et al. and J. Qu et al.), path-planning (C. Xiong et al.), and position tracking (H. Dong et al.).

The special issue starts with the first group of papers and with the contribution by D. Gong et al., dealing with the synchronization problem in general complex networks: A new criterion is proposed on purpose resulting in a simpler and less computational demanding method for synchronization analysis, especially if compared to the approaches appeared in the literature so far. Then, in the work by Z. Wang et al., the global asymptotic stability problem for a class of recurrent neural networks with multi-time scale is studied. Some novel stability criteria, also consistent from a biological viewpoint, are proposed on the basis of linear matrix inequality technique for the concerned neural network, which sufficiently consider the inhibitory actions in the different memories.

Some relevant contributions in the adaptive dynamic programming field also belong to this first group. D. Wang et al. propose a novel neural network-based iterative adaptive dynamic programming (ADP) algorithm for

solving the optimal control problem of a class of nonlinear discrete-time systems with control constraints. By introducing a generalized non-quadratic functional, the iterative ADP algorithm through globalized dual heuristic programming (GDHP) technique is developed to design the optimal controller. R. Song and H. Zhang present a new iteration algorithm to solve the finite horizon optimal control problem for a class of time-delay affine nonlinear systems with known system dynamic: the convergence and accuracy issues of the algorithm are discussed from a theoretical perspective. C. Song and J. Ye finally extend the numerical method in previous works already appeared in the literature in order to suitably deal with Hamilton–Jacobi–Isaac (HJI) equations derived from robust receding horizon control schemes of uncertain fuzzy systems with constraints. The developed finite difference scheme with sigmoidal transformation is a stable and convergent algorithm for solving HJI equations.

Then, the special issue continues with the second group that starts with the paper by T. Lan et al., where a particle swarm optimization-based approach is presented for optimal sitting and sizing of aggregator controlled public car park for electric vehicle (EVs) fleets in modern power system, which is convenient to the optimal charger control of plug-in hybrid EVs, as demonstrated by several performed experiments. T. Huang and D. Liu apply in their work an intelligent optimization method to the challenge of intelligent price-responsive management of residential energy use, with an emphasis on home battery connected to the power grid. On purpose, they propose a self-learning scheme, based on the adaptive critic design paradigm that can learn from the user demand and the environment for the residential energy system control and management. Z. Liu et al., always in the field of power management system field, propose an efficient method for short-term load forecasting based on multiwavelet transform and multiple neural networks. D. Qian et al. address the load frequency control (LFC) task, which represents one of the most profitable ancillary services of power systems. In their work, they perform the design of a neural sliding mode controller for the LFC issue of power systems presenting the governor dead band nonlinearity problem, which strongly degrade the performances in non-controlled situations.

As aforementioned, some other application-oriented contributions appear in this same second group of papers. The first one, by H. He et al., is about time series prediction. They develop a computational intelligence approach for wind profile prediction focusing on two aspects: first, they investigate the missing value recovery for wind data and then they implement an efficient ensemble learning approach based on multiple neural network models. The second contribution is by X. Song et al. and presents a novel robust constant modulus algorithm for blind adaptive beamforming via the worst-case performance optimization and the oblique projection of signal steering vector. A theoretical analysis of the algorithm in terms of signal-to-interference plus noise ratio is deployed and convergence performance also discussed. In the third paper, J. Qu et al. propose an improved selective attention model, which is designed as a network of spiking neurons of Hodgkin–Huxley type with star-like connections between the central units and peripheral neurons. In this model, peripheral neurons represent the neurons located in the primary visual cortex and they allow the model to suitably consider the orientation preference property therein. The fourth paper, by C. Xiong et al., focuses on the robot path-planning task and develops an ant-colony optimization (ACO)-based approach on purpose. Their technique is composed by two fast cooperating stages, which solve the inherent problem of traditional ACO algorithm by introducing the scent information along the path to direct the ants, also allowing bypassing the limitations occurring with the usual mode of modifying the distance-elicitation function. And then, the last contribution, by H. Dong et al., is about modeling and simulation of high-speed automatic train operation systems. The authors propose an approach based on self-regulating fuzzy control on purpose and they also establish within the work, a simplified multiparticle dynamic model of high-speed train through analyzing the displacement, velocity and acceleration of different particles during the operation, selecting appropriate fuzzy ratio factors according to fuzzy rules so as to calculate the traction/braking forces under the high speeds.

Finally, as guest editors, we would like to thank all authors for their great contributions to this special issue. We also would like to express our sincere appreciation to all reviewers for their time and efforts and to the Neural Computing and Applications editorial board for their substantial support in the whole organizing procedure.