



## PREDICTION OF STOCK VALUES IN STOCK MARKET USING ARTIFICIAL NEURAL NETWORK

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### ABSTRACT—

*Neural networks are presenting an interesting alternative to traditional concepts for solving problems with regard to prediction of stock market values. It has ability to identify pattern and has a techniques to accurately solve complex processes, especially in financial forecasting it is very useful tool to predict stock market value. In this paper we evaluate the performance of back-propagation neural networks model and established a stock market value prediction model. The past stock market prices are used in order to predict the values for the future stock market. In order to do that our past data contains not only past companies stock values but also the various factors that make effects on company's stock values. The results obtained lead to the conclusion that neural networks can be considered as useful instruments to analysis or predict values of a companies.*

**Keywords—neural network; back-propagation; feed-forward; data mining; stock value;**

### INTRODUCTION

Stock market forecasting involves the gathering and processing of enormous data each year the field of computer science becomes more sophisticated. Stock market value prediction serves as a parameter to help investors to make profit while investing. From their perspective the stock market is highly peril and it is very difficult to investors to make right decision. The future stock market value depends on various market variables. The variable like variable stock, political events, policies of company, interest rates are usually considered for prediction. Even the various parameters in real time affect the future stock values because of the uncertainty factors. There are too many factors can make affect on stock value. Thus the data required for predicting stock market values are high dimensional in nature and reducing its dimensional results in loss of information so, predicting stock market value is very complex task. For a human expert predicting the market using the stock variables are error prone task. It is necessary to develop intelligent system in financial forecasting to predict financial value accurately. Several attempts were made by scientist to develop a system which can predict stock accurately but still it will remain a big question whether stock market value can be predicted accurately[1][2].

Stock market prediction involves extraction of information on the correlation between market values from the complex and enormous stock market data and presents an interesting and challenging data mining task. Neural network achieves success in financial value prediction. They also have some disadvantages but using various technique artificial teams succeed to overcome these disadvantages. In this paper we use neural network

with back-prorogation algorithms to predict stock market value using companies past data as a input to neural network. Data mining is a process of extracting nontrivial, valid, novel, and useful information from large database, clustering is a promising approach to mine stock market data and it attempts to group similar object based on future and actual data. Machine learning techniques like neural network and genetic algorithm have been successfully used to cluster large amount of data

Neural network consist of number of neurons called as processing unit and each processing unit get signals from other or outside. They process on it and produce required output through output layer. . It has ability to identify pattern and has a techniques to accurately solve complex processes. In neural network every neuron makes impact on another neuron and the impact of the one neuron on second neuron is shown with the weight of the connection between neuron one and second. Below fig 1 shows the simple neural network with its input, hidden and output layer. In this paper we use feed forward neural network which is characterized in principle by a network topology, a connection neural network with its input, hidden and output layer. In this paper we use feed-forward Neural network which is characterized in principle by a network topology, a connection pattern, neural activation properties, train strategy and ability to process data. This type of neural network is known as multilayer perceptron used to correctly map input to the output using past data so that the model can then be used to produce the output when the required output is unknown. There are two types of neural network normally used one of them is feed forward neural network and another one is recurrent neural network. In this paper we use feed forward neural network with back propagation algorithm also called as BP neural network. Fig 2 shows the three tire BP neural network [1].

