International Journal of Innovative Computing, Information and Control
Volume **2**, Number **5**, October **2006**

ICIC International ©2006 ISSN 1349-4198
pp. **985–996**

REVISED GMDH-TYPE NEURAL NETWORK ALGORITHM WITH A FEEDBACK LOOP IDENTIFYING SIGMOID FUNCTION NEURAL NETWORK

Tadashi Kondo and Junji Ueno

School of Health Sciences
The University of Tokushima
3-18-15, Kuramoto-cho, Tokushima 770-8509, Japan
{ kondo; ueno }@medsci.tokushima-u.ac.jp

Received December 2005; revised June 2006

Abstract. *In this paper, a revised Group Method of Data Handling (GMDH)-type neural network algorithm with a feedback loop identifying sigmoid function neural network is proposed. In this algorithm, the optimum sigmoid function neural network architecture is automatically organized so as to minimize the prediction error criterion defined as Akaike's Information Criterion (AIC) or Prediction Sum of Squares (PSS) by using the heuristic self-organization. The structural parameters such as the number of neurons in each layer, the number of feedback loops and the useful input variables are automatically determined using AIC or PSS criterion. Therefore, it is easy to apply this algorithm to the identification problem of the complex nonlinear system and to obtain a good prediction results.*
Keywords: GMDH, Neural network, Sigmoid function, System identification

1. **Introduction.** The Group Method of Data Handling (GMDH)-type neural network algorithms have been proposed in our early works [1,4]. The GMDH-type neural network algorithms can automatically organize the multi-layered neural networks fitting the complexity of the nonlinear system. In these algorithms, the structural parameters such as the number of neurons in each layer, the number of layers and the useful input variables are automatically determined so as to minimize the prediction error criterion defined as Akaike's Information Criterion (AIC) [5] and the optimum neural network architecture is organized by using the heuristic self-organization [6,8] which is the basic theory of the GMDH algorithm [6,9]. On the other hand, the conventional sigmoid function neural network trained using the back propagation do not have the structural identification ability of the neural network architecture and AIC can not be used to determine the optimum neural network architecture due to the non-uniqueness of the connection weights [10,11].

In this paper, we propose a revised GMDH-type neural network algorithm with a feedback loop identifying sigmoid function neural network. In this algorithm, the neural network architecture is automatically organized so as to minimize the prediction error criterion defined as AIC or Prediction Sum of Squares (PSS) [9]. This revised GMDH-type neural network have a feedback loop and the complexity of the neural network architecture increases gradually by the feedback loop calculations so as to fit the complexity of the nonlinear system. The structural parameters such as the number of neurons in