

A Study on the Prediction of Infosys Stock Price using Artificial Neural Network (ANN)

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Abstract— Stock markets tend to be stock trading institutions where stocks and shares (equity) as well as other financial instruments for instance bonds are offered intended for trade. With regard to stocks, the marketplace generally operates any kind of 'willing buyer, willing-seller' trade, wherever buyers and sellers price tags are matched for the fit. Predicting has long been within the domain of linear statistics. An artificial neural network (ANN) is a large-scale, nonlinear compelling technique that is capable of executing extremely nonlinear functions, self-learning, and self-organizing. ANN is considered as more desirable pertaining to stock market forecasting than any other techniques given, it will be able to identify and find out patterns or even relationships through the data itself. For the study, simulation have been used as a way of predicting the stock price. The two efficiency measures, Mean Square Error (MSE), and Sum Squared Error (SSE) are applied to evaluate the actual performances for the model designed. The results produced will help the investors to take decision in a wise manner.

Key words: Artificial Neural Network, ANN, Prediction, Feed-Forward Back Propagation, Stock Price

I. INTRODUCTION

Stock markets tend to be stock trading institutions where stocks and shares (equity) as well as other financial instruments for instance bonds are offered intended for trade. With regard to stocks, the marketplace generally operates any kind of 'willing buyer, willing-seller' trade, wherever buyers and sellers price tags are matched for the fit. Predicting has long been within the domain of linear statistics. Linear models hold the advantage that they may easily be understood and analysed within great detail and they are generally easy to explain as well as put into action. The stock market appertains to the variety of markets and exchanges in which the issuing and buying and selling of equities (stocks of publicly held organizations), bonds along with other kinds of investments takes place, either through conventional exchanges or even over-the-counter markets, also referred to as the equity market, the stock market is among the most important aspects of a free-market economy, because it provides companies with having access to capital in return with regard to providing investors a portion of ownership. Investors in stock market would like to take full advantage of most of their earnings by buying or maybe selling most of their investments in an appropriate time frame. Given that stock market data are quite time-variant and they are in most cases in a nonlinear structure, forecasting the long run price of an investment is extremely complicated. With the improve of economic globalization and also development of information technological know-how, examining stock market data with regard to forecasting the future of the actual stock is becoming progressively complicated.

Numerous traditional techniques for instance statistical analysis, fundamental analysis along with technical analysis have the ability to be utilized for forecasting reasons in stock markets, but they are challenging to carry out and not one of them have presented the actual anticipated outcomes.

An artificial neural network (ANN) is actually a large-scale, nonlinear compelling technique that is capable of executing extremely nonlinear functions, self-learning, and self-organizing. ANN is considered as more desirable pertaining to stock market forecasting than any other techniques, given it will be able to identify and find out patterns or even relationships through the data itself. Feedforward network moves in a single direction: coming from input, via hidden layers, towards the output. A feedforward backpropagation network is a network which merely been trained using a backpropagation algorithm. The backpropagation training algorithm subtracts the training outcome from targeted output to get the error sign. After that it extends back to modify the weights and biases within the input and hidden layers to minimize the error.

What is simulation? Simulation can be defined as the virtual environment where the real world process is done. Simulation is similar to the actual operations of a real-world procedure or even system as time passes. The act associated with simulating something initially requires that the model be formulated; this model presents the main element: characteristics, behaviours and also functions of the determined physical or fuzzy system or procedure. The model represents the training course itself, whilst the simulation represents the particular operation of the program as time passes. For the study Simulink in MATLAB to perform our simulation to get the output.

The objectives of the study are to understand the Artificial Neural Network. And also to predict the stock prices using an ANN simulator. Accuracy is the major aspect of the study so one of the objective is to get the highest accuracy possible.

II. LITERATURE REVIEW

As stated by Yasen, Kesra and Akeel (2017) that a Feed Forward network with backpropagation with only one hidden layer is suitable for a time series forecasting. Even though increasing number hidden layer increases the complexity but provide a more precise result but there is no necessity to use multiple hidden layer, a single hidden layer is as efficient as multiple hidden layer. So for this particular study I have used a single layer ANN in the simulator. Phua, Ming and Lin (2001) The authors have taken 2 adaptive method for their neural network production very first being genetic search through input data window and second back propagation and learning unique networks. They trained their neural network on Stock Exchange of Singapore. The end result they obtained was merely 81% accurate. Which exhibits

weaknesses in algorithm and coding improvement. To overcome these drawbacks and limitations, simulation can be a reliable method to perform the prediction.

