

Chapter 18

Applications of Evolutionary Neural Networks for Sales Forecasting of Fashionable Products

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ABSTRACT

The evolutionary neural network (ENN), which is the hybrid combination of evolutionary computation and neural network, is a suitable candidate for topology design, and is widely adopted. An ENN approach with a direct binary representation to every single neural network connection is proposed in this chapter for sales forecasting of fashionable products. In this chapter, the authors will first explore the details on how an evolutionary computation approach can be applied in searching for a desirable network structure for establishing the appropriate sales forecasting system. The optimized ENN structure for sales forecasting is then developed. With the use of real sales data, the authors compare the performances of the proposed ENN forecasting scheme with several traditional methods which include artificial neural network (ANN) and SARIMA. The authors obtain the conditions in which their proposed ENN outperforms other methods. Insights regarding the applications of ENN for forecasting sales of fashionable products are generated. Finally, future research directions are outlined.

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INTRODUCTION

It is well-known that fashionable products exhibit a highly volatile demand pattern which follows the ever-changing market trend. In order to cope with the trend and market response, retailers would take measures such as accurate and quick response (Hammond 1990), automatic inventory replenishment, and even collaborative planning and forecasting between supply chain agents (De Toni 2000) are widely-adopted. It is known that fashion companies can improve their inventory and pricing decisions by acquiring market information (see Choi, 2007). By utilizing market information, fashion companies can reduce the forecasting error which in turn helps to lower stocking costs (e.g., see Thomassey, 2005). However, even with information updating, an efficient forecasting is still fundamentally important. In this chapter we will explore the use of a well-established machine intelligence tool, the Evolutionary Neural Networks, for forecasting the sales of fashionable products.

Essentially, the idea of Artificial Neural Network (ANN) was inspired by the biological neural networks and the mathematical modeling of how the human brain works. The early multilayered neural network with a training algorithm was introduced in 1970s (Fukushima, 1975). ANN has been applied successfully in a lot of areas such as pattern recognition of handwriting, speech, and sounds, etc. (Pao, 1989). Research has also proven that the multilayer feedforward neural networks are universal approximators (Hornik et al., 1989). This feature makes ANN a powerful tool for pattern classification and recognition. Owing to the similar requirement of pattern learning or approximation of historical data in forecasting, in the 1980s and 1990s, many researchers have proposed to use ANN for forecasting (White, 1988; Hill et al., 1994; Kuan et al., 1995; Dorffner, 1996; Luxhoj et al., 1996; Frank et al., 2002; Schikora et al., 2003; Sztandera et al., 2004; Cavalieri et al., 2004; Wu et al., 1994 & 2004; Sun et al., 2008). As the ANN is a data-driven self-adaptive method, few a priori assumptions about the model are needed for problems under study. It can learn from past data and capture subtle functional relationships among the data even if the underlying relationships are unknown or hard to describe. After learning the data, ANN can often correctly infer other part in the data. This feature enables ANN to predict future behavior from examples of past behavior, and thus makes it an ideal tool for forecasting. ANN has more general and flexible functional forms than what the traditional statistical methods can effectively deal with. Traditional statistical forecasting models have limitations in estimating underlying functions due to the complexity of the real system, while ANN can be a good alternative method to identify these functions. ANN is also nonlinear (Chu, 2003), and it is capable of performing nonlinear modeling without a priori knowledge about the relationships between input and output variables. Thus it is a more general and flexible modeling tool for forecasting. In this book chapter paper, we discuss how an Evolutionary Neural Network (ENN) model can be utilized in assisting fashion companies to make a scientifically sound and implementable forecasting decision for the sales of fashionable products. A flexible overfitting test is explicitly proposed which has been shown to be capable of improving the performance of the existing ENN models. The performance of our proposed forecasting ENN method is compared with the traditional statistical model SARIMA, and the traditional ANN. It is found that our proposed ENN model exhibits significant benefits and outperforms SARIMA and ANN in terms of forecasting accuracy. Future research direction is outlined.

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