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# MULTI-LAYERED GMDH-TYPE NEURAL NETWORK SELF-SELECTING OPTIMUM NEURAL NETWORK ARCHITECTURE AND ITS APPLICATION TO 3-DIMENSIONAL MEDICAL IMAGE RECOGNITION OF BLOOD VESSELS

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Abstract. *In this study, 3-dimensional medical image recognition of the blood vessels in the liver is developed using a revised multilayered Group Method of Data Handling (GMDH)-type neural network self-selecting optimum neural network architecture. A revised GMDH-type neural network algorithm has the ability to self-select optimum neural network architecture from three neural network architectures such as sigmoid function neural network, radial basis function (RBF) neural network and polynomial neural network. The revised GMDH-type neural network also has abilities to self-selecting the number of layers, the number of neurons in hidden layers and useful input variables. Therefore, this algorithm is easy to apply to the practical complex problem because optimum neural network architecture is automatically organized. In this study, this algorithm is applied to medical image recognition of the blood vessels in the liver and it is shown that this algorithm is useful for medical image recognition.*
**Keywords:** GMDH, Neural network, Medical image recognition

1. **Introduction.** In recent years, there have been considerable advances in computational techniques for medical image processing. The medical images generated by multidetector row computed tomography (MDCT) and magnetic resonance imaging (MRI) are widely used in clinical diagnosis. A large number of 2-dimensional section images are generated at once from these modalities such as MDCT and MRI and the generated 2-dimensional section images are too many to be read by the medical doctors for clinical diagnosis of the diseases. Recently, 3-dimensional medical images are generated and utilized for clinical diagnosis instead of a large number of 2-dimensional section images and computer aided diagnosis (CAD) systems using 3-dimensional medical images are developed [1-3]. In the CAD system, the medical image recognition algorithm is very important to recognize and to extract specific organs of the human body [4,5]. Conventional neural networks, such as the sigmoid function type neural network trained using the back propagation algorithm and the radial basis function (RBF) type neural network, have been applied to medical image recognition but conventional neural networks are difficult to apply to medical image recognition because the present algorithm cannot determine the optimum neural network architecture fitting the characteristics of medical images of many kinds of organs and diseases automatically. Group Method of Data Handling (GMDH)-type neural networks, which have been proposed in our earlier works [6-8], can automatically organize the optimum neural network architecture fitting the complexity of the nonlinear system by an heuristic self-organization method [9,10] that is a basic theory of the GMDH algorithm and is one of the evolutional computations. The conventional