SPECIAL ISSUE ON RECENT ADVANCES ON BRAIN-INSPIRED INNOVATIVE COMPUTING

SUNG-BAE CHO[1] AND TAKESHI YAMAKAWA[2]

[1]Department of Computer Science
Yonsei University
262 Seongsanno, Sudaemoon-ku, Seoul 120-749, Korea
sbcho@cs.yonsei.ac.kr

[2]Graduate School of Life Science and Systems Engineering
Kyushu Institute of Technology
2-4 Hibikino, Wakamatsu-ku, Kitakyushu 808-0196, Japan
yamakawa@brain.kyutech.ac.jp

Received February 2009

ABSTRACT. *Brain requires the most important scientific endeavor of the 21st century, and the International Conference on Neural Information Processing (ICONIP2007) looks for a clue to reveal and implement the brain functions with an integrated approach. To make an archive on the innovative results presented and discussed at ICONIP2007, this special issue includes extended versions of six selected papers on "Recent Advances on Brain-inspired Innovative Computing" from ICONIP2007, held in Kitakyushu, Japan, 13-16 November, 2007. The papers in this issue have been thoroughly reviewed and revised to give the readers a variety of recent findings on the brain-inspired innovative computing.*

1. **Introduction.** This special issue is composed of six excellent papers which present new insight and models based on the brain function and verify the effectiveness with a variety of interesting real problems. The first three papers mainly focus on the modeling part and tend to be rather theoretical, and the remaining three papers highlight the challenging applications of the new models, ranging from task segmentation in a mobile robot to every day load forecasting for an electric power company.

In the paper entitled *Bifurcation-based Model Construction of a Pyramidal Cell of the Primary Visual Cortex*, Ishiki et al. proposed a physiologically plausible pyramidal cell model of the primary visual cortex which contains many regulating systems of the intracellular calcium ions concentration, and shows the usefulness of the nonlinear dynamical system theory such as global bifurcation and slow/fast decomposition analyses for a construction of the neuron model. In the paper, *Classifying Deep Brain Neuronal Activities by Bursting Parameters*, Chao et al. developed a method for classifying neuronal activities from the deep brain nuclei, subthalamic nucleus (STN) and subtantia nigra (SNr). Analyzing 54 trials of data from Parkinson's patients with seven bursting relevant parameters inducing a classifier of support vector machine with principal component analysis that improves the classification accuracy for 22% on average. In the work *Novel Models for Hourly Solar Radiation Using a 2-D Approach*, Hocaoglu et al. analyzed one year hourly solar radiation data and modeled the general behavior of the solar radiation in a year using a 2-dimensional surface fitting approach. Gaussian surface model with proper model parameters is found to be the most accurate model among the tested analytical models for data characterization.

In *Task Segmentation in a Mobile Robot by mnSOM and Clustering with Spatio-Temporal Contiguity*, Muslim et al. extended their previous study to do task segmentation by applying various clustering methods to the resulting mnSOM without using any prior information. The effectiveness in segmentation with robotic problems was demonstrated. The segmentation performance by the clustering techniques is very close to the upper bound for novel data. While, Cho and Ryu in the work *Classifying 2-Dimentional Point Light Actors' Gender Using Structure-Adaptive Self-Organizing Map*, presented a structure-adaptive self-organizing map which adaptively updates the weights, structure and size of the map, with two physical input features of the movement patterns: positions and velocities of six locations. They have compared the results with those of conventional pattern classifiers and human subjects by obtaining the recognition accuracy, discriminability and efficiency. In the paper, *Next Day Load Forecasting Using Artificial Neural Network Models with Autoregression and Weighted Frequency Bin Blocks*, Kurban and Filik developed two different hybrid approaches based on artificial neural network (ANN) models with autoregressive (AR) method and weighted frequency bin blocks. In the experiments, the results of the AR method applied to all data taken from Turkish electric power company and electricity generation company are used as only additional input for ANN model.

2. **Conclusion.** This special issue cannot stand in a comprehensive and perfect position to represent all the spectrum of brain-inspired computing, and especially it lacks of the incorporation of evolution in the hybrid modeling [1,2]. However, it surely highlights some of the recent developments in the modeling and application of brain-inspired computing in engineering problems. The guest editors hope it would play a role as a milestone, and helpful to academics, scientists, engineers and postgraduates who are working in brain-inspired computing area. Last but not least, we would like to thank all the authors, reviewers and Prof. Yan Shi, Executive Editor of IJICIC, whose kind support makes this special issue possible.

REFERENCES

[1] K.-J. Kim and S.-B. Cho, A unified architecture for agent behaviors with selection of evolved neural network modules, *Applied Intelligence*, vol.25, no.3, pp.253-268, 2006.
[2] K.-J. Kim and S.-B. Cho, Evolutionary ensemble of diverse artificial neural networks using speciation, *Neurocomputing*, vol.71, no.7-9, pp.1604-1608, 2008.