

An Improved Approach to Forecast Equity Market Using Time Series Method

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Abstract: *It is well known that short-term market price prediction has been a difficult problem for a long time because of too many factors which cannot be accurately predicted. Usually time series analysis has been often employed in modeling short-term price predictions. In recent years a new technique of artificial neural networks ANN has been proposed as an efficient tool for modeling and forecasting. A feed-forward ANN model has been developed for short-term price forecasting of stocks and in comparison with time series model ARIMA in this study. The data used include daily price, weekly price (average) and monthly price (average). The results showed that ANN model clearly outperformed the time series model in forecasting the cost before one day or one week. A fine relationship between the modeled and the real prices observed from the feed-forward ANN model, with a relative error less than 5.0%.Index.*

Keywords: stock forecasting, ARIMA model, Data Mining, ANN model

1. Introduction

The stock market is essentially a nonparametric, non-linear system that is extremely hard to model with any reasonable precision. Investors have been trying to discover a way to forecast stock prices and to find the right stocks and right timing to sell or buy. To attain those objectives and according to some research used the techniques of fundamental analysis where trading rules are developed based on the information associated with industry and company. Fundamental analysis assumes that the cost of a stock depends on its inherent value and predictable return on investment. Examining the company's the market and operations in which the company is operating can do this. Thus the stock price can be predicted sensibly well. Most people consider that fundamental analysis is a fine technique only on a long-term basis. However for medium and short-term speculations, fundamental analysis is usually not suitable. Some other researchers have used the techniques of technical analysis in which trading rules were developed based on the historical input of volume and stock price. Technical analysis uses various methods that aim to forecast future price movements using past volume and stock prices information. It is based on the hypothesis that history repeats itself and that future market directions can be determined by examining historical price data. Thus it is assumed that price trends and patterns exist that can be utilized and identified for profit. Most of the techniques used in technical analysis are highly subjective in nature and have been shown not to be statistically suitable. Recently artificial intelligence techniques and data mining techniques like rough set approach, decision trees and artificial neural networks have been applied to this area. Data mining refers to mining or extracting information from large data sets. Some of its functionalities are the discovery of class descriptions or concept, clustering, correlations and associations, outlier, deviation, classification, prediction, trend analysis, analysis, and similarity analysis. Data classification can be done by many different techniques; one of those methods is the classification by using Decision Tree. It is graphical demonstration of all possible paths and outcomes by which they can be reached.

1.1 Essential of Stock Market

Companies can raise their money with the help of equity market. This allows businesses can operate publicly and it produces additional capital growth to shelling shares of ownership of the company in public market. History shows that the price of shares and other assets is important part of the economic movement. In fact the equity market is one of the main indicators of a country's economic development and strength. Rising share price increases the business investments and growth of the company profitability. Share prices affect the prosperity of households and their expenditure. Therefore central banks tend to keep an eye on the behavior and control of the equity markets. Major exchanges will also act as the clearinghouse for transaction, which means that they collect the orders and deliver the shares in time and provide guarantee payment to the seller of a security. This will decrease the risk to an individual seller or buyer on every transaction. Primary market includes the new issues of securities and also securities are brought the share directly from the companies. But in the secondary market securities are sold and bought the shares among investors. Secondary market deals with outstanding securities. This market is made of prearranged exchanges and it has trading floor where orders are transmitted for exchange. All the trading of shares are guided and maintained by the exchanges. The rules and regulations are set by the exchanges. Many practitioners and researchers proposed many models using various technical, fundamental and analytical techniques to give a more or less accurate prediction. Fundamental analysis includes the in depth study of the changes of the stock prices in terms of exogenous macroeconomic variables. It assumes that the share price of a stock will depends on its expected return and intrinsic value of the investors. But this estimated return subjects to change as new information pertaining to the stock is available in the market which in turn changes the share cost. Moreover the analysis of the economic factors is fairly subjective as prediction of Indian Stock Market Index Using Artificial Neural Network. The understanding completely lays on the intellectuality of the analyst. Alternatively technical analysis centers on using volume, price, and open interest statistical

charts to forecast future stock movements. The principle behind technical analysis is that all of the internal and external factors that influence a market at any given point of time are already factored into that market's price. Apart from these commonly used methods of forecast, some conventional time series forecasting tools are also used for the same. In time series prediction the past information of the prediction variable is analyzed and modeled to capture the patterns of the historic changes in the variable. These models are then used to forecast the future prices of shares.

