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Editorial

Special issue on hybrid neurocomputing

The concept of intelligence is complex, and thus many theories, definitions and taxonomies has emerged to explain its essence. Their limited success has given rise to the idea that such a multidimensional concept cannot be explained by a single theory. As a result, a multidisciplinary approach has led to remarkable advancement in the theory of intelligence. Accordingly, the necessity to build intelligent systems has resulted in the development of a variety of techniques. Over recent years, several computational intelligence paradigms have been established.

Despite the advances made, progress across the board has been moderate. One reason stems from the relatively slow pace at which work to understand biological intelligence has progressed. Another reason is rooted in the same inertia that has hampered the development of the research on intelligence previously—the reluctance to actively benefit from the achievements of the complementary approaches. Incorporating a hybrid approach would have the following benefits:

- developments across fields share common issues and methods that can be exploited,
- methods developed in different fields may complement the limitations of others and help support the common conceptual framework, and
- different techniques facilitate modeling on different scales of adaptive organization—e.g. symbolic, behavioral, neural.

The Second International Conference on Hybrid Intelligent Systems gathered individual researchers who see the need for synergy between various intelligent techniques. This special issue comprising of nine papers is focused on the hybrid neurocomputing approach and its applications. Papers were selected on the basis of fundamental ideas/concepts rather than the thoroughness of techniques deployed. The papers are organized as follows.

In the first paper, Lee et al. present a performance guided neural network for rapidly self-organizing active network management. Self-organizing is achieved by real-time learning and mapping of patterns using an external performance indicator. The algorithm combines adaptive resonance theory (ART) and learning vector quantization (LVQ) with the performance input. Fast learning by the ART called snap and slower learning by the LVQ called drift, are combined with a semi-supervised learning system. The network is capable of rapid re-learning and re-stabilization according to changes in either the operating environment or the input pattern.

Chen et al. propose a self-growing probabilistic decision-based neural network with applications to anchor/speaker identification in the second paper. The authors

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propose a solution to two major problems in clustering tasks, namely, determining the number of clusters and the initial parameters for learning in self-organizing neural networks.

In the third paper, Youssif and Purdy have used a synergistic approach to build a high-performance signal pattern classifier (GNSPC). Genetic algorithms provide a suitable technique for searching the large space of similarity rules while neural networks ease computing the rule similarity cutoff and evaluating its fitness. This combination provides powerful classification capabilities with tuning flexibility for either performance or cost-efficiency. Learning techniques are employed to set the genetic algorithm global parameters and to obtain training data for the neural network.

Saegusa et al. in the fourth paper propose a nonlinear PCA algorithm that transforms data into principal components, and at the same time, preserves the order of the principal components, performed by a hierarchical neural network. The novelty of this approach is that the user does not need to know the number of principal components in advance.

Aguilar compares the multiple class recurrent neural network approach with the combination of genetic algorithm and random neural network, and gives the advantages of both approaches. With regard to several performance parameters the hybrid approach outperforms the multiple class random neural network model. The study also investigates the objective evaluation and advantages of hybrid and non-hybrid approaches.

In the sixth paper, Tran et al. propose an efficient decision support system for tactical air combat environment using a combination of unsupervised learning for clustering the data and a feed forward neural network to classify the different decision regions. The hybrid decision support system they have developed can solve complex decision-making problems where no information about the decision regions is known a priori.

Cios et al. in the seventh paper present an original application of the network of spiking neurons to image segmentation. A network of spiking neurons is applied for identification of diabetic retinopathy images, via clustering. The Hebbian-type-learning rule with temporal correlation shows potential benefits in the clustering process.

Prudencio and Ludermir present an approach for selection of time-series forecast models. The contribution of paper is in the application of meta-learning for time-series prediction. The performance is compared with several known learning techniques. The proposed meta-learning method appears as a high-potential function approximation technique in the field of hybrid neurocomputing.

In the last paper Sisman-Yilmaz et al. present a temporal neuro-fuzzy system to provide an environment that keeps temporal relationships between the variables and to forecast the future behavior of data by using fuzzy rules. The rule base contains temporal Takagi–Sugeno–Kang fuzzy rules. The system takes the multivariate data and the number of lags needed to construct the unfolded model in order to describe a variable and predicts the future behavior. Experimental results show that the proposed model achieves online learning and prediction on temporal data.

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stipulated time. Finally, we hope the reader will share our joy and find this special issue very useful.

Guest Editors
Ajith Abraham, István Jónyer
Department of Computer Science,
Oklahoma State University, *USA*
E-mail address: ajith.abraham@ieee.org

Emilia I. Barakova
Lab. for Dynamics of Emergent Intelligence,
RIKEN Brain Science Institute (BSI), *Japan*

Ravi Jain, Lakhmi Jain
University of South Australia
Adelaide, *Australia*