Tilakarathne, Mammadov and Morris (2009) in their study they aimed to present Modified Neural Network Algorithms to predict whether it is best to buy, hold or sell shares of stock market. They have used modified network algorithms on feed forward and Ordinary Least Square method, authors also used global optimisation algorithm to train the network. The study that has been done is keeping few corporate governance assumptions which fail in real world. Which shows that real world factors play a fair role in determining the possibility of the prediction.

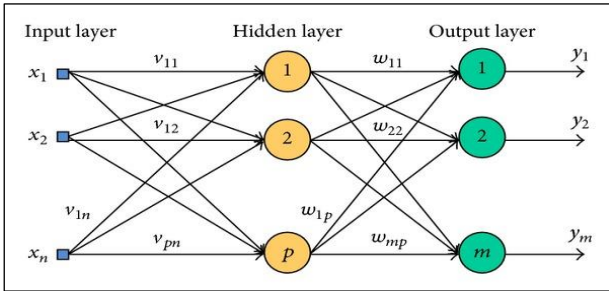


Fig. 1: Artificial Neural Network (Koo et al. 2013)

An ANN can have multiple numbers of input, multiple number of hidden layers and multiple outputs. With increasing number of hidden layer complexity increases. Number of hidden layers can also increase the accuracy and precision of the output.

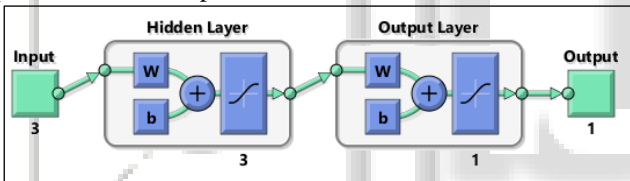


Fig. 2: Designed Artificial Neural Network (Author's work)

Shown above is the ANN that has been used in the study. It consists of a one input layer with three input variables, one hidden layer and one output layer. Hyperbolic tangent sigmoid is used as the activation function.

III. RESEARCH METHODOLOGY

The dataset used in this paper is collected through secondary sources. The study has only been focussed on the single IT Company. Infosys stock chosen is because of some specific reason, Infosys has shown a stable growth for past year, there haven't been a lot of fluctuations and is one of the most reliable and prominent leader in the industry. The data collected is from August 1, 2016 to 31 July, 2017. Data collected is from www.nseindia.com (National Stock Exchange).

The data set consists of the High Price, Low Price, Traded Quantity and Closing price have been taken. Closing price acted as the target value or output required and high price, low price, traded quantity are the input variables. Augmented Dicky Fuller test was done on the data to check the stationarity. On performing Augmented Dicky Fuller (ADF) 1st level data was found to be stationary.

Hyperbolic tangent sigmoid activation function is used. TANSIG is really a neural transfer function. Activation functions determine the layer's result through the net input.

$A = \text{tansig}(N,FP)$ calls for N as well as optionally available function parameters,

N	S-by-Q matrix of net input (column) vectors
FP	Struct of function parameters (ignored)

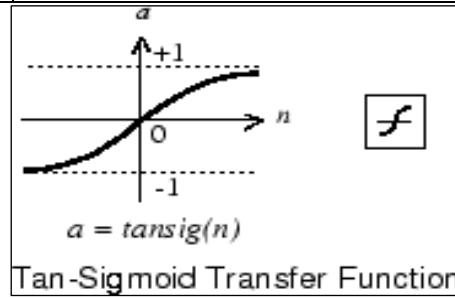


Fig. 3: Tan-Sigmoid Transfer Function

$$a = \text{tansig}(n) = 2/(1+\exp(-2*n))-1$$

This really is a mathematically equal to $\tanh(N)$. This varies it operates speedier compared to the MATLAB rendering of \tanh , however the results may have very little statistical differences. This specific function is an excellent tradeoff regarding neural networks, in which speed is essential and also the precise shape of the transfer function is not really.

IV. DATA ANALYSIS

Here for the study Feed Forward Back Propagation is used to do the prediction. This method uses preassigned weights in the simulation. Mean Squared Error and Sum Squared Error is calculated to do a comparison with each other and to check whether the result is accurate.

In this Neural Network all the data is stored into a single data set or variable, from that variable carry 3 input variable in to one variable and one target variable. A maximum of 1000 epochs is done (i.e., is equal to 1000 iterations); six validation checks have been done after a certain point. Using NNTOOL in MATLAB a network is formed consisting of one hidden layer. For training purpose Levenberg-Marquardt algorithm is used which is by default training algorithm used in MATLAB; data division is done on a random basis. Figure below is the screenshot of the network designed for the study.

