

National Stock Exchange Stock and Index Price Direction Prediction using Back-propagation Artificial Neural Network

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ABSTRACT: Stock price are highly volatile, non linear and random in nature. Soft computing technique, such as Artificial Neural Network is capable to solve non liner problem. We find properly tuned back propagation feed forward neural network can effectively predict price direction. Here we design price prediction generalize model that can predict price direction of random time series. Research study used National Stock Exchange benchmark stock index and top ten weighted index stock. Technical indicators are applied as input to the model. Model used daily stock data from January 2006 to June 2015. Performance of model are measured using hit rate. After properly tuning ANN, experimental result show that model can effectively improve price prediction.

KEYWORDS: Nifty index, stock price prediction, back propagation neural network, Levenberg-Marquardt, Nifty Stock.

I. INTRODUCTION

Stock price direction prediction is always challenging task for analyst and researchers. The stock price are non linear and random time-series patter. Stock security price is highly dependent on various parameters such as company fundamental, government policy, global financial policy, stock security demand-supply, inflation, etc. There is always uncertainty about these parameters, It involves an assumption that past publicly available information has some predictive relationship to future stock returns[1]. Emerging markets, such as National Stock Exchange (NSE) gaining popularity due to their high return, for this reason, emerging markets attract many investors. CNX Nifty index, also known as Nifty Index, was launched in April 1996. The CNX Nifty is a well diversified 50 stock index accurately reflecting overall market conditions. There have been many empirical researches which deal with predicting the financial market. However, few researches exist in the literature to predict the direction of stock price in emerging markets such as NSE.

It is found in many research literature [2]–[10], The most popular architecture applying for financial market is the multilayer feed-forward neural networks. A standard Neural Network has at least three layers. The first layer is called the input layer. The last layer is called the output layer. An intermediary layer of nodes, the hidden layer, separates the input from the output layer. The number of nodes defines the amount of complexity the model is capable of fitting. Each node of one layer has connections to all the other nodes of the next layer. Figure 1 shows standard MLP.

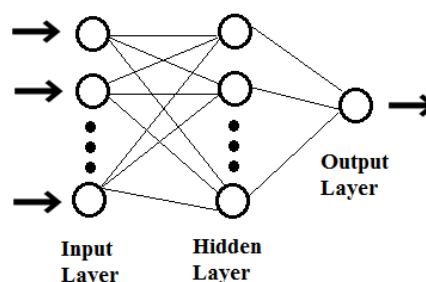


Figure 1 Multi Layer Feed Forward Neural Network.

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The core objective of this paper is to predict the direction of Nifty index and top ten stock security's price direction which have highest weightage in nifty index. Here we proposed price prediction generalized model (PPGM) as shown in Figure 2. The direction of daily closing of stock security is categorized as 0 (down) or 1 (up). If stock security price at time t is higher than that at time $t-1$, direction t is 1 (up). If the stock security price at time t is lower than that at time $t-1$, direction t is 0 (down). Five technical indicators are used as input to the model. Levenberg-Marquardt algorithm is used to train the network. Number of hit rate is used to measure the performance of the network prediction.

