FORECASTING OF STOCK MARKET PRICES USING NEURAL NETWORK

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ABSTRACT: Forecast stock market prices are an essential pace while building investment portfolios. On the stock market study and forecast, investigation has been paid attention to by people. Stock price movement is a complex nonlinear function, so the price has convinced predictability. Artificial neural networks have been implemented in stock market prediction throughout the last decade. Studies were carried out for the prediction of stock index values also daily direction of variation in the index. Back propagation is one of the approaches to realize neural networks. Back propagated to former ones, allowing arriving weights to these layers to be updated. In our study, we employ data mining and neural network concepts to stock market in order to investigate the trend of price. It intends to forecast the future prices of the stock market and the fluctuation of price. Our aim is achieve better predictive system to improve forecast accuracy.

KEYWORDS: Artificial Neural Network, Back propagation, Prediction model.

INTRODUCTION

In few years, data-mining (DM) has turn out to be one of the most helpful tools for digging out and directing data and for establishing patterns in turn to produce functional information for decision-making. Data Mining is the process that starts from actually unstructured data attempt to dig out knowledge or unknown interesting patterns. Throughout this process data mining employs complicated mathematical algorithms to section the data and estimate the probability of future events. On the other hand Machine Learning grows from the study of pattern recognition and computational learning conjecture in artificial intelligence. Machine learning discovers the study and creation of algorithms that learns from and makes prediction on that data. Machine Learning is the study, design and creation of the algorithms through which computers become capable to learn without being overtly programmed. The purpose of machine learning is to program computers to use instance data or past occurrence to solve a certain problem. The potential of the systems to learn from previous knowledge, training, exploratory observations, and other means, ends with a system that can incessantly self-improve and in so doing exhibit competence and effectiveness.

Applications appropriate for data mining are very vast, and are still being explored in many areas of business and life concerns. Data Mining has application in diverse areas like Financial Data Analysis, Retail Industry, Telecommunication Industry, Biological Data Analysis, Other Scientific Applications, and Intrusion Detection etc. Machine learning also has many applications in diverse areas as Face detection, Image classification, Speech recognition, Genetics, Weather forecast, Signal de noising and many more.

Our survey is about prediction of share market price using data mining and machine learning concepts. The major trouble in share market forecast is that the share market is a pandemonium system. There are numerous variables that could influence the share market directly or indirectly. There are no considerable associations between the variables and the price. We cannot portray any mathematical next of kin among the variables. There are no regulations for predicting the share price using these variables. For this sort of muddled system the neural network approach is suitable because we do not have to understand the solution. This is a major advantage of neural network. Where traditional techniques not succeeded to map nonlinear data relationships, Artificial Neural Networks (ANNs) accomplish across disciplines.

The Artificial Neural Network (ANN) formation is motivated by the compound parallel structure of the human nervous

system. Biological neural system functions by processing copious input signals through an intricate network of neurons in turn to generate some useful output. With their skill to find out patterns in nonlinear and messy systems, neural networks propose the capability to predict market directions more precisely than current techniques. Common market analysis techniques such as technical analysis, fundamental analysis, and regression are discussed and compared with neural network performance. In our paper, we introduce a method which can forecast share market price using Back propagation algorithm and Multilayer Feed forward network. Back propagation algorithm is one of the best algorithms used for Feed forward neural network because it decreases an inaccuracy between the actual output and desired output in a gradient descent manner.

LITERATURE SURVEY

Classification is a data mining (machine learning) method used to forecast group membership for data instances. Accepted classification techniques include decision trees and neural networks. Whereas Prediction attempts to form patterns that allows it to forecast the next event(s) given the accessible input data. Predictive modeling influence statistics to forecast outcomes. Prediction task is a Supervised learning task where the data is used straightforwardly (no explicit model is created) to forecast the class value of a new instance. Most often the event one wants to forecast is in the future, however predictive modeling can be functional to any type of unknown event, in spite of that when it occurred.