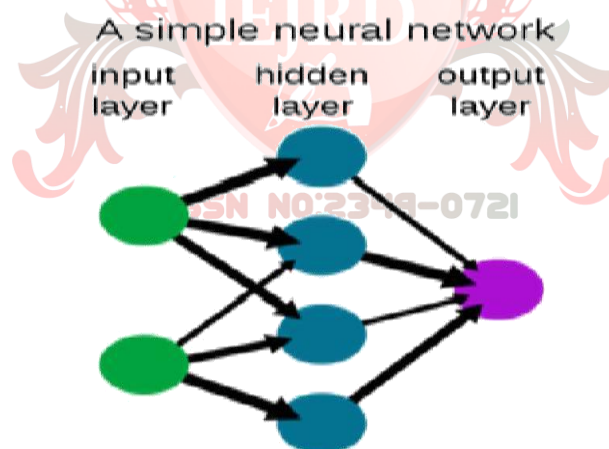


Figure 1: Simple neural network

## BP NETWORK

A back propagation network consists of three layers input layers, hidden layers and output layers. In back-prorogation errors are propagated back during training and using these errors weights are adjusted. Error in output determine in the error in hidden layer which are used for the bias for the adjustment connecting weight between the pair of layer and the re-computing outputs in t an iterative process that is carried out until the error fall below a tolerance level. Learning rate parameter scale the adjustment to weights and a momentum parameter

is used to overcome local minimal. In the back-propagation neural network each layer represents the number of neurons. It is difficult to determine the future required for predicting the stock market.

#### A. Feed forward network

A multilayer feed-forward neural network which adopts the BP algorithm is generally called as BP neural network, BP networks learning process is made up of two parts that is forward propagation of input parts and error back propagation. Forward propagated information is transferred to the output layer from the input layer after processing in the hidden layer. The state of each layer neuron only influences the state of neuron in the next layer. If it cannot obtain the expected output in output layer then we need to improve output for getting expected output it shifts to back propagation and error signal return along original path of the neural connection. While returning the connection weight of each layer is modified one by one. Through successive iteration, the error between the expected output signal of the network and practical output signal of the system reaches an allowable range. The feed forward neural network is a following important application.[6]

1) *Pattern recognition*: It is one of the earliest and most successful applications of their feed forward neural network. A feed forward neural network automatically extracts and memorizes the essential characters of various pattern samples by learning the training sample set.

2) *Classification and clustering*: It is a common problem in signal processing and many other. When there are several classes how to classify are samples is called classification. When the class number is unknown, how to merge sample in to classes reasonably is called clustering.

3) *Forecast decision making*: As a feed forward neural network has a mechanism of learning regarding the environment, adaptive capability and continuity, the neural network that has learned some knowledge about related domain is like a prediction model

4) *System identification and adaptive control*: These are other important application of feed forward neural networks. System identification based on neural network uses a nonlinear transformation mechanism and the adaptability of neural networks

5) *Modeling and optimizing*: Feed forward neural network have good learning capability and nonlinear transformation mechanisms. They can effectively simulation modeling for problem including sensing system and automatic production process. Where it is difficult to build accurate model using mathematical formulas [13].