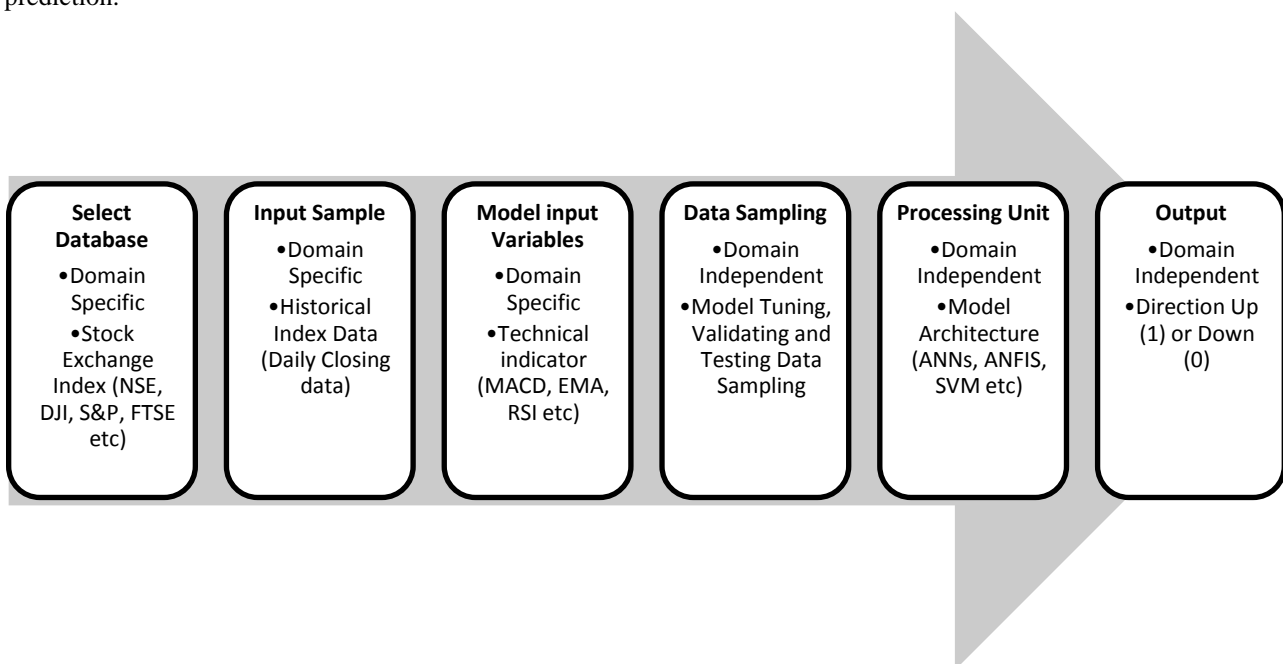


Figure 2 Price Prediction Generalized Model

II. LITERATURE REVIEW

After going through various research study, it is found that properly trained Neural Network can effectively predict stock security price direction. These studies have used various Artificial Neural Network (ANN) architecture, input parameters, model performance measured parameter to predict accurately the stock securities movement. The performance of model depend on selection of appropriate model parameters so that it is challenging task. Research studies [11]–[14] has provide satisfactory forecasting result using ANN. The research study by Chen [14] attempted to predict the direction of return on the Taiwan Stock Exchange benchmark index. The probabilistic Neural Network was used to predict the direction of index return. Performance of the PNN forecasts is compared with that of the generalized methods of moments with kalman filter and the random walk perdition models. Kim [15] proposed an advanced genetic algorithm approach to instance selection in ANNs for financial data mining. Using this approach, authors claim basic limitations of ANNs such as inconsistency, problems in prediction for noisy data, etc. could be avoided. This study GA based ANN (GANN) on Korean Stock Price Index (KSPI). Kara [16] compared the prediction performance of ANN with support vector machine (SVM). Their performance in predicting the direction of movement in the daily Istanbul Stock Exchange (ISE) National 100 index and concluded that average performance of ANN model was found better than that of SVM. Banerjee [17] have collected data on the monthly closing stock indices of sensx for six years (2007-2012). Study develop an appropriate model which would help to forecast the future unobserved values of the Indian stock market indices.

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III. RESEARCH DATA

The research data used in this study is the daily closing price of the nifty index of NSE stock exchange and ten nifty stock as shown in table 1. The data are collected from NSE website (www.nseindia.com). The entire dataset covers the period from Jan 2, 2006 to Jun 30, 2015. The total number of trading daily sample is 2318. Entire dataset are divided into two sets. The first dataset is called the training dataset which is used during training and second dataset is called the performance measure dataset. The second datasets contain last one and half years data, which is further divided in to subsets. First subsets of performance measure dataset, contain half year data (125 sample), called holdout datasets. This dataset used to validate the model after training whether it will properly tuned or not. The second subset of performance measure dataset, contain last one year data (250 sample), called testing dataset. This dataset used to test prediction performance of model. Table 1 illustrates data sample contain in each dataset.

