Chapter VIII

Backpropagation and Kohonen Self-Organizing Feature Map in Bankruptcy Prediction

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ABSTRACT

The back-propagation (BP) network and the Kohonen self-organizing feature map, selected as the representative types for the supervised and unsupervised artificial neural networks (ANN) respectively, are compared in terms of prediction accuracy in the area of bankruptcy prediction. Discriminant analysis and logistic regression are also performed to provide performance benchmarks. The findings suggest that the BP network is a better choice when a target vector is available. Advantages as well as limitations of the studied methods are also identified and discussed.
INTRODUCTION

Artificial neural networks are often classified into two distinctive training types, supervised and unsupervised. Supervised training requires training pairs, that is, input vectors as well as corresponding target vectors. A BP network is a good example of the supervised training type and is the most popular training method in the ANN literature. The reason for the success of the multilayer perceptron (MLP) and its learning algorithm, BP, is that the outputs of the BP network are the estimates of posterior probabilities that have a central role in statistical pattern classification theory (Berardi, 1998).

However, to train supervised networks such as the BP network, we must provide a target vector. In the case of bankruptcy prediction tasks, the target vector is “whether or not a firm has failed” which must be embedded in the supervised training process. But in some situations, especially in today’s fast-changing, real-time-based business environment that demands prompt responses, such extra target information may not be readily available for training. In such circumstances, unsupervised neural networks might be more appropriate technologies to be applied. Unlike supervised networks, unsupervised neural networks need only input vectors for training. Developed by Kohonen (1997, 1982) and many others, the training algorithms for the unsupervised networks modify the algorithm weights to process input vectors into similar output classes (or clusters).

The BP supervised network has been the most widely used network type for bankruptcy prediction. These two different approaches, supervised and unsupervised, should be compared so that the feasibility and effectiveness of diverse neural network algorithms may be better understood. Note that it is somewhat difficult to compare these supervised and unsupervised networks directly because of their radically different orientations. Thus, in this study, we confine ourselves to comparing the BP network and the Kohonen self-organizing feature map, selected as the representative types for the supervised and unsupervised neural networks respectively, in the context of bankruptcy prediction. Quadratic discriminant analysis (QDA) and logistic regression are also performed to provide performance benchmarks. QDA was used because the group covariance matrices failed to pass an equality of variance test (SAS Proc Discrim).

Since the BP network (supervised) utilizes one more critical variable, the target vector, in the training process, it might be expected that the BP network would be more accurate than the Kohonen self-organizing feature map (unsupervised). However, the focus of this study is to compare prediction accuracy between the two neural networks (and the two other statistical techniques). In
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