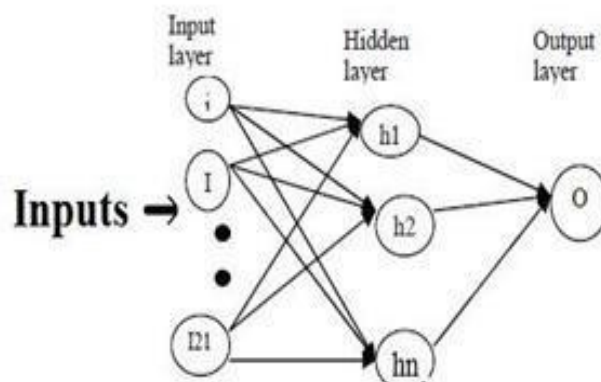


Figure 2: Three-tier BPNN architecture

Result

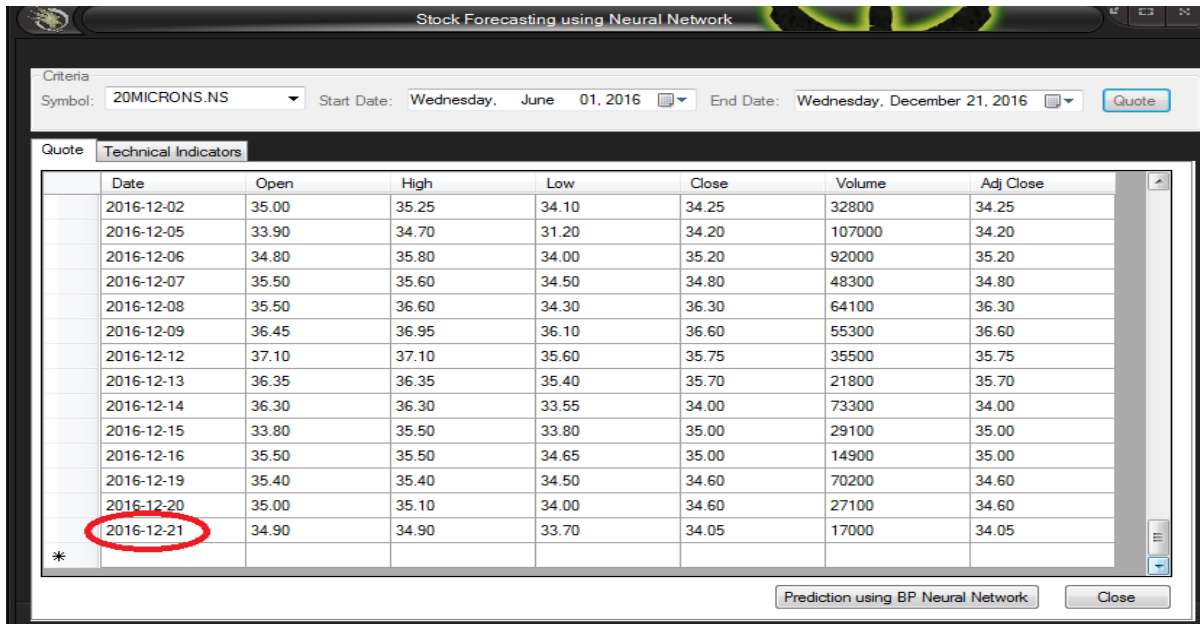


Figure 3 Quote form

The above figure 3 shows the stock data for 20MICRON till 21-Dec-2016 and using the application we have predicted the next day result as shown in figure 4.