Predictive data models

- **Decision tree** Decision trees is one of the most accepted and influential approaches in data mining. The science and technology of discovering large and complex data to find out useful patterns this area is most important for modeling and knowledge extraction from the data which are accessible.
- Naive Bayes Classifier Naive Bayes classifiers are a family of uncomplicated probabilistic classifiers based on applying Bayes' theorem with strong (naive) independence suppositions between the features. Naive Bayes is a straightforward process for constructing classifier models that assign class labels to problem instances, stand for vectors of feature values, where the class labels are drawn from some finite set.
- **k-Nearest Neighbors Algorithm** *k*-NN is a sort of instance-based learning, or lazy learning, where the function is only estimated locally and all calculation is deferred awaiting classification. The *k*-NN algorithm is among the easiest of all machine learning algorithms. Both for classification and regression, it can be of use to assign weight to the contributions of the neighbors, so that the nearer neighbors contribute more to the average than the more distant ones.
- Neural Networks Artificial neural networks (ANNs) is motivated by biological neural networks and are used to approximate functions that can depend on a great amount of inputs and are usually unknown. Artificial neural networks are commonly viewed as systems of interconnected "neurons" which swap messages between each other. The connections include numeric weights that can be tuned based on experience, creating neural networks' adaptive to inputs and competent of learning. After weight assignment and altered by a function, the activations of these neurons are then transferred to other neurons. Process repeats until as a final point, an output neuron is activated.
- **Support Vector Machines (SVM)** Support Vector Machines are supervised learning models coupled with learning algorithms that examine data used for classification and regression analysis. SVM training algorithm builds a model that allocates new examples into one category or the other, making it a non-probabilistic binary linear classifier.

In the previous two decades forecasting of stock proceeds has become a significant field of research. In the majority cases the researchers have tried to establish a linear relationship between the input macroeconomic variables and the stock proceeds. With the sighting of nonlinearity in the stock market, the focus of the researchers has been diverted towards the nonlinear prediction of the stock returns. Such systems are extremely sensitive to the initial conditions of the systems. These systems are active, intervallic, and complex and are hard to deal with normal analytical methods. Because of all these reasons like stock market values being noisy, unsure, muddled and nonlinear in nature, ANN come into sight to be an improved practice in capture the structural relationship between a stock's performance and its determinant factors more precisely than many other statistical practice.

Mayankkumar B Patel, Sunil R Yalamalle et al.,2014, proposed that the stock market data are extremely time variant and are usually in a nonlinear pattern, forecasting the future index value of a stock is very challenging. Prediction offers conversant information concerning the current status of the stock price movement

Arti R. Naik, Prof. S.K.Pathan et al., 2012, propose a new method of weather forecasting using Feed forward ANN where data can be trained using LM algorithm to predict the future weather and to classify it.

The proposal of Ravichandran K.S. et al., 2005, represents that Regression models were traditionally used to model the

variation in the stock markets. Though, such model feasibly predicts linear patterns only. The stock market values vary in a non-linear pattern so that the neural networks are more apt to model these changes. Back propagation neural networks need not to worry about the sequence in which the inputs are offered.

Nekoukar et al., 2010, have employed used radial basis function neural network for financial time-series forecasting in his study whose results shows feasibility and effectiveness.

The neural networks are effective in learning such non linear muddled systems with the reason that they build very few assumptions about the functional form of the underlying vibrant dependencies and their initial conditions. In our study we will use Back propagation algorithm for training session and Multilayer Feed forward network as a network model for predicting price.

Our study overcomes the lacking that exists in current traditional statistical analysis in the stock market prices, and makes use of BP neural network algorithm to predict the stock market by establishing a three-tier structure of the neural network, namely input layer, hidden layer and output layer. Finally, we will get a better predictive system to improve forecast accuracy.

PROPOSED WORK

In Back propagation the error is back propagated in the system and respectively the weights are calculated and adjusted that result in reduction of error. This cycle continues awaiting the point where target value with minimum error is reached. Back-propagation is a multi-layer forward network, learning by minimum mean sq. error. Back-propagation algorithm works in a manner where the errors from the output layers are back-propagating towards the input layer during training sessions. Back-propagation is indispensable since the hidden units have no target values which can be used, so these units must be trained based on errors from the prior layers. The output layer has a target value which is used to compare with calculated value. Since errors are back-propagated through the nodes, the connection weights are continuously updated. Training will take place until the errors in the weights are tolerably minute to be accepted. The computational complexity of Back-propagation Algorithm is only O(n). These features of the algorithm are the key measures to predict share prices precisely.