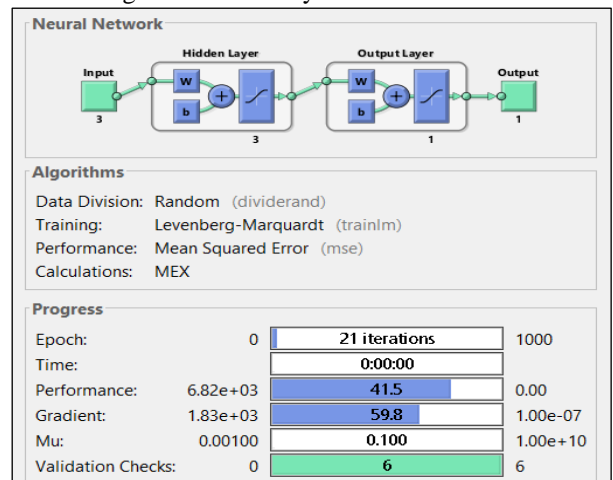


Fig. 4: Neural Network Training (Author's Study)

First the network was trained for Mean Squared Error (MSE), after training the data the best result came in 15 epochs.

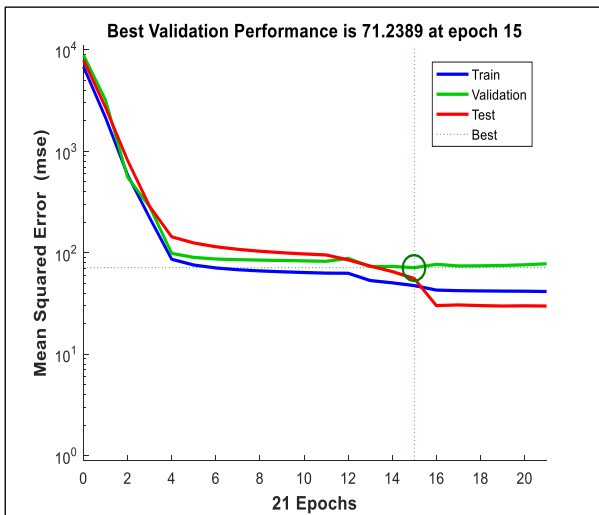


Fig. 5: Performance Validation MSE

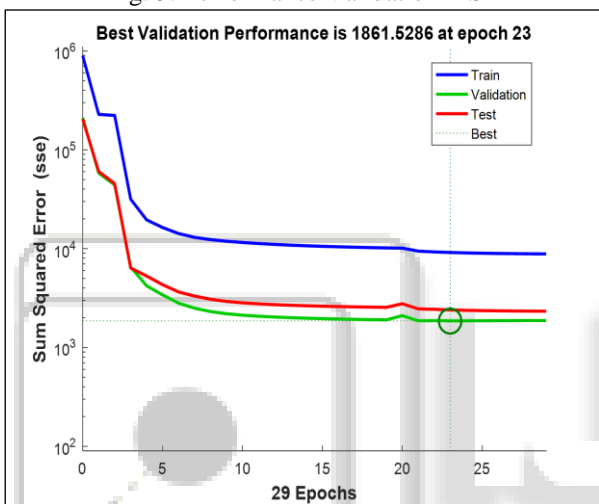


Fig. 6: Performance Validation SSE

Figure 5 and Figure 6 shows the graph of Performance validation for MSE and SSE respectively. Figure 5 shows after 15 epochs validation becomes stationary, which represents after training the validation is accurate to the target output. The intersection point shows the best result or outcome. Figure 6 shows that all the curve do not have a significant difference between them, in SSE performance the best result came at 23 epoch as compared to the MSE, this is due to the default parameters that are involved in MSE and SSE. The validation and test curve are similar which shows that there is not any major errors involved with the training.

After performance curve, regression curve is analysed to check the accuracy as mentioned in the abstract MSE and SSE are used as the measure to check the accuracy of the result obtained.