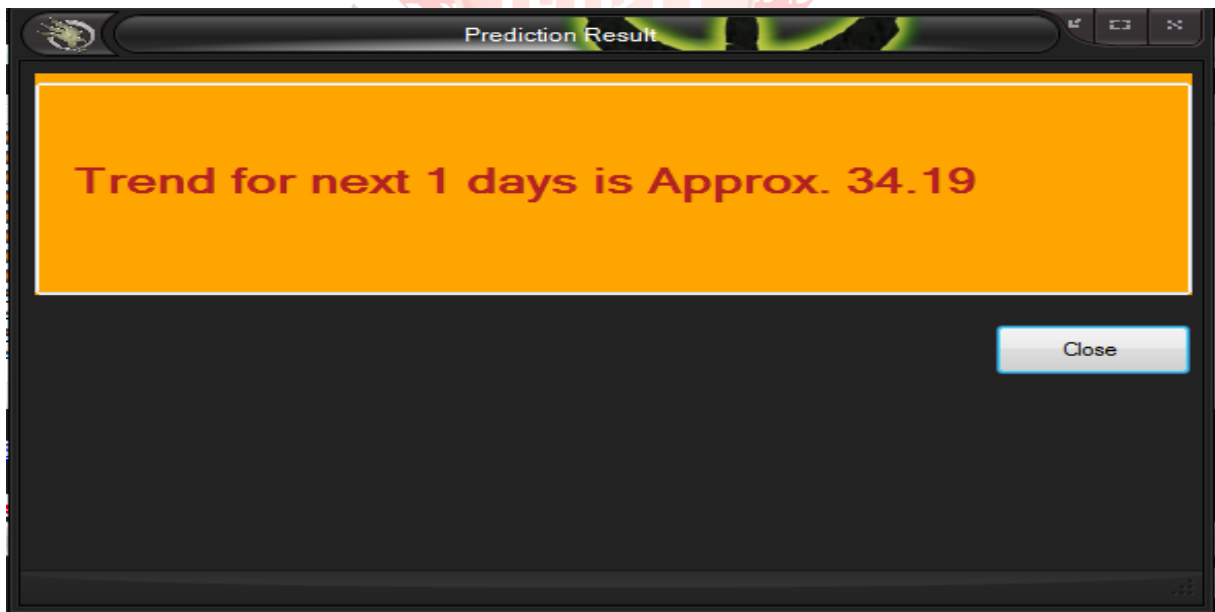


Figure 4: Next day prediction.

After the prediction, next day's predicted result is compared with actual result to find the accuracy. The next day result is shown in following figure 5.

Date	Open	High	Low	Close	Volume	Adj Close
2016-12-05	33.90	34.70	31.20	34.20	107000	34.20
2016-12-06	34.80	35.80	34.00	35.20	92000	35.20
2016-12-07	35.50	35.60	34.50	34.80	48300	34.80
2016-12-08	35.50	36.60	34.30	36.30	64100	36.30
2016-12-09	36.45	36.95	36.10	36.60	55300	36.60
2016-12-12	37.10	37.10	35.60	35.75	35500	35.75
2016-12-13	36.35	36.35	35.40	35.70	21800	35.70
2016-12-14	36.30	36.30	33.55	34.00	73300	34.00
2016-12-15	33.80	35.50	33.80	35.00	29100	35.00
2016-12-16	35.50	35.50	34.65	35.00	14900	35.00
2016-12-19	35.40	35.40	34.50	34.60	70200	34.60
2016-12-20	35.00	35.10	34.00	34.60	27100	34.60
2016-12-21	34.90	34.90	33.70	34.05	17000	34.05
2016-12-22	34.50	34.75	33.50	34.20	25100	34.20

Figure 5 Next day's Quote form

Now from the figure 4 and 5 it is clear that the predicted result was 34.19 and the actual result on next day is 34.20 so the accuracy will be as:

Predicted value= 34.19.

Actual value = 34.20.

$$\begin{aligned}
 \text{Accuracy} &= \frac{\text{Actual value} - (\text{difference})}{\text{Actual value}} \times 100 \\
 &= \frac{34.20 - (34.20 - 34.19)}{34.20} \times 100
 \end{aligned}$$

Accuracy = 99.97 %.

So in first prediction the accuracy is 99.97 %, but as it is the prediction it value get change with different results.

### 7.1.2 Result-2

From figure 3 on date 21-Dec-2016 for the same company 20MICRON we have predicted the second next day result as shown in figure 6.