Back propagation Algorithm

- Take inputs.
- Perform weighted summation at each neuron.
- Apply to input layer neurons.
- Apply transfer function to each neuron.
- Pass output of hidden layer neurons to all output layers and repeat 1,2,3,4 to get final output.
- Display the final output.

The Stock market data contains many attributes like date, time of day, opening price, and closing price, high, low, adjacent close, volume etc. Out of these, only six attributes were taken into account, the opening price, closing price, high price and the low price, adjacent close, volume. The output consisted of a single attribute, the closing value. We will further split the data into training set for training the model and testing set.

There are two phases 1^{st} is the training phase and 2^{nd} is the prediction phase. The training stage can be divided into two stages, the propagation stage and the weight update stage. Back propagation Algorithm is used for the training stage. These weights are used in prediction stage using same equations which are used in training stage. This is the fundamental planning of our System and this approach is known as a Feed forward Network. There are lots of external attributes which affects the share prices. In our system all inputs are not included because their impacts are not significant in share market price. We use 6 inputs for the system. The inputs are: Open, Close, low, High, Adjacent close, volume. Then normalized the data set to scale the inputs then feed the data to the network.

Training

- 1. Prepare two arrays, one is input and hidden unit and the second is output unit.
- 2. Here first is a two dimensional array W_{ij} is used and output is a one dimensional array Y_i .
- 3. Original weights are random values put inside the arrays after that the output is given as.

$$x_j = \sum_{i=0} y_i W_{ij}$$

Where, y_i is the activity level of the jth unit in the previous layer and W_{ij} is the weight of the connection between the ith and the jth unit.



Fig. 1. Flow Chart of Back Propagation algorithm

4. Next, action level of y_i is estimated by sigmoidal function of the total weighted input.

$$y_i = \left[\frac{e^x - e^{-x}}{e^x + e^{-x}}\right]$$

When event of the all output units have been determined, the network calculates the error (E) given in equation.

$$E = \frac{1}{2} \sum_{i} (y_i - d_i)^2$$

Where, y_i is the event level of the jth unit in the top layer and d_i is the preferred output of the j_i unit.

In the propagation phase the input data is normalized to feed the network into the input nodes using the formula:

$$V' = \frac{V - \min A}{\min A - \max} \operatorname{New}_{\min A} - \operatorname{New}_{\max A} + \operatorname{New}_{\min A}$$

Here,

V' = Normalized Input and V = Actual Input.

minA, maxA = Boundary values of the old data range. New_{minA}, New_{maxA} = Boundary values of the new data range. In this case it is -1 and 1 because the back propagation can only handle data between -1 to 1.

The normalized input data are fed into the input layer, and then the weights are calculated by multiplying with the each input data then enters hidden layer. In our model the hidden layer neurons has the same functions as the input layers neurons. After that each neuron passes the output to the next neuron of the output layer. The output layer neurons calculates in the same way as the hidden layer neuron and generate the final out put which is compared with the real output and calculate an error signal "e".

$e = \frac{\text{actual output} - \text{ANN output}}{\text{actual output}}$

The error "e" is generated from the Propagation Phase is used to update the weight backward. This process repeats in the system for updating weight. The Phase 1 and Phase 2 procedure repetitively used awaiting the sum of square error is zero or close to zero. Each neuron is composed of two units. First unit adds products of weights coefficients and input signals. Then this output enter into the second unit of the neuron which contains the nonlinear activation function, in our model we use sigmoid function as our activation function.

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EXPECTED OUTCOME

In our research for better performance and precision we have used ANN trained by back propagation algorithm for stock market price prediction. The performance will be investigated by varying different units like, varying the number of the hidden layers, number of input functions etc. Many researchers have already proved that linear regression for prediction and other methods are not efficient for share market prediction as their results are not closer to the real values. Our study shows that AAN trained with the back propagation algorithm is efficient and accurate for prediction of stock market prices. For more precision and accuracy here we use different statistical test on the input data like t-test. The t-test enables you to see whether two samples are different when you have data that are continuous and normally distributed. The test allows you to compare the means and standard deviations of the two groups to see whether there is a statistically significant difference between them. And finally against the next day, we predicted the market trend, with the ANN successfully achieving precision.

