IMPROVING NEURAL NETWORK CLASSIFICATION USING FURTHER DIVISION OF RECOGNITION SPACE

Zhenxiang Chen[1], Bo Yang[1,*], Yuehui Chen[1], Lin Wang[1]
Haiyang Wang[2], Ajith Abraham[3] and Crina Grosan[4]

[1]School of Information Science and Engineering
University of Jinan
106 Jiwei Road, Jinan, Shandong, 250022, P. R. China
{ czx; yangbo; yhchen; wanglin_1983 }@ujn.edu.cn
*Corresponding author

[2]School of Computer Science and Technology
Shandong University
73 Jingshi road, Jinan, Shandong, 250061, P. R. China

[3]Centre for Quantifiable Quality of Service in Communication Systems
Norwegian University of Science and Technology
Trondheim, Norway

[4]Department of Computer Science
Babes-Bolyai University
Cluj-Napoca 400084, Romania

Abstract. *Further Division of Recognition Space (FDRS) is a novel technique used for neural network classification. Recognition space is a space that is defined to categorize data sample after sample, which is mapped by neural network learning. It is divided manually into few parts to categorize samples, which can be considered as a line segment in the traditional neural network classification. In addition, the data recognition space is divided into many partitions, which will attach to different classes automatically. Experiments results using network traffic and intrusion detection data illustrate that the method has favorable performance especially with respect to the optimization speed and classification accuracy.*
Keywords: Classification, Neural network, Recognition space, Further division

1. **Introduction.** Classification is an important research area in data mining. Many classification techniques including decision tree [1, 2], neural network (NN) [3], support vector machine (SVM) [4, 5] and other rule based classification systems have been proposed. Neural network classification, which is supervised, has been proved to be a practical approach with lots of success stories in several classification tasks. However, its training efficiency is usually a problem, which is the current focus in this paper.

Many attempts have been made to speed up the convergence and improve the accuracy of neural network classification. Commonly known heuristic approaches such as momentum [6], variable learning rate [7] lead only to a slight improvement. Better results have been obtained with the artificial enlarging of errors for neurons operating in the saturation region [8]. A significant improvement on realization performance can be observed by using various second order approaches namely Newton's method, conjugate gradient's, or the Levenberg-Marquardt optimization technique [9], which is widely accepted as the most efficient one in the sense of realization accuracy. Generalization ability has been