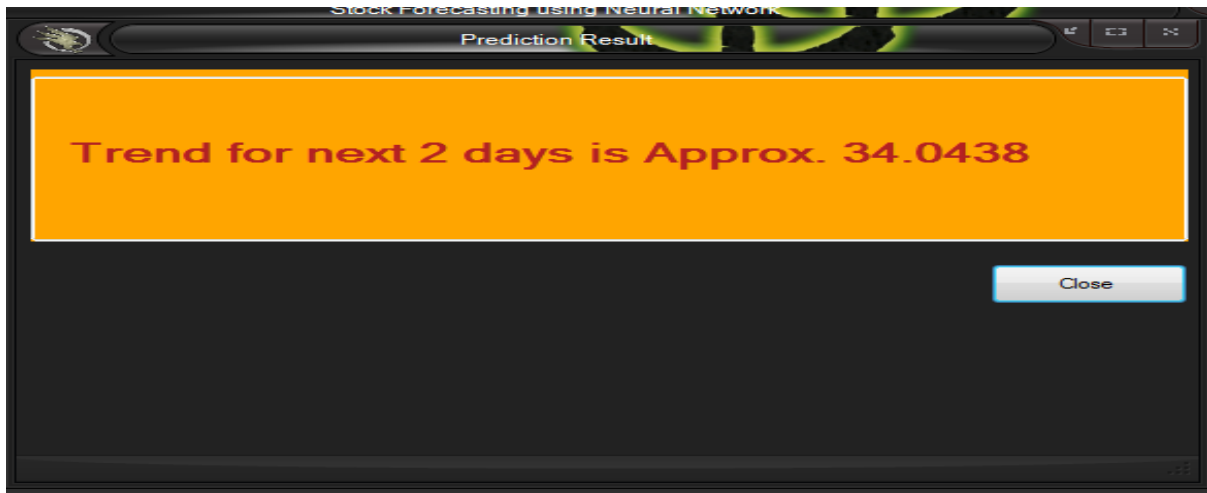


Figure 6 Second Next day's predictions.

After the prediction, second next day's predicted result is compared with actual result to find the accuracy. The second next day's result is shown in following figure 7.

The screenshot shows a 'Quote' window for the stock symbol 20MICRONS.NS. It displays a table of technical indicators for the period from 2016-12-06 to 2016-12-23. The 'Adj Close' column for 2016-12-23 is circled in red, showing a value of 33.70. The predicted value from Figure 6 is 34.04.

Date	Open	High	Low	Close	Volume	Adj Close
2016-12-06	34.80	35.80	34.00	35.20	92000	35.20
2016-12-07	35.50	35.60	34.50	34.80	48300	34.80
2016-12-08	35.50	36.60	34.30	36.30	64100	36.30
2016-12-09	36.45	36.95	36.10	36.60	55300	36.60
2016-12-12	37.10	37.10	35.60	35.75	35500	35.75
2016-12-13	36.35	36.35	35.40	35.70	21800	35.70
2016-12-14	36.30	36.30	33.55	34.00	73300	34.00
2016-12-15	33.80	35.50	33.80	35.00	29100	35.00
2016-12-16	35.50	35.50	34.65	35.00	14900	35.00
2016-12-19	35.40	35.40	34.50	34.60	70200	34.60
2016-12-20	35.00	35.10	34.00	34.60	27100	34.60
2016-12-21	34.90	34.90	33.70	34.05	17000	34.05
2016-12-22	34.50	34.75	33.50	34.20	25100	34.20
2016-12-23	34.80	34.80	33.00	33.70	73500	33.70

Figure 7 Second next day's Quote form

Now from the figure 6 and 7 it is clear that the predicted result was 34.04 and the actual result on next day is 33.70 so the accuracy will be as:

Predicted value= 34.04.

Actual value = 33.70.

$$\text{Accuracy} = \frac{\text{Actual value} - (\text{difference})}{\text{Actual value}} \times 100$$

$$= \frac{33.70 - (34.04 - 33.70)}{33.70} \times 100$$

Accuracy = 98.99 %.

So in first prediction the accuracy is 98.99 %, but as it is the prediction it value get change with different results.

### 7.2 Analysis

At the time of prediction different parameter are considered, the parameter are accuracy, time and numbers of iteration required for the prediction of stock values. In the analysis we have considered data of five stock market companies and for those companies we have analyze the accuracy, time and iterations in three cases.

Case 1: Accuracy, Time and numbers of iteration for next 5 day’s prediction.

Case 2: Accuracy, Time and numbers of iteration for next 10 day’s prediction.

Case 3: Accuracy, Time and numbers of iteration for next 15 day’s prediction.

Following are the three different parameters on the basis of which we have analyzed the predicted result with the actual result.

#### 7.2.1 Accuracy

The accuracy is the most important factor for estimating the performance of the system. The reliable system is totally dependent on accuracy, more the accuracy the system is more reliable. In following table 1 we have calculated the accuracies for 5 stock companies for next 5, 10 and 15 days.