Table 1 Top ten nifty stock constituents by their weightage [source: www.nseindia.com, as on 30 Oct 2015]

Company Name	Symbol	% Weight in Index	Total Data Sample	Training Dataset	Performance Measure Dataset	
					Holdout Dataset	Testing Dataset
Infosys Ltd.	INFY	8.19	2318	1943	125	250
HDFC Bank Ltd.	HDFCBANK	7.43	2318	1943	125	250
Housing Development Finance Corporation Ltd.	HDFC	6.75	2318	1943	125	250
ITC Ltd.	ITC	6.51	2318	1943	125	250
ICICI Bank Ltd.	ICICIBANK	5.54	2318	1943	125	250
Reliance Industries Ltd.	RIL	5.02	2318	1943	125	250
Tata Consultancy Services Ltd.	TCS	4.68	2318	1943	125	250
Larsen & Toubro Ltd.	LT	4.24	2318	1943	125	250
Sun Pharmaceutical Industries Ltd.	SUNPHARMA	3.34	2318	1943	125	250
Axis Bank Ltd.	AXISBANK	2.94	2318	1943	125	250

IV. PREDICTION MODEL

As illustrated in figure 2 here we implemented a three-layered feed-forward ANN model to predict nifty index and ten nifty stock price direction. This ANN consists of an input layer, a hidden layer and output layer, each of which is connected to the other. The input layer consists of five neurons, the hidden layer consists of 20 neurons, and output layer consists of a single neuron. Weights of connected neighboring neurons are adjusted during training to classify the given input patterns correctly for a given set of input-output pairs. The initial values of these weights were randomly assigned. At the input layer five technical indicators: Moving Average Convergence and Divergence (MACD), Relative Strength Index (RSI), William % R, Accumulator and Distribution and On Balance Volume (OBV), are fed as input variables to neural network. The selection of five technical indicators is done by the review of domain experts and prior researches [18]–[20]. Minimum input to ANN will save network space and improve execution performance of model. Technical analysts and investors in the stock market generally accept and use certain criteria for technical indicators as the signal of the market future trend [18]. The first 25 data samples from the training dataset have not reflected the technical indicator value, so they are ignored. The Levenberg-Marquardt [21], [22] learning algorithm was used to train ANN. The authors in [23], [24] compared Levenberg-Marquardt, conjugate gradient and resilient algorithm for stream-flow forecasting and determination of lateral stress in cohesion-less soils. They found that Levenberg-

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Marquardt algorithm was faster and achieved better performance than the other algorithms in training. Other research study by Kumar [3], claim that smaller size input, Levenberg-Marquardt algorithm was faster and achieved better result with minimum number of epoch, less time in execution and lowest prediction error in performance. Hyperbolic tangent sigmoid transfer function is used at both hidden layer and output layer. The output of the model is between 0 and 1. If the output of the model is greater than 0.5 then direction of price is considered as 1 (up) otherwise the direction of price is considered as 0 (down).

V. EXPERIMENTAL RESULT

ANN was trained for the 100 epoch. Training is stopped if goal reaches 0 or maximum validation fail reaches 6 or training epoch reaches 100. Table 2 show the experimental result of nifty index and ten selected stock prediction performance applying proposed PPGM model. From table 2 it can be observed that prediction performance is improved after training compare to that of without training, except the case ITC stock.

Table 2 Experimental Prediction Result of Nifty and Stock Securities

Stock Security	Before Training % Prediction	After Training % Prediction
Nifty Index	47.56	56.40
INFY	47.61	53.20
HDFCBANK	47.86	50.40
HDFC	46.68	52.40
ITC	51.26	50.40
ICICIBANK	47.97	52.00
RELIANCE	49.67	52.80
TCS	49.51	53.60
LT	47.76	54.00
SUNPHARMA	46.83	54.80
AXISBANK	47.86	52.80

VI. CONCLUSION:

From the experimental results Artificial Neural Network can effectively predict stock security price direction if it is properly tuned. It will be observed performance of neural network depends on training, input selection, data sampling, various network parameters such as no of node, transfer function, learning algorithm etc. This will provide opportunity to researchers finding new methodology and algorithms. Levenberg-Marquardt training algorithm is faster as compared to gradient descent, if the network size is small. Further this research study give opportunity to other researchers by applying proposed model they can predict other stock market index/stock price direction and help to investor and traders.

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