1.2 Time Series Forecasting

There are primarily two approaches of time series modeling and forecasting: linear approach and the nonlinear approach. Mostly used linear methods are time series regression, moving average, exponential smoothing etc. One of the most popular and common linear method is the Autoregressive integrated moving average (ARIMA) model (Box and Jenkins (1976)). It presumes linear model but is quite flexible as it can represent different types of time series, i.e. Autoregressive (AR), moving average (MA) and combined AR and MA (ARMA) series.

1.3 Method of Time Series Analysis

Random Walk

The equity market price changes have the same distribution and these are independent of each other. The stock prices are variable and the financial status of a gambler may be modeled as random walk. Random walks can be used in many fields such as psychology, ecology and economics. The random walks can explain the observed activities of processes in these areas. This provides a fundamental model for the recorded of stochastic activity.

Moving Average

Moving average are also called rolling mean or rolling average or running average is a type of finite impulse response filter used to analyze a set of data points by creating a series of averages of different subsets of the full data set in the equity market area. This can be used to level out the short term fluctuations with the help of time series analysis data and highlight longer term stock market trends or cycles. This will be used in technical analysis of financial data such as stock price, trading volumes or stock returns.

Regression Method

This method includes many techniques for analyzing modeling several variables, which can be used to focus on the relationship between a dependent variable and one or more independent variables. Regression analysis is broadly useful for forecasting and prediction; it has considerable overlap with the field of machine learning. This can be used to understand which among the independent variables are connected to the dependent variables and discover the relationship. The regression analysis are carried out the techniques are linear regression, ordinary least squares regression are parametric, which is defined in terms of finite number of unknown parameters that are estimated from the data set. This model is used for forecast even though the moderately violated data.

ARIMA Model

This model is suited to the time series analysis data for forecast future points in the series. These models can be applied in some cases where the data is no stationary also where an integrated part of the model can be applied to remove the non stationary. ARIMA models are obviously identifiable trends such as a constant trend (i.e. zero average model), a quadratic trend (i.e. quadratic growth behavior) and a linear trend (i.e. linear growth behavior).

2. Literature Review

Gan-qiong Li, Shi-wei Xu, Zhe-min Li in [1] proposed a technique in which a feed forward ANN model has been developed for short term price prediction of tomato and in comparison with time series model ARIMA in this study. The outcome showed that ANN model evidently outperformed the time series model in predicting the value before one day or one week. A good correlation between the real prices and modeled was observed from the feed-forward ANN model, with a relative error less than 5.0%. The ANN model can be more appropriate for forecasting ahead of one cycle. Time series model and ANN model are equally efficient in correctness for forecasting ahead of one day, one week and one month but ANN model is better than time series model.

Qasem a. al-Radaideh, Adel Abu Assaf Eman Alnagi in [2] assist the investors in the stock market to make a decision of better timing for buying or selling stocks based on the knowledge extracted from the historical prices of stocks. The decision taken is based on decision tree classifier which is one of the data mining techniques. To construct the proposed model the CRISP DM technique is used. It is useful tool for the investors to make the right decision concerning their stocks based on the study of the historical prices of stocks in order to extract any predictive information from that historical data.

Khalid Alkhatib, Hassan Najadat, Ismail Hmeidi, Mohammed K. Ali Shatnawi in [3] proposed a model in which they used the non-linear regression approach and k-nearest neighbor algorithm and to forecast stock prices for a sample of six major companies listed on the Jordanian stock exchange. A prediction process for five listed companies on the Jordanian Stock Market is carried out. Results of kNN algorithm are stable and robust with small error ratio. Depending on the real stock prices data; the prediction results are close to actual prices.

S Abdulsalam Sulaiman Olaniyi, Adewole, Kayode S., Jimoh, R. G in [4] proposed a study of regression analysis for use in stock price prediction. Data is obtained from the daily official list of the values of all shares traded on the stock exchange available by the Nigerian Stock Exchange. A data mining software tool is used to discover relationships and patterns and also to extract prices of variables from the database to forecast the future values of other variables through the use of time series data that used moving average method. In this paper they used the regression analysis as a data mining technique to explain the trends of stock market prices and forecast the future stock market prices of three

banks. It is a case study from banking sector of Nigerian economy.

