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Original Article

Forecasting of Bombay Stock Exchange By Using Artificial Neural Network

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ABSTRACT

This Paper Presents a Computational approach for predicting the BSE stock Exchange data .A Neural Network based model has been used in Predicting the Direction of the movement of the closing value of the Index. The data set encompassed the trading days from 1/7/97 to 24/12/2014 .In this paper ,the model has been validated across 17 years of the trading days.Accuracy of the performance of the neural network is compared with various methods like random forests, GLM, Time Series Analysis. Finally we proved that ANN models are better forrandom forests, GLM, Time Series Analysis

Keywords : Stock Exchange data, Neural Network.

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1.0 Introduction

Stock price prediction is one of the most important topics in finance and business. However the stock market domain is dynamic and unforecastable. Several researchers have been carries out to predict the market in order to make profit using different techniques ranging from statistical analysis, technical analysis, to fundamental analysis among others, with different results, Thesetechniquescannot provide deeper analysis that is required and therefore not effective in predicting stock market prices.

Artificial Neural network technique is one of forecasting technique that is gaining increasing acceptance in the business area due to its ability to learn and detect relationship among nonlinear variables.Also,it allows deeper analysis of large set of data especially those that have tendency to fluctuate with in a short of period of time. The ANN models have been used extensively in the fields of business, finance and economics for several purposes like time series forecasting and performance measurement. However, the focus of this paper is to improve the accuracy of stock price prediction by using the ANN models. The rest of the Papers is organized as follows. Section 2 presents the Descriptions about Technical analysis about technical Analysis and fundamental analysis. Section 3 describes various measures of forecasting techniques. Section 4 Describes about ANN model, Section 5 describes Research methodology, section 6 discussed the results obtained.

2.0 ANALYSIS IN FORECASTING TECHNIQUES:

2.1 FUNDAMENTAL ANALYSIS:

Fundamental price analysis is based on the notion that the underlying supply/demand conditions in a given market ultimately determine price. Since the futures market is attempting to discover prices that will balance supply and demand in some future time period, there is uncertainty in initially establishing an equilibrium price. The market may be “shocked” by new information; resulting in traders’ changing their assessments of what the equilibrium price will be in the future. Fundamental analysis is attempts to both anticipate changes in supply/demand information, and to evaluate the

direction and range of price movement resulting from new information.

Fundamental analysis may be simple (intuitive), or complicated (using a statistical or mathematical models). In both cases, analysts are attempting to assess price implications of economic variables including:

1. Seasonal use patterns
2. Seasonal supply patterns
3. Prices of substitute goods
4. Prices of compliment goods
5. Market structure

2.2 TECHNICAL ANALYSIS

Technical analysis is simply the analysis of price trends -- by looking at past prices, volume, and open interest technical analysts attempt to identify buy and sell signals based on underlying market emotion. The idea is to reduce the opportunity cost of buying too early or selling too late.

There are literally an infinite number of ways to look at past prices, but some of the more common technical indicators include:

1. Bar Charts
2. Lines of support and resistance
3. Consolidation planes (also called price channels)
4. Key reversals
5. Price Gaps and
6. Moving Averages

3.0 METHOD IN FORECASTING FOR STOCK MARKET PERFORMANCE:-

3.1 Random Walk

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

3.2 Moving Average

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

3.3 Regression Method

This method includes many techniques for modeling and analysing several variables, which is used to focus on the relationship between a dependent variable and one or more independent variables. Regression analysis is widely used for prediction and forecasting, it has substantial overlap with the field of machine learning. This is used to understand which among the independent variables are related to the dependent variables and explore the relationship. The regression analysis carries out the methods 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 prediction even though the moderately violated data.

3.4 ARIMA Modal

This model is fitted to the time series analysis data for predict future points in the series. These models are applied in some cases where the data show evidence of nonstationarity also where an integrated part of the model can be applied to remove the nonstationarity. ARIMA models are clearly identifiable trends such as a constant trend (i.e. zero average model), a linear trend (i.e. linear growth behavior), and a quadratic trend (i.e. quadratic growth behavior).

