RESEARCH ARTICLE

CNX PSU Bank Index Prediction Using Soft Computing - A Study

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Abstract— Stock markets are incredible systems wherein thousands of stocks, ETFs and bonds are traded by millions of traders every day, around the world, in a never-ending battle to make money. Predicting stock markets has been one of the biggest challenges of the AI community since about two decades ago. The objective of this paper is to review the previous methods used for prediction and the proposed method. The aim of this work is to predict the National Stock Exchange (NSE) market PSU Bank Index value by external indicators such as world market, policies, inflation rate and the measures taken by Reserve Bank of India with the help of Multi-Layer Feed-Forward Neural Networks (MLFFNN).

Key Terms: - Stock Prediction; Neural Networks; Rough sets; Genetic Algorithm; Fuzzy

I. INTRODUCTION

Stock movement prediction has been at focus for years since it can yield significant profits. Fundamental and technical analyses were the first two methods used to forecast stock prices. A new method appeared more recently, the technological analysis, where the systems are used as a tool to predict and forecast the stock movements.

Technology analysis tries to model and simulate as accurately as possible the behavior of the stock exchanges, by different techniques.

During last few years there has been much advancement in technology analysis with the help of soft computing techniques.

Researchers have tested the accuracy of ANN in predicting the stock market index return of most developed economies across the globe. Literatures are available for forecasting index returns of US markets like NYSE [8], FTSE [9], DJIA [10] and S&P500 [11]. Few papers are also available in context to Asian stock markets like Hang Seng Stock Exchange, Korea Stock Exchange, Tokyo Stock Exchange and Taiwan Stock Exchange. Some literatures are also available in Indian context.

In this paper, a suitable neural network model is proposed to predict the movement of psu bank index in National Stock Exchange of India.

First I will give the different forecasting techniques available, and then I will focus on artificial neural networks as it is the most widely used and studied for forecasting.

II. FORECASTING TECHNIQUES

Many researchers and practitioners have proposed many models using various fundamental, technical and analytical techniques to give a more or less exact prediction. Fundamental analysis involves the in-depth analysis of the changes of the stock prices in terms of exogenous macroeconomic variables. It assumes that the

share price of a stock depends on its intrinsic value and the expected return of the investors. But this expected return is subjected to change as new information pertaining to the stock is available in the market which in turn changes the share price. Moreover, the analysis of the economic factors is quite subjective as the interpretation totally lays on the intellectuality of the analyst. Alternatively, technical analysis centers on using price, volume, and open interest statistical charts to predict future stock movements. The premise behind technical analysis is that all of the internal and external factors that affect a market at any given point of time are already factored into that market's price. (Louis. B. Mendelsohn, 2000). [1][2]

Apart from these commonly used methods of prediction, some traditional time series forecasting tools are also used for the same. In time series forecasting, the past data 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.

During last few years there has been much advancement in the application of soft computing in stock market indices forecasting with a hope that market patterns can be extracted.

Some most commonly used stock forecasting techniques are:

A. Genetic Algorithms:

Genetic algorithms are problem solving methods of heuristics that mimic the process of natural evolution. GA's are commonly used as optimizers that adjust parameters to minimize or maximize some feedback measures. In the financial markets, genetic algorithms are most commonly used to find the best combination values of parameters in a trading rule and they can be built into ANN models designed to pick stocks and identify trades. [3].

B. Hidden Markov Model:

Markov Model is basically the generation of any sequence. There are many states involved with any sequence. The value of the system switches between any of these states. The probability of the value to occupy a state depends on the previous states. The hidden Markov model (HMM) is a probabilistic method used to determine the behavior of a time varying system. Since this is a probabilistic method, more the data we consider for applying in the Markov model, more accurate are the results [4].

C. Fuzzy:

Fuzzy is used in predicting stock price in such a way, construct a data mart to reduce the size of stock data and combined fuzzification techniques with the grey theory to develop a fuzzy grey prediction as one of predicting functions in our system to predict the possible answer immediately.

