INTRODUCTION

Over the last decade or so, we have witnessed neural networks come of age. The idea of learning to solve complex pattern recognition problems using an intelligent data-driven approach is no longer simply an interesting challenge for academic researchers. Neural networks have proven themselves to be a valuable tool across a wide range of functional areas affecting most businesses. As a critical component of most data mining systems, they are also changing the way organizations view the relationship between their data and their business strategy.

Neural networks are simple computational tools for examining data and developing models that help to identify interesting patterns or structures in the data. The data used to develop these models is known as training data. Once a neural network has been exposed to the training data, and has learned the patterns that exist in that data, it can be applied to new data thereby achieving a variety of outcomes. Neural networks can be used to

- learn to predict future events based on the patterns that have been observed in the historical training data;
- learn to classify unseen data into pre-defined groups based on characteristics observed in the training data;
- learn to cluster the training data into natural groups based on the similarity of characteristics in the training data.

While there are many different neural network models that have been developed over the last fifty years or so to achieve these tasks of prediction, classification, and clustering, we will be focusing only on the two main models that
have successfully found application across a broad range of business areas. The first of these is the multilayered feedforward neural network (MFNN) and is an example of a neural network trained with supervised learning (Rumelhart & McClelland, 1986). With supervised learning models, the training data contains complete information about the characteristics of the data and the observable outcomes. Models can be developed that learn the relationship between these characteristics (inputs) and outcomes (outputs). Using a MFNN to model the relationship between money spent during last week’s advertising campaign and this week’s sales figures is an example of a prediction application. An example of a related classification application is using a MFNN to model the relationship between a customer’s demographic characteristics and their status as a high-value or low-value customer. For both of these example applications, the training data must contain numeric information on both the inputs and the outputs in order for the MFNN to generate a model. The MFNN is repeatedly trained with this data until it learns to represent these relationships correctly.

The second type of neural network we consider in this chapter (and in this book) is the self-organizing map (SOM), which is the most common example of a neural network trained with unsupervised learning (Kohonen, 1982, 1988). The primary application for the SOM is clustering and data segmentation. Unlike the MFNN, which requires that the training data contain examples of both inputs and outputs, the SOM only requires that the data contain inputs that describe the characteristics of the variables or fields. The SOM then learns to cluster or segment the data based on the similarities and differences of the input variables only. An example of a clustering application is using a SOM to find an automatic grouping of customers based on their response to a market survey. The resulting clusters can then be used for targeting different products to different clusters, since all customers within a cluster are assumed to be similar to each other and different from those in other clusters.

Thus MFNNs are supervised neural network models that can be used for prediction and classification, while SOMs are unsupervised neural network models that can be used for clustering. Together, these two models span a wide range of applications across many functional areas of a business, as shown in Table 1. In each of the functional business areas identified in Table 1, the MFNN can be seen to find applications for a diverse range of prediction and classification problems. Likewise, the application of the SOM to clustering problems spans the complete cycle of business functions.
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