STOCK SYMBOL (05-12-2016)	NEXT 5 DAYS (On 12-12-2016)		NEXT 10 DAYS (On 16-12-2016)		NEXT 15 DAYS (On 21-12-2016)		Average Accuracy (in %)
	Predicted Value	Actual Value	Predicted Value	Actual Value	Predicted Value	Actual Value	
20MICRON.NS	35.75	35.61	35.45	35	34.35	34.05	99.15 %
3MINDIA.NS	10823	10798	10735	10595	10496	10400	99.18 %

<b>ABB.NS</b>	1051.2	1049.9	1057.2	1065.6	1047.2	1043.2	99.56 %
<b>KOTAKBANK.NS</b>	732.37	729.85	721.8	719.1	719.23	719.8	99.73 %
<b>BAJAJ-FINSV.NS</b>	2991.14	2975.25	2739.16	2829.80	2619.57	2659.90	98.24 %

Table 1: Accuracy comparison table

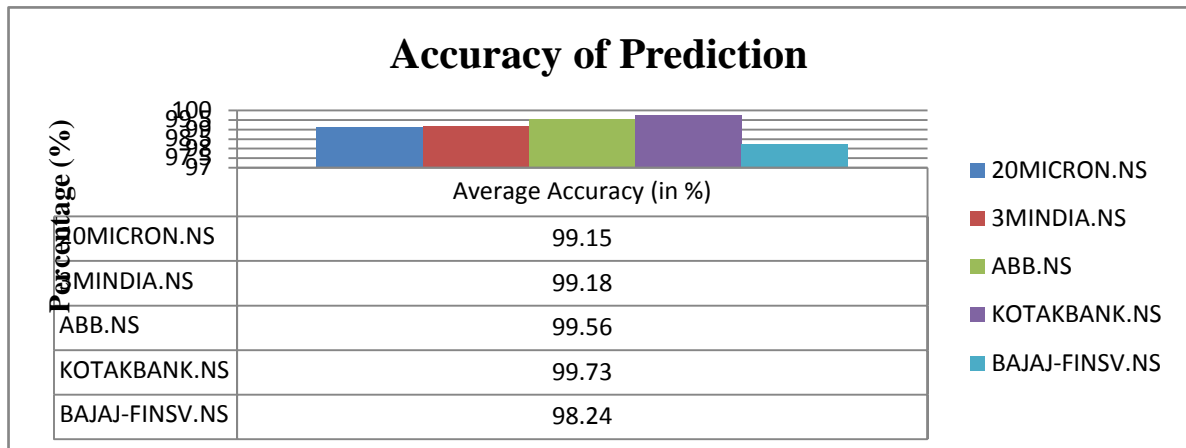


Figure 8. Comparisons of accuracy

The figure 8 shows the graph of five stock market companies on the basis of next 5, 10 and 15 days. From graph it seems that the accuracy of algorithm ranging from 98.24 % to 99.15 % which shows the great reliability and efficiency of back propagation algorithm.

### 7.2.2 Time Requirement

The time is second most important factor for estimating the performance of the system. The time required to execute the algorithm is known as “time complexity”, less the time complexity faster the system is consider. In following table 2 we have calculated the Time requirement in minutes for 5 stock companies for next 5, 10 and 15 days.

STOCK SYMBOL	Time Required for Prediction (in Minutes)		
	5th Day	10th Days	15th Days
<b>20MICRON.NS</b>	3.21	4.55	5.4