CONCLUSION

Potential shareholder and active day investors need an effective strategy to secure their investment assortment. The use of artificial neural networks (ANNs) in a muddled market does not require an understanding underlying market. For such reasons it is practically feasible and advantageous to use machine learning systems like neural networks to forecast the behavior of financial system such as stocks. In this paper, we tried to sum up the application of Artificial Neural Networks (ANN) for predicting stock market. The ultimate target is to increase the yield from the investment. It has been already proved by many researches that the assessment of investment in share markets through any of the traditional techniques is tedious, expensive and a time-consuming process. In this paper, we described the application of Artificial Neural Networks for the stock market prediction. ANN is suitable and an effective, general purpose approach for pattern recognition, classification, and clustering and especially time series prediction with an immense degree of precision. Back propagation algorithm is the best algorithm to be used in Feed forward neural network because it reduces an error between the actual output and desired output in a gradient descent manner. Thus in it involvement to knowledge this research paper utilize the learning capability of a feed forward neural network with back-propagation algorithm for the forecasting of daily prices of the Stock Exchange and as a result introduces another interesting way of wealth creation.

REFERENCES

- [1] Budhani N,...Jha C.K, Budhani S.K.; 2012; *Application Of Neural Network In Analysis Of Stock Market Prediction;* "International Journal Of Computer science And Engineering Technology"; **3**.
- [2] Chaudhuri Tamal Datta and Ghosh Indranil; *Forecasting Volatility in Indian Stock Market using Artificial Neural Network with Multiple Inputs and Outputs*; 2015 ;"International Journal of Computer Applications" **120**.
- [3] Dase R.K, Pawar D. D. and Daspute D.S.; (2011); *Methodologies for Prediction of Stock Market: An Artificial Neural Network*; "International Journal of Statistika and Mathematika", **1**, 08-15.
- [4] Dongare A. D, Kharde R.R, Kachare Amit D; 2012; *Introduction to Artificial Neural Network* ;"International Journal of Engineering and Innovative Technology (IJEIT)" **2**.
- [5] Devadoss A. Victor, T. Antony Alphonnse Ligori ; 2013; *Forecasting of Stock Prices Using Multi Layer Perceptron* ; "International Journal of Computing Algorithm"; **2**, 440-449.
- [6] Kumbhar G. V., Argiddi R. V.; 2015; *Stock Market Index Prediction by Hybrid Neuro-Genetic Data Mining Technique*; "International Journal of Advanced Research in Computer and Communication Engineering"; **4**.
- [7] Liu Xiangwei; 2012; Based on BP Neural Network Stock Prediction; "Journal of Curriculum and Teaching"; 1.
- [8] Mantri Dibendu Kumar, Gahan. P. and Nayak. B.B.,; 2010 Artificial Neural Networks-an application to stock market volatility;. "International journal of Engineering Science and Technology"; 2,
- [9] Nayak Bhagirathi, Nahak C., Mishra Arun K, ;2011;. Forecasting of Financial Markets –Application of Fuzzy Association Rules; "International Journal of Research in Commerce IT & Management"; 1.
- [10] Khan Zabir Haider, Tasnim Sharmin Alin, md. Hussain Akhter,; 2011; Price prediction of share market using Artificial Neural Network(ANN); "International Journal of Computer Application"; 22..
- [11] Ramani Prakash, Murarka P.D.; 2013; *Stock market Prediction Using Artificial Neural Network*; "International Journal of Advanced Research in Computer Science and Software Engineering"; **3**.
- [12] Sureshkumar K. K., Elango N. M.; 2012; *Performance analysis of Stock Price Prediction using Artificial Neural Networks;* "Global journal of computer science and Technology"; **2**.
- [13] National Stock Exchange of India Fact Book (2010). Retrieved October 1, 2011, from NSE Website http://www.nseindia.com/archives/us/fact/us_factbook2011.htm