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MEDICAL IMAGE RECOGNITION OF ABDOMINAL MULTI-ORGANS BY RBF GMDH-TYPE NEURAL NETWORK

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Abstract. *In this paper, a Radial Basis Function (RBF) Group Method of Data Handling (GMDH)-type neural network algorithm is proposed and applied to the medical image recognition of abdominal X-ray CT images. In the RBF GMDH-type neural network, two kinds of neuron architectures such as RBF type neuron and polynomial type neuron, are used for self-organizing the optimum neural network architecture and the structural parameters such as the number of layers, the number of neurons in the hidden layers, the optimum neuron architecture and useful input variables are automatically determined so as to minimize the prediction error criterion defined as Prediction Sum of Squares (PSS) by the heuristic self-organization method. In the medical image recognition of the abdominal X-ray CT images, the image densities of the abdominal organs such as the liver, stomach and spleen are very similar each other, and so it is very difficult to recognize the regions of these organs accurately. In this paper, the RBF GMDH-type neural network is applied to the medical image recognition of abdominal organs. The optimum neural networks fitting the image characteristics of these organs are automatically organized using RBF GMDH-type neural network algorithm, and the regions of the abdominal organs are recognized and extracted accurately. The recognition results are compared with those obtained using the sigmoid function type neural network trained using the back propagation algorithm.*

Keywords: Neural network, GMDH, Medical image recognition

1. **Introduction.** The Group Method of Data Handling (GMDH)-type neural network algorithms have been proposed in our early works [1-3]. The GMDH-type neural network architectures are automatically organized using the heuristic self-organization [4,5] and the structural parameters such as the number of layers, the number of neurons in the hidden layers, useful input variables and optimum neuron architectures are automatically determined so as to minimize the prediction error criterion defined as Akaike's Information Criterion (AIC) [6] or Prediction Sum of Squares (PSS) [7]. Furthermore, the GMDH-type neural networks automatically select the optimum neural network architecture from three kinds of neural network such as the sigmoid function type neural network, the radial basis function (RBF) type neural network and the polynomial type neural network so as to fit the complexity of the nonlinear system. The conventional sigmoid function type neural network trained using the back propagation algorithm does not have the structural identification ability for optimum neural network architectures, so we must find the optimum structural parameters such as the number of neurons, the number of layers and the initial values of the weights, and also we must repeat calculations of the back propagation many times. Therefore, in applying the conventional neural network to