D. Data mining:

Data mining techniques have been successfully shown to generate high forecasting accuracy of stock price movement. Nowadays, instead of a single method, traders need to use various forecasting techniques to gain multiple signals and more information about the future of the markets. The approaches include linear discriminant analysis (LDA), Quadratic discriminant analysis (QDA), K-nearest neighbor classification, Naïve Bayes based on kernel estimation, Logit model, Tree based classification, Bayesian classification with Gaussian process, Support vector machine (SVM) and Least squares support vector machine (LS-SVM) [5].

Artificial neural networks have been used in stock market prediction during the last decade. Studies were performed for the prediction of stock index values as well as daily direction of change in the index.

III. Neural Networks for Stock Market Prediction

Nowadays artificial neural networks (ANNs) have been popularly applied to finance problems such as stock exchange index prediction, bankruptcy prediction and corporate bond classification.

Artificial neural network (ANN) is a mathematical model, which can be set one or more layered and occurred from many artificial neural cells. The wide usage of the ANN may be due to the three basic properties:

1. The ability of the ANN as a parallel processing of the problems, for which if any of the neurons violate the constraints would not affect the overall output of the problem.

2. The ability of the ANN to extrapolate from historical data to generate forecasts.

3. The successful application of the ANN to solve non-linear problems. The history and theory of the ANN have been described in a large number of published literatures and will not be covered in this paper except for a very brief overview of how neural networks operate.

The ANN computation can be divided into two phases: learning phase and testing phase. The learning phase forms an iterative updating of the synoptic weights based upon the error back propagation algorithm. Back propagation algorithm is generalized of least mean square learning rule, which is an approximation of steepest descent technique. To find the best approximation, multi-layer feed forward neural network architecture with back propagation learning rule is used.
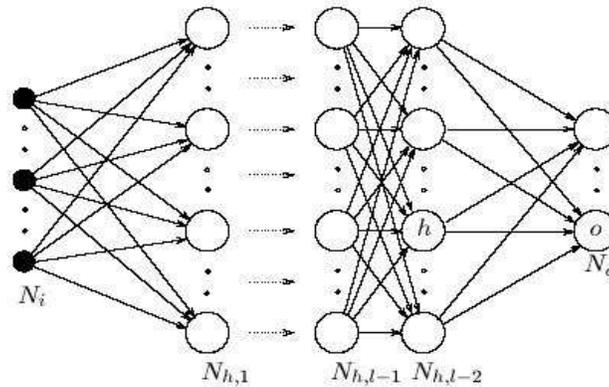
FIG.1.MULTILAYER FEED-FORWARD ANN

Feed-forward networks were first studied by Rosenblatt [6]. Input layer is composed of a set of inputs that feed input patterns to the network. Following the input layer there will be at least one or more intermediate layers, often called hidden layers. Hidden layers will then be followed by an output layer, where the results can be achieved (Figure-1). In feed forward networks all connections are unidirectional.

IV. CNX PSU BANK INDEX

Before entering into the model we will analysis the PSU Bank Index in National Stock Exchange India.

A stock market index is created by selecting a group of stocks that are representative of the whole market or a specified sector or segment of the market. An Index is calculated with reference to a base period and a base index value. An Index is used to give information about the price movements of products in the financial, commodities or any other markets. Financial indexes are constructed to measure price movements of stocks, bonds, T-bills and other forms of investments. Stock market indexes are meant to capture the overall behaviour of equity markets.

CNX PSU Bank Index is computed using free float market capitalization weighted method with base date of Jan 1, 2004 indexed to base value of 1000, wherein the level of the index reflects the total free float 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, etc., without affecting the index value.