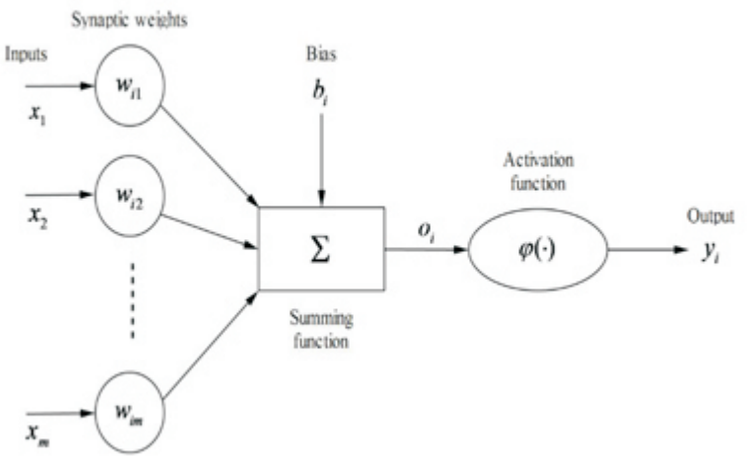
4.0 NEURAL NETWORK FORECASTING:-

Artificial neural networks are based on simple mathematical model of the way brains are thought to work when applied to time series; they provide a non-linear forecasting method. Neural network forecasting generally requires as much larger number of observations then the other methods discussed in the study, but it also allows more flexible and complicated models to be fitted.

Artificial neural networks are computational structures which are based on simulation of the biological central nervous system. The simulation borrowers from the knowledge of biological neurons and contrary to others computational methods, by using relatively simply mathematical operations they solve ill-defined, nonlinear or stochastic issues.

4.1 Simple Artificial Neuron:

A single neuron (node) is an information-processing unit that is fundamental to the functioning of neural network. Below figure shows the model of an artificial neuron.



4.1 An artificial neuron

On the scheme we can see elementary parts of a neuron. Each synapsis (or) connection is determined by its weight. Concretely, a signal x_i at the input of synopsis j linked to neuron I is multiplied by weight W_{ij}.

Mathematically, a neuron i can be defined by following equations.

$$Yi = x_i (s_i + b_i)$$

Where si + bi is denoted as induced local field (or) activation potential Oi

$$S_{-i} = \sum^{m}_{j=1} W_{-ij}\, x_{-j}$$

x_1.....x_m are the neuron inputs, W_{ij} .....W_{im} are the synaptic weights, $s_i$is the linear confiner outputof the inputsignals, bidenotes bias term. $\phi(.)$ is the activation function, and Y_i output of the neuron. The bias b_i is an external parameter and has an effect of using affine transformation to the output of the linear confiner, therefore the line of O_i versus sidoes no intersect the origin of coordinate system.

The fallowing Sections are devoted to several optimization algorithms that are usually used

to modify connection weights in feed foreword networks with back propagation learning

a) Gradient Descent
b) Quasi-Newton methods
c) Levenberg-Marquardt Algorithm
d) Conjugate Gradient

5.0 RESEARCH METHODOLOGY

5.1 DATA DESCRIPTION AND ANALYSIS VARIABLES :-

The latest models in forecasting area which involves more volatility in nature is found in the financial problems and the present study is taken from the stock market indices like SENSEX,

SENSEX : The SENSEX-(or SENSITVE INDEX) was introduced by the Bombay stock exchangeon January 1 1986. It is one of the prominent stock market indexes in India. . Based on SENSEX several investors plan their financial investments accordingly. Even though some of the foreign financial organizations looks this index as standard index.

This study covers the time period of 1/7/97 to 24/12/2014. Thus, the data set contained 4321 obseravtions. This data set is quite similar in length to data sets in previous studies of similar nature. We used data for all listed companies traded on the Bomby stock exchange. The data consists of daily opening and closing prices. The source of the closing price data is the taken from www.yahoofinance.com.. This will enable the user to apply many sophisticated models like Random walk ,Generalized linear models ,Time series models and Neural Networks .

Neural Network(NN), is an interconnected group of artificial neurons that uses a mathematical model or computational model for information processing based on a connectionist approach to computation. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network. In more practical terms neural networks are non-linear statistical data modelling tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data. The tasks to which artificial neural networks are applied tend to fall within the following broad categories:

- Function approximation, or regression analysis, including time series prediction and modeling
- Classification, including pattern and sequence recognition, novelty detection and sequential decision making
- Data processing, including filtering, clustering, blind signal separation and compression

They can be trained using two paradigms:

SUPERVISED LEARNING: In supervised learning, we are given a set of examples,where each example consists of output to corresponding input. and the network ismade to learn those examples, using certain algorithms, after which they are usedto produce unknown outputs for the new inputs.

- UNSUPERVISED LEARNING: In unsupervised learning we are given some data x, and accost function to be minimised which can be any function of x and the network'soutput,. The cost function is determined by the task formulation. Most applications fall within the domain of estimation problems such as statistical modelling,compression, filtering, blind source separation and clustering.

