Chapter VII
Demand Forecasting of Short Life Span Products:
Issues, Challenges, and Use of Soft Computing Techniques

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ABSTRACT

This chapter briefly reviews forecasting features of typical data mining software, and then presents the salient features of SIMForecaster, a forecasting system developed at the Singapore Institute of Manufacturing Technology. SIMForecaster has successfully been used for many important forecasting problems in industry. Demand forecasting of short life span products involves unique issues and challenges that cannot be fully tackled in existing software systems like SIMForecaster. To introduce these problems, we give three case studies for short life span products, and identify the issues and problems for demand forecasting of short life span products. We identify specific soft computing techniques, namely small world theory, memes theory, and neural networks with special structures, such as binary neural networks (BNNs), bidirectional segmented memory (BSM) recurrent neural networks, and long-short-term-memory (LSTM) networks for solving these problems. We suggest that, in addition to these neural network techniques, integrated demand forecasting systems for handling optimization problems involved in short life span products would also need some techniques in evolutionary computing as well as genetic algorithms.

INTRODUCTION

Sophisticated machines like manufacturing robots, aircrafts, and so forth have many electronic components that have shorter life span as compared to their parent system. Such mismatch of lifecycles results in unique demand forecasting problems. During the manufacturing of such sophisticated products, their relatively longer manufacturing time, certification time, and so forth add to unique demand forecasting problems (Foucher, Kennedy, Kelkar, Ranade, Govind, Blake, W., et al. 1998). Existing forecasting tools based on time series tools need large data and are not suitable for short life-span products. Some studies have been reported to develop the models for this problem (Henke & Lai, 1997; Solomon, Sandborn, & Pecht, 2000); however, the problem has increased complexity due to the fact that the short life span products do not have adequate data for the construction of suitable model for forecasting. To enable us to model the decision making and to effectively tackle the data inadequacies, in this chapter, we propose the adaptation of the general framework of soft computing.

Professpr Lofti Zadeh introduced an approach of soft computing in 1965; this approach has since then found a variety of applications in diverse application domains (Zimmermann, 1999) like design of controllers, natural language processing, and so forth. In the following section, we review salient features a typical data mining software as we take SAS Enterprise Miner (Walsh, 2005) as an example to illustrate these features. Further, we give main features of one demand forecasting tool developed by researchers at the Singapore Institute of Manufacturing Technology. This tool, SIMForcaster, mainly uses standard forecasting tools based on statistical forecasting methods like time-series, but enhances them by combining various optimization algorithms (Yuan, 2004a, 2004b). An attractive feature of SIMForecaster is that it has an estimation module to automatically estimate and select the optimization algorithm resulting in better performance. Although SIMForecaster has these advanced features, it has limitations for its use to products like short life span products. To develop and appreciation of these limitations, in the third section we give three case studies of short life span products, with emphasis on demand forecasting. We also point out the problems for the deployment of existing tool like existing softwares (e.g., SIMForecaster) for demand forecasting of short life span products. In the forth sectionl we give the recommendations regarding the adaptation of selected soft computing technologies in *SIMForecaster*. In the last section, we briefly give concluding remarks as well as a short sketch of future trends.

EXISTING TOOLS

Typical Data Mining Software

To highlight the importance of domain knowledge in data mining activity, it is useful to point out a well-known quote by Herb Edelstein (Beck, 1997):

If you got terabytes of data and you are relying on data mining to find interesting things for you, you have lost before you have even begun. .... You really need people who understand what it is they are looking for—and what they can do with it once they find it.

Successful data mining involves a combination of statistical methods, visualization tools, and database techniques. Data mining requires various expertise, of which the first important expertise is the domain knowledge, second expertise is about handling of data, and third expertise is understanding and judicious use of various analytical methods.

There are many data mining software packages available commercially that are useful tools for data mining, and they include forecasting capabilities. As an illustration, we give some features in SAS