Stocks in the index are

Company Name	Mkt. Cap.* Rs. Cr.	Weight (%)
State Bank of India	49265	45.01
Bank of Baroda	12827	11.72
Punjab National Bank	12681	11.59
Canara Bank	6350	5.80
Bank of India	5882	5.37
Union Bank of India	5509	5.03
Oriental Bank of Commerce	3580	3.27
IDBI Bank Ltd.	3521	3.22
Allahabad Bank	3153	2.88
Andhra Bank	2908	2.66
Indian Overseas Bank	1956	1.79
Syndicate Bank	1821	1.66
Total	**109452**	**100.00**

* Free-float Market Capitalization as on September 30, 2011

TABLE:1 CONSTITUENT OF PSU BANK INDEX

A. Selection Criteria

Selection of the index set is based on the following criteria:

- Constituent should be a Public sector bank
- Constituent's market capitalization rank in the universe should be among the top 500.

- Constituent's turnover rank in the universe should be in the top 500.
- Constituent should have a positive Net worth.
- The constituents should be available for trading in the derivatives segment (Stock Futures & Options market) on NSE.

Fig.2 shows the PSU bank Index movement from June 2004 to September 2011. Various factors affect the movement of psu bank index. For example, Financial results of the stock, RBI's rules and regulations, world market, Indian politics, inflation rate etc.
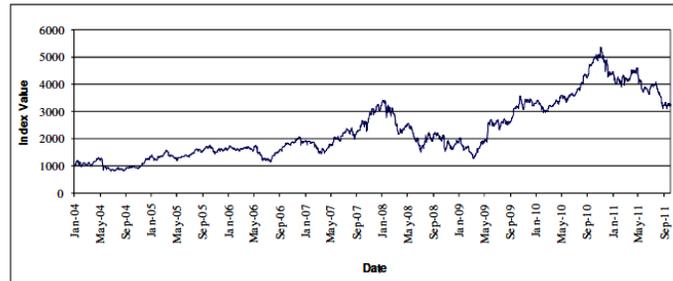

FIG. 2 INDEX MOVEMENT

V. MLFFNN FOR STOCK MOVEMENT

The performance of the neural network largely depends on the model of the neural Network. In this we select the multi-layer feed forward model.

Step-by-step approach is used to model a neural network for predicting stock movement [7].

A. Input Selection:

The selection of input is the fundamental to forecast the stock accurately. Selection of input variable for the neural network model is a critical factor for the performance of the neural because it contains important information about the complex nonlinear structures of the data. The criticality in selecting the input variables lies in selecting the number of input variables and the lag between each.

In this, I select the external factors such as world market (Asian & European), new policies, Inflation rate, Act by Reserve bank of India and Currency value against dollars as input variables. Based on the above mentioned factor the movement of bank index in National Stock Exchange will be predicted.

B. Data Preprocessing:

The performance and the reliability of a neural network model also to a large extent depend on the quality of the data used. As neural networks are pattern recognizers, the data presented to it largely influences the accuracy of the result. The data preprocessing of the input variable of the neural network model facilitates de-trending of the data and highlight essential relationship, so as to facilitate proper network learning process. Various preprocessing methods are considered and tested for an optimal result.

C. Sensitivity Analysis:

The sensitivity analysis is the process which determines whether an input variable influence the output or not. There are several ways to find that. The most common approach is to run the neural network with and without each input variable, and to check the variations of the input. If there are no variations then the input variable may be omitted. This will improve the performance of the system.

D. Model construction:

Generally three types of neural networks are used by the researchers in forecasting stock market they are Back propagation, Feed forward networks and Radial Basis Function. Here I select the multilayer feed forward network to improve the accuracy of the system. While selecting the MLFF we have to concentrate on Number of input neurons, number of hidden layers and the transfer functions.

VI. CONCLUSION

There are various methods or tools used to predict the movement of stock market. We get overall review and the contributions provided by neural network to improve the accuracy the highly volatile Indian market. If we use multi-layer feed forward neural network we will get better result. However, for prediction at different time in future, the network may be trained periodically and need be there the network may be revalidated with changes in the some of the features of the model. Before selecting the set the input variables rough set can be used to select the proper input variable which may give much better accuracy.

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