Chapter XV

Combining Supervised and Unsupervised Neural Networks for Improved Cash Flow Forecasting

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This chapter examines the use of neural networks as both a technique for pre-processing data and forecasting cash flow in the daily operations of a financial services company. The problem is to forecast the date when issued cheques will be presented by customers, so that the daily cash flow requirements can be forecast. These forecasts can then be used to ensure that appropriate levels of funds are kept in the company’s bank account to avoid overdraft charges or unnecessary use of investment funds. The company currently employs an ad-hoc manual method for determining cash flow forecasts and is keen to improve the accuracy of the forecasts. Unsupervised neural networks are used to cluster the cheques into more homogeneous groups prior to supervised neural networks being applied to arrive at a forecast for the date each cheque will be presented. Accuracy results are compared to the existing method of the company, together with regression and a heuristic method.

INTRODUCTION

In this chapter we are concerned with the problem of accurately forecasting the cash flow of a large financial institution. The company issues cheques of...
various magnitudes to its business and personal clients and needs to ensure that adequate funds are available in the cheque account in anticipation of the clients cashing their cheques. However, clients can sometimes take days or even weeks to present their cheques, while the money is underutilized in the cheque account. For instance, some business clients present cheques only at the end of the month, while personal clients are more likely to present their cheque within a day or so of receiving it. If the company can better predict when to expect the client to present the cheque, then it can better utilize the funds available through short-term investment. Naturally, the problem involves finding a balance between maximizing return on available funds and minimizing penalty charges if the cheque account is underfunded and utilizes the overdraft facility.

It is clear that the cash flow forecasting problem is similar to an inventory management problem, where the items of inventory are cash, the cost of oversupply is equivalent to loss of investment income, and the cost of undersupply is equivalent to the overdraft penalty charges. For any inventory control problem, it is essential to better understand the distribution of demand. Fortunately for this problem, we know the dates when cheques are issued and their monetary value, as well as approximately how long the cheque will take to reach the client through the postal delivery system. The only uncertainty is when the client will present the cheque. More accurate forecasting of client cheque presentation behavior is essential for addressing this problem. Neural networks are a suitable choice of technique for forecasting and have been used successfully within the context of inventory management (Dhond et al., 2000; Bansal et al., 1998; Col and Karlik, 1997).

The company involved in this case study is a leading financial institution that meets the needs of more than one million Australian customers. Their services cover a wide range of superannuation and insurance products, as well as investment and savings products, life insurance plans, preparation of wills, and estate-planning services. Most importantly, the company manages funds for individual investors, corporate firms, industries and government sectors, which are currently worth $29 billion (Australian) dollars. Such a diverse range and number of services and clients contribute to a huge number of daily transactions, a great deal of which involve issuing cheques. The company keeps a daily record of cheques issued to its customers, which may range from a very small amount to as much as millions of dollars. There may be as many as a thousand cheques issued in a day. The company has little knowledge about when and which of those cheques the clients will cash in. Hence, there is no accurate method for determining how much money to keep in its bank accounts to meet the demand.
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