Preface: 3rd International Conference on Fuzzy Logic, Neural Nets, and Soft Computing

Hisao Ishibuchi*
Department of Industrial Engineering, University of Osaka Prefecture, Sakai, Osaka, Japan

This is a special issue on fuzzy neural systems. The papers were mainly selected from the presentations in the 3rd International Conference on Fuzzy Logic, Neural Nets, and Soft Computing (IIZUKA '94) that was held in Iizuka, August 1–7, 1994.

Integration of fuzzy systems and neural systems is an active research area. Many papers were presented in this area at IIZUKA '94, and six papers were selected after the usual review process. Fuzzy systems and neural systems each have their own merits: Fuzzy systems can utilize linguistic knowledge of human experts in the form of fuzzy if-then rules, and neural systems can be trained by numerical input-output data. Many approaches have been proposed for integrating these two systems. Those approaches can be classified into several categories.

One category consists of multilayer feedforward neural networks for fuzzy reasoning. Those neural networks are sometimes referred to as fuzzy neural networks. The first paper, by Horikawa, Furuhashi, and Uchikawa, can be classified in this category. The authors propose a fuzzy neural network architecture based on the truth space fuzzy reasoning approach for automatically acquiring fuzzy rules with linguistic hedge. This architecture is their fifth fuzzy neural network. The second paper, by Lee, Lee, and Park, can be also classified in the same category as the first paper. In it, a new controller design algorithm is proposed based on a neurofuzzy identi-
fier, a feedforward controller, and a feedback controller. The feedback controller is trained by the back-propagation algorithm.

Another category consists of fuzzy reasoning models with learning ability. Those fuzzy models are usually called neurofuzzy models. The third paper, by Ichihashi et al., and the fourth paper, by Watanabe, Kuwata, and Katayama, can be classified in this category. The neurofuzzy model in the third paper is based on a simplified fuzzy reasoning model that is trained by a steepest descent algorithm. The simplified fuzzy reasoning model employs Gaussian membership functions in the antecedent part of fuzzy if-then rules and real numbers in the consequent part. This model can be regarded as a radial basis function network, because each radial basis function corresponds to the antecedent fuzzy sets of a single fuzzy if-then rule. The neurofuzzy model in the fourth paper is a tree-structured radial basis function network. The main advantage of the tree-structured network is its compactness for a large scale problem with many input variables.

Fuzzification of neural networks is another category of integration of fuzzy systems and neural systems. Fuzzy numbers are used for training data and connection weights in fuzzified neural networks. The fifth paper, by Ishibuchi, Morioka, and Turksen, can be classified in this category. In this paper, a learning algorithm of connection weights given as fuzzy numbers is derived in a similar manner to the back-propagation algorithm.

The sixth paper, by Cho, may be classified in another category: a combination of neural systems and fuzzy models. In it, the outputs from several neural networks are aggregated by a fuzzy integral with an ordered weighting averaging operator to obtain final decisions. High performance of the aggregated modular neural network is clearly demonstrated by computer simulations on handwriting character recognition problems.

I am grateful to the referees, to Professor Yamakawa (Chairman of IIZUKA '94), and to Dr. Bonissone (Editor-in-Chief of IJAR). Special thanks go to Professor Turksen; I worked as the guest editor of this special issue during my stay at his laboratory in the University of Toronto.

I hope the readers will find this special issue useful.