3MINDIA.NS	2.11	2.3	2.48
ABB.NS	2.15	3.23	4.2
KOTAKBANK.NS	1.54	2.49	3.2
BAJAJ-FINS.NS	2.19	2.53	3.37

Table 2.Comparison of Time required

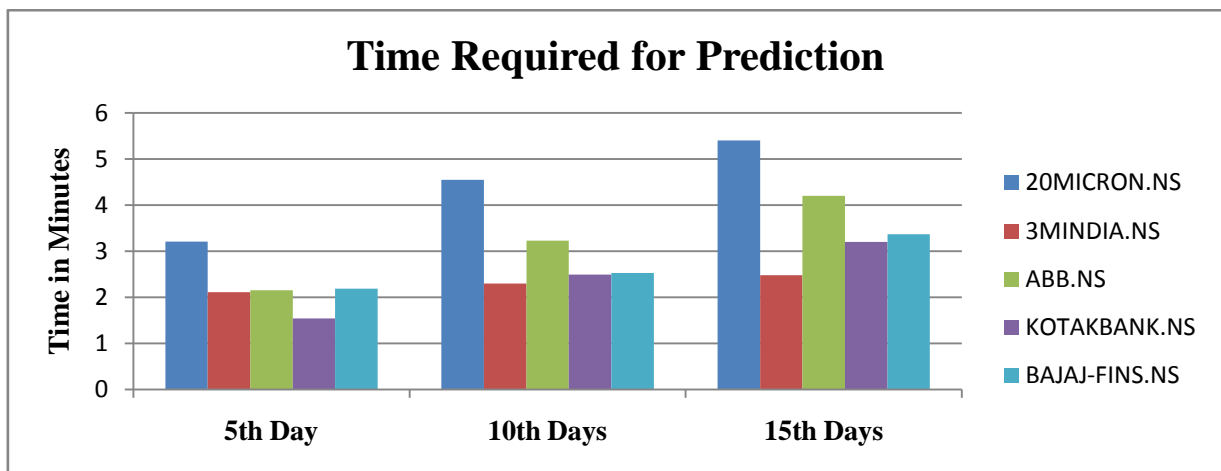


Figure 9: Comparison of Time required

The figure 9 shows the graph of Time requirement for five stock market companies to predict result on the basis of next 5, 10 and 15 days. From graph it seems that the times required for the execution of algorithm is ranging from 1.54 to 5.4 minutes which also shows the great reliability and efficiency of back propagation algorithm.

### 7.2.2 Number of Iterations

The numbers of iterations are the third most important factor for estimating the performance of the system. Numbers of iterations are directly proportional to the time. In following table 3 we have observed the numbers of iterations for 5 stock companies for next 5, 10 and 15 days.

STOCK SYMBOL	Numbers of Iteration Required for Prediction		
	5th Day	10th Days	15th Days
20MICRON.NS	1526	1756	1985
3MINDIA.NS	1170	1307	1576
ABB.NS	1132	1723	2205
KOTAKBANK.NS	962	1435	1636
BAJAJ-FINS.NS	1231	1527	1763