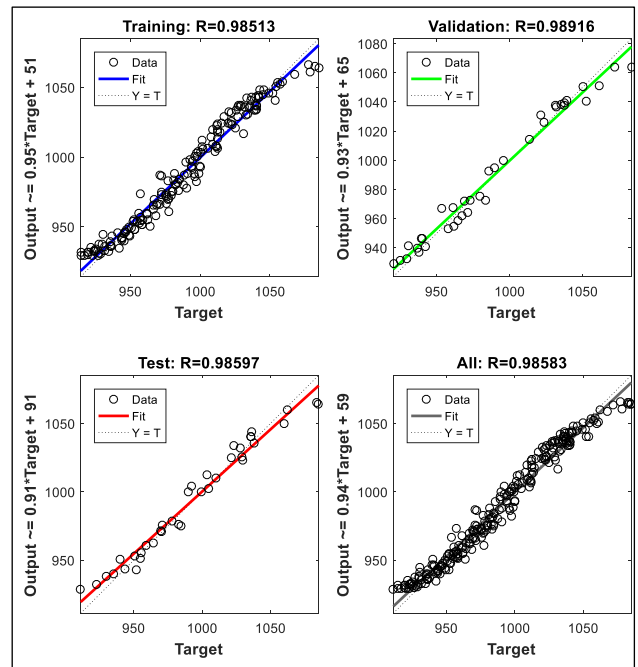


Fig. 7: Regression of MSE (Author's Study)

The next step includes validating the network that was created, a regression plot. Figure 7 shows the regression graph of the output received. The dashed line in each plot represents the perfect result. The solid lines shows the best fit that can be obtained between target and output. This plot shows the relationship between the output received and the target which want to receive. From the plot above can deduce that Training is 98.513%, Validation is 98.916% and testing is 98.597% accurate. Validation and the target are nearly equal which shows a perfect relationship. From above regression plot it can also be inferred that the accuracy of the network is close to 98%, which achieves one of the objective of the study.

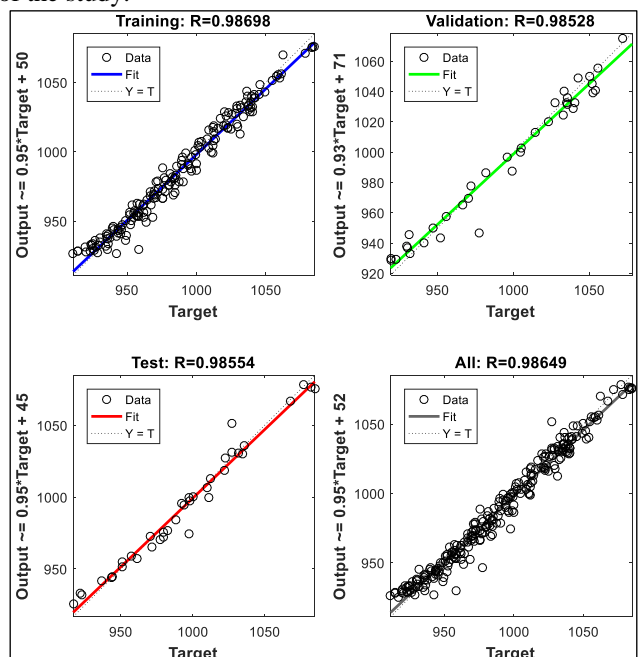


Fig. 7: Regression of SSE (Author's Study)

Regression plot in figure 7 is of Sum Squared Error, to check whether the result that was attained in MSE is correct

or reliable again the process is repeated with SSE. After plotting the regression can infer that the validation is 98.528% and the test is 98.554% which is almost equal to each other, this signifies that the data is accurate.

Further to confirm whether the target outcome is reliable or not can look at the MSE and SSE regression plot, which shows that the validation and test are almost equal which proves that the output received is reliable and accurate.

V. CONCLUSION

Stock market is now a backbone of the financial system all around the world. It fluctuates and move in a constant manner with the performance of the company as well as some of the external factors that differs from time to time. Nevertheless Stock Market is a place which is always open to new opportunities, technological innovations and experimentation. For an investor achieving highest profit or high returns is the sole objective in general terms, to help the investor to achieve his target he uses various statistical and prediction tools to get the best output. From the study done using ANN are getting 99% (approx.) efficiency and accuracy. Using few limitations over the data collected and the input and target variables, with very low errors feed forward back propagation helps to predict the future close price of Infosys Stock.

VI. FUTURE SCOPE

This research was done taking the historical values of Infosys Stock for one year. This study can be further conducted using other various AI tools like Deep Learning, Data Mining, etc. Since for a stock price to fluctuate there are other macro-economic factors as well as factors including news regarding the company, various chatrooms available on web and many more, can be taken into account and then the study should be conducted. Further the results achieved can also be compared with the various forecasting statistical model and there reliability can be measured. Limitations also include number of hidden layer, number of iterations and increasing complexity. All these challenges which were faced due to time constraint can be tackled in further research.

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