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CLASSIFICATION AND MEDICAL DIAGNOSIS USING WAVELET-BASED FUZZY NEURAL NETWORKS

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Abstract. *In this paper, we propose a Wavelet-based Fuzzy Neural Network (WFNN) for classification and medical diagnosis. The proposed WFNN integrates the wavelet transform functions into a fuzzy system. We use non-orthogonal and compactly supported functions as the wavelet neural network (WNN) bases. The goal of the WFNN model combined with WNN is to improve the accuracy of function approximation. An on-line structure/parameter learning algorithm is used in the WFNN. Structure learning is based on the input partitions to determine the number of fuzzy rules and wavelet functions, and parameter learning is based on the supervised gradient descent method to adjust the shape of the membership functions and the connection weights of the wavelet neural networks. Computer simulations were conducted to test the performance and applicability of the proposed system.*
Keywords: Classification, Fuzzy model, Wavelet neural networks, On-line learning

1. **Introduction.** Classification is one of the most frequent decision-making tasks performed by humans. A classification problem occurs when an object needs to be assigned to a predefined group or class based on the observed attributes related to that object. Many problems in business, science, industry, and medicine can be treated as classification problems. Traditional statistical classification procedures, such as discrimination analysis, are built on the Bayesian decision theory [1]. In these procedures, an underlying probability model must be assumed in order to calculate the a posteriori probability upon which a classification decision is made. One major limitation of statistical models is that they work well only when the underlying assumptions are correct. The effectiveness of these methods depends to a large extent on the various assumptions or conditions under which the models are developed. Users must have a good knowledge of both data properties and model capabilities before the models can be successfully applied.

Neural networks [2-5,31] have emerged as an important tool for classification tasks. The vast and recent research on neural classification has established that neural networks are promising alternatives to various conventional classification methods. However, it is difficult to understand the meaning associated with each neuron and each weight in neural networks. A fuzzy entropy measure [6] is employed to partition the input feature space into decision regions and to select relevant features with good separability for the classification