QiSen Caia, Defu Zhanga, Bo Wua, Stephen C.H. Leungb in [5] proposed a hybrid model FTSGA based on fuzzy time series and genetic algorithm. FTSGA improved the performance by applying the operations of genetic algorithm such as selection, mutation and crossover to iteratively find a good discourse partition. TAIEX is chosen as the experimental data set and experimental outcomes showed that comparing with other models based on fuzzy time series FTSGA can significantly reduce the root mean square error and improve accuracy. This model can achieve more suitable partition of the universe which can improve the prediction results considerably.

WEN Fenghuaa, XIAO Jihongb, HE Zhifanga, GONG Xua in [6] proposed a model in which it uses the singular spectrum analysis (SSA), decomposes the share price into terms of the trend, the noise, and the market fluctuation with different economic features over different time horizons and then bring in these features into the support vector machine (SVM) to make cost predictions. SSA-SVM combination forecasting can have better predictive effect than that of the EEMD-SVM combination prediction.

Nikitas Goumatianosa, Ioannis Christoua and Peter Lindgrenb in [7] proposed a mode in which it presents the architecture of a whole intraday trading management system using a stock selection algorithm for building long or short portfolios. Their approach for share choice is based on knowledge discovery in large databases technologies; more particularly they build techniques that allow one to discover hidden price patterns which can be capable of predicting the direction of share prices. The base of the entire system is a novel pattern mining algorithm from time-series data, which includes highly compute intensive aggregation calculations as complex but efficient distributed SQL queries on the relational databases that store the time-series. The results showed that the proposed system can discover patterns that can assist intraday trading to pick the best shares whose value is expected to increase.

Huanhuan Yua, Rongda Chenb, Guoping Zhangc in [8] introduced a machine learning method of support vector machine to build a stock selection model which can do the nonlinear classification of stocks. It brought the principal component analysis (PCA) into SVM model to take out the low-dimensional and efficient feature information which improves the training efficiency and accuracy as well as conserve the features of initial data. Result suggested that the return of stocks selected by PCA-SVM is in fact superior to a share index.

José Manue Azevedo, Rui Almeida, Pedro Almeida in [9] proposed a model in which literature review of the use of Data Mining with time series data focusing on short-time stocks forecast. Research is associated with the combined use of fundamental and technical indicators.

G.preethi, B.santhi in [10] surveyed recent literature in the area of Neural Network, Hidden Markov Model, Data Mining, and Neuro-Fuzzy system used to forecast the stock market variation. Neuro-Fuzzy and Neural Networks systems

are recognized to be the leading machine learning techniques in stock market index prediction area. This paper surveyed the neuro Fuzzy, Neural Network, Markov Model, Data mining, system and in the area of stock market prediction.

3. Conclusions and Future Scope

Previous researchers have used time series forecasting which uses the past data of the forecasting variable is analyzed and modeled to find the patterns of the historic changes in the variable. But data is non linear and prediction will not be accurate.

Most of the researches are not capable to forecast the share price accurately for all companies. The stock market returns are perfectly linear for the very reason that the residual difference between the forecasted return and the actual is quite high. The non linear model must be determined before the estimation of the parameters is done.

Economic factors will be quite subjective as Forecasting of Indian Stock Market Index Using Artificial Neural Network. All of the internal and external factors that influence a market at any given point of time must be considered. The non linear model must be specified before the estimation of the parameters is done.

Solution Strategy

Use ANN technology. ANN lies in their capability to discover nonlinear relationship in the input data set without a priori assumption of the knowledge of relation between input and the output.

Neural networks are analogous to nonlinear, nonparametric, regression model so neural network fits better than other models in forecasting the stock market returns.

Use ARIMA model. Though ARIMA uses linear model but is quite flexible as it represents different kinds of time series, i.e. Autoregressive (AR), moving average (MA) and combined AR and MA (ARMA) series.

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Author Profile



Rihjal Mune received the Bachelor of Engineering degree in Information Technology in 2011. During 2011-2012, he got training with center for Development of Advance Computing. Now he is doing masters of technology in Computer Science and Engineering.