



Chapter IV

Hybrid-Learning Methods for Stock Index Modeling

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Abstract

The use of intelligent systems for stock market prediction has been widely established. In this paper, we investigate how the seemingly chaotic behavior of stock markets could be well represented using several connectionist paradigms and soft computing techniques. To demonstrate the different techniques, we consider the Nasdaq-100 index of Nasdaq Stock MarketSM and the S&P CNX NIFTY stock index. We analyze 7-year Nasdaq 100 main-index values and 4-year NIFTY index values. This chapter investigates the development of novel, reliable, and efficient techniques to model the seemingly chaotic behavior of stock markets. We consider the flexible neural tree algorithm, a wavelet neural network, local linear wavelet neural network, and finally a feed-forward artificial neural network. The particle-swarm-optimization algorithm optimizes the parameters of the different techniques. This paper briefly explains how the different learning paradigms could be formulated using various methods and then investigates whether they can provide the required level of performance — in other

words, whether they are sufficiently good and robust so as to provide a reliable forecast model for stock market indices. Experiment results reveal that all the models considered could represent the stock indices behavior very accurately.

Introduction

Prediction of stocks is generally believed to be a very difficult task — it behaves like a random walk process and time varying. The obvious complexity of the problem paves the way for the importance of intelligent prediction paradigms (Abraham, Nath, & Mahanti, 2001). During the last decade, stocks and futures traders have come to rely upon various types of intelligent systems to make trading decisions (Abraham, Philip, & Saratchandran, 2003; Chan & Liu, 2002; Francis, Tay, & Cao, 2002; Leigh, Modani, Purvis, & Roberts, 2002; Leigh, Purvis, & Ragusa, 2002; Oh & Kim, 2002; Quah & Srinivasan, 1999; Wang, 2002). Several intelligent systems have in recent years been developed for modeling expertise, decision support, and complicated automation tasks (Berkeley, 1997; Bischi & Valori, 2000; Cios, 2001; Kim & Han, 2000; Koulouriotis, Diakoulakis, & Emiris, 2001; Lebaron, 2001; Palma-dos-Reis & Zahedi, 1999; Wuthrich et al., 1998). In this chapter, we analyse the seemingly chaotic behavior of two well-known stock indices namely the Nasdaq-100 index of NasdaqSM and the S&P CNX NIFTY stock index.

The Nasdaq-100 index reflects Nasdaq's largest companies across major industry groups, including computer hardware and software, telecommunications, retail/wholesale trade, and biotechnology. The Nasdaq-100 index is a modified capitalization-weighted index, designed to limit domination of the Index by a few large stocks while generally retaining the capitalization ranking of companies. Through an investment in Nasdaq-100 index tracking stock, investors can participate in the collective performance of many of the Nasdaq stocks that are often in the news or have become household names. Similarly, S&P CNX NIFTY is a well-diversified 50-stock index accounting for 25 sectors of the economy. It is used for a variety of purposes such as benchmarking fund portfolios, index-based derivatives, and index funds. The CNX indices are computed using the market capitalization weighted method, wherein the level of the index reflects the total market value of all the stocks in the index relative to a particular base period. The method also takes into account constituent changes in the index and importantly corporate actions such as stock splits, rights, and so on, without affecting the index value.

Our research investigates the performance analysis of four different connectionist paradigms for modeling the Nasdaq-100 and NIFTY stock market indices. We consider the Flexible Neural Tree (FNT) algorithm (Chen, Yang, and Dong, 2004), a Wavelet Neural Network (WNN), Local Linear Wavelet Neural Network (LLWNN) (Chen et al., 2006) and finally a feed-forward Neural Network (ANN) (Chen et al., 2004). The particle-swarm-optimization algorithm optimizes the parameters of the different techniques (Kennedy & Eberhart, 1995). We analysed the Nasdaq-100 index value from 11 January 1995 to 11 January 2002 and the NIFTY index from 01 January 1998 to 03 December 2001. For both indices, we divided the entire data into roughly two equal halves. No special rules were used to select the training set other than ensuring a reasonable representation of the

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