Table 3: Comparison of Iterations required

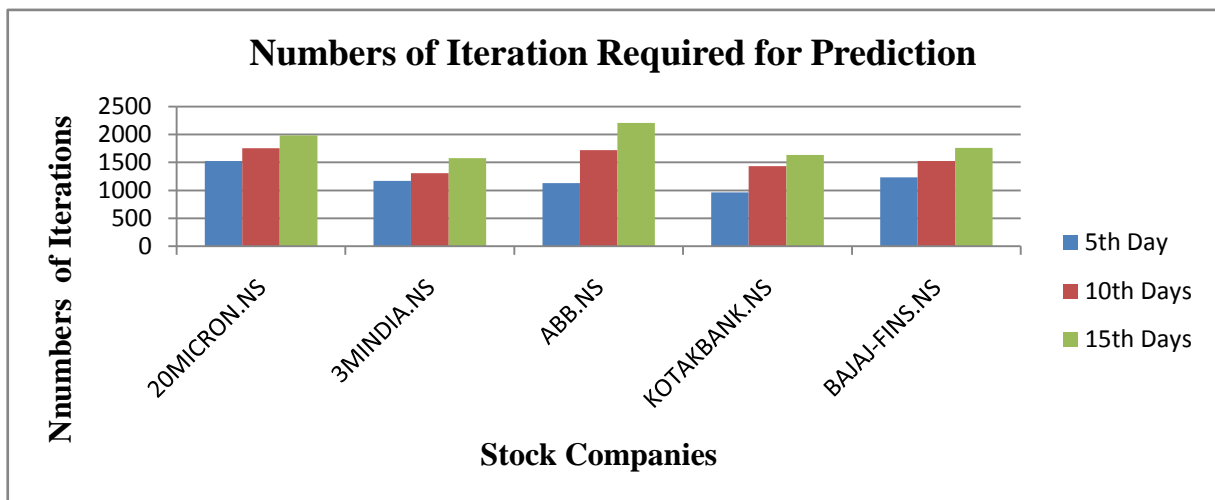


Figure 10. Comparison of numbers of iteration required

The figure 10 shows the graph of numbers requirement for five stock market companies to predict result on the basis of next 5, 10 and 15 days. From graph it seems that the times required for the execution of algorithm is ranging from hundreds to thousands of iterations, less the iteration less the time required, which also shows the great reliability and efficiency of back propagation algorithm.

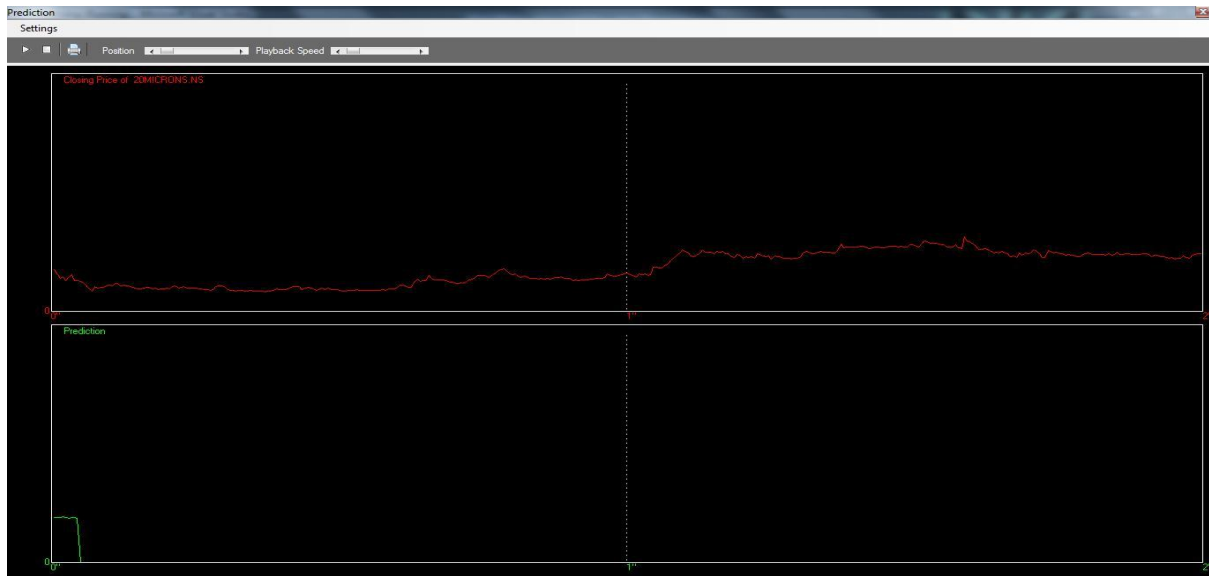


Figure 11: .Change in stock

## CONCLUSION

This paper proposes stock market value prediction model using back propagation neural networks. We use past data of stock market as an input to predict future stock market value. For these purpose we used feed forward neural network with BP algorithm. The empirical result of this model as compared to linear regression model and also the error of this model is less than Elman and linear regression model. Still some research is necessary to improve accuracy. In future, with the power of neural network, we will try different combination factor which are crucial. We mostly concentrate on the quality of training data because we realize that it will mostly effect on the result. In stock market value prediction method we need to know which factor is more important.

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