5.2 NEURON

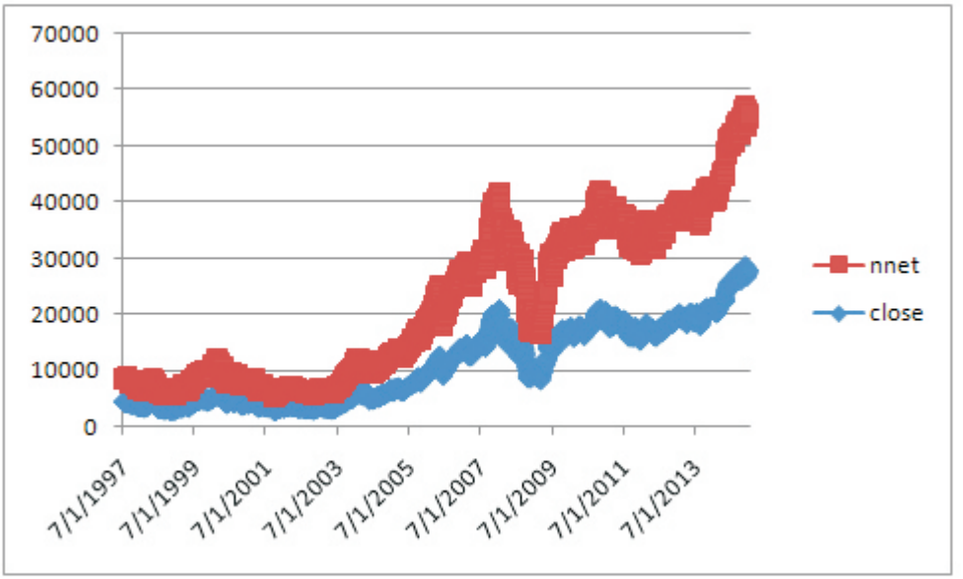
A neuron is a processing unit that takes several inputs and gives a distinct output. The Figure 2 below depicts a single neuron with R inputs p1, p2,…, pR, each input is weighted with a value w11, wl2,…, wlR and the output of the neuron an equal to f (w11•p1 + w12•p2 +…+ w1R•pR).Each neuron apart from the number of its input is characterized by the function f known as a transfer function.The most commonly used transfer functions are the hard limit, the pure linear, te sigmoid and the tansigmoid function

5.3 LAYER

Artificial Neural network is defined as data processing system consisting of many of simple highly interconnected processing elements (artificial neurons) is an architecture inspired by the structure of the cerebral cortex of the brain. Each network has got exactly one input layer, zero or more hidden layers and one output layer. All of them apart from the input layer consist of neuron. The number of inputs to the Artificial Neural Networks equal to the dimension of our input samples Figure 3 shows, while the number of the outputs we want from the Artificial Neural Networks define the number of neurons in the output layer.

ANALYSIS AND DISCUSSIONS:-

The forecasting tool ANN has been used to forecasts the BSE Index value. To obtainforecasted value, the daily closing price is used as an input to this model. This model then automatically accustomed with the training datasets and makes forecast, given the current day's stock prices. ANN models with different network parameters are created, trained and tested for each series. For the BSE Index, the study has run neural network on data input. Since the behaviour of stock market is more random, the study has considered 10 day lag data as input for the neural network so that learning can be maximum and higher precision can be achieved



The forecast error is the difference between the actual value and the forecast value for the corresponding period. Et = Yt - Ft where E is the forecast error at period t, Y is theactual value at period t, and F is the forecast for period t.Measures of aggregate error are

as shown in above For the estimate of directionalaccuracy, Directional Symmetry is used.Out of these MAPE and MAE are the commonly used ones. MAPE and MAE arerelated with how close are the forecasted values to the target ones. Lower the MAPEand MAE values, better is the forecaster. But they deal only with the absolute differencebetween forecasted values and target values. It doesn't take into account the directionalprediction. For the estimate of directional accuracy, Directional Symmetry(DS) is used.DS is generally used as an error measure in directional forecasting (e.g. predicting themovement of an index). DS gives the directional prediction efficiency; i.e. how efficient is the forecaster in predicting the direction of the series. It's good to have higher DS value with low MAPE.

COMPARISON OF ARIMA, FFNN AND SVR FOR FORECASTING THE INDEX VALUE:-

	min MAPE(L)			
	ARIMA	RF	ANN	GLM
BSE	1.7456	1.9865	1.2987	2.0381

Table show the comparison of ARIMA, ANN and SVR models forecasting index values of BSE Sensex Comparison Of Forecasting Performances Of ARIMA, ANN, RF and GLM Models

CONCLUSION:-

In this Paper it's very clear that ANN models outperformedARIMA and RF models by considerable margin in case of all the three series. ANN models are mostly reported to be better at forecasting than ARIMA models.This is again confirmed here. But between ANN and RF models, itis not clear that which model is better. From these results it can be asserted that ANNmodels are better for long term forecasting than RF models for these three series.

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