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Stock Market Volatility and Prediction using Artificial Neural Network: A Review

Atul Kumar Tripathi¹, Prof. Satyarth Tiwari²

M. Tech. Scholar, Department of Electronics and Communication, Bhabha Engineering Research Institute,
Bhopal, India¹

Guide, Department of Electronics and Communication, Bhabha Engineering Research Institute,
Bhopal, India²

ABSTRACT: -Trading in stock markets is not an easy task and requires expertise and knowledge that improve and increase the chances of making more profits and ensuring that you make profitable decisions at all times. The study was conducted with different sectors like, IT sector, Automobile sector, Banking sector, Pharmaceutical sector and FMCG sector. All the sectors taken for the study is highly volatile compared to other sectors in NSE/BSE. Hence it is very essential to study on the nexus between the Indian Stock Market and selected companies behaviour. The specialty of the framework lies in the utilization of the hybrid framework which can adjust itself to the changing market conditions and in the way that while the greater part of the endeavors at stock market trend foreseeing have approached it as a regression issue into a classification issue, subsequently enhancing the anticipation precision altogether. The behavior of the proposed hybrid system is assessed on the past data from the Bombay Stock Exchange sensitive index (BSE-Sensex). The system execution is then contrasted with that of an Artificial Neural Network (ANN) based system and a Naïve Bayes based system. It is discovered that the pattern anticipation precision is most elevated for the hybrid system and the genetic algorithm optimized decision tree SVM hybrid system beats both the Artificial Neural Network and the Naïve Bayes based pattern forecast system.

KEYWORDS: -National Stock Exchange (NSE), Bombay Stock Exchange (BSE), Artificial Neural Network

I. INTRODUCTION

Nowadays with the introduction of online trading, stock market has tuned into one of the way where even a little financial specialists can yield great benefits. Hence if we can predict the market behavior precisely, then the investors can decide when and where to contribute their money. Previous estimation of stock price return is extremely risky and troublesome since there are too many events like traders' desire, economic conditions and some ecological events that may impact stock prices. Moreover, stock price movements are not sequential, complicated, and dynamic by nature. These changes which impact on stock price and trading volume have some challenges in estimation. The impacts of changes on the behavior of people are in terms of initial funds or speculation, the stock price, and the risk of speculators. Thus the anticipation of stock market behavior is achieved via different techniques and methods and it is a valuable tool to support speculators to act with more prominent conviction and volatility of an investment in account and should know when to purchase the least expensive price and when to sell to most elevated price. For making investment decision, the professional traders use traditional techniques and methods to examine the stocks. The traditional way includes the entire review of a company's fundamental which includes revenues, market position, annual growth rate, etc. whereas the technical examination is all about the review of price changes in the previous terms of the company. This technical examination of stock is a relation between the price and the company which decides when to enter and leave the market. The most conventional models stock price estimation use neural network models and statistical models from the price data [1, 2]. This research is aiming to anticipate the upcoming stock price using machine learning algorithm and soft computing techniques.

1.1 Stock Market

A stock market is an open market for companies or for individuals to raise money. Stock market helps companies to purchase or sell their shares. The cost of shares relies on the interest and supplies of shares. This procedure of purchasing and selling of shares is called trading/exchanging; just the Listed Companies are permitted to do

exchanging. Recently huge amounts of investment are exchanged via stock market over the world. National economies are firmly connected and intensely affected the execution of their Stock Markets. Therefore they are identified with macroeconomic parameters, as well as they impact ordinary life in a more straightforward manner. Hence they constitute a mechanism which has vital and immediate social effects. The nature of stock market in common is unpredictable which may depend on the long and short term future state. This is unpleasant and also unavoidable for the speculator when Stock Market is chosen as an investment tool. The main aim is to reduce this unpredictability and the Stock Market Anticipation (or Forecasting) is used in this process. Data Related to the Market The details about the market originate from the investigation of pertinent information. Here we are attempting to depict and group into categories the information that is identified with the stock markets. In the relevant works, this information is categorized in three main categories.

(i) Technical data: are all the data that are related to stocks only. Technical data include:

- The price at the end of the day
- The highest and the lowest price of a trading day
- The volume of shares traded per day

(ii) Fundamental data: are data referred to the intrinsic value of a company or category of companies as well as data related to the general economy. Fundamental data include:

- Prices of related commodities (e.g. oil, metals, currencies)
- Inflation
- Prognoses of future profits of a firm
- Trade Balance
- Interest Rates
- Net profit margin of a firm
- Indexes of industries (e.g. heavy industry)

II. RELATED WORK

Shravan Raviraj et al. [1], investigates the Support Vector Machine and Least Square Support Vector Machine models in stock forecasting. Three predominating anticipating systems General Autoregressive Conditional Heteroskedasticity (GARCH), Support Vector Regression (SVR) and Least Square Support Vector Machine (LSSVM) are consolidated with the wavelet kernel to structure three novel algorithms namely Wavelet-based GARCH (WL_GARCH), Wavelet-based SVR (WL_SVR) and Wavelet-based Least Square Support Vector Machine (WL_LSSVM) to resolve the non-parametric and non-linear financial time series issue.

J. J. Duarte et al. [2], SVMs based on basic data anticipate the stock crises and the financial position of the companies in the Chinese market. It used ϵ -SVM (ϵ -support vector machine) to build a stock price prediction model. It another forecast algorithm that makes use of the temporal among global stock markets and different financial items to foresee the following day stock trend with the assistance of SVM. They use same algorithm with distinctive regression algorithm to predict the actual development in the markets. At last they build a basic trading model and contrast its performance with the existing algorithm. A significant pitfall of SVM for the direction forecast is that the input variables lie in a highdimensional feature space, extending from hundreds to thousands. The capacity of the variables obliges a considerable measure of memory and computation time. Particularly, a stock market comprises of a few many stocks, which prompts the high dimensionality of the variables. Accordingly, it is of significant imperative to direct dimension reduction to procure a proficient and discriminative representation before classification.

R Kumar et al. [3], use back-propagation neural networks to anticipate the Athens stock index. They utilized a design with one hidden layer comprising of seven hidden neurons and report a decent forecast execution regarding the Mean Squared Error (MSE) up to nine days ahead. It examines the benefit of a trading system focused around recurrent neural network that endeavors to anticipate the direction of progress of the market, on account of the NASDAQ composite index. They differentiate the prediction execution of neural networks to the adaptive exponential smoothing technique in the Brazilian stock market. The authors express that the neural network performs better than the adaptive exponential smoothing technique and that correct direction prediction hit rate reached 60%. A lot of analyses are performed that show that the result are maintained a constant rate in all the markets. The authors finally infer that a decent prediction performance can be utilized to create beneficial speculation strategies and that their model is suitable

for making a decision support framework for the Brazilian market.

P. Ghosh et al. [4], studied modified neural network algorithms to anticipate the actual situation of the stock market which supports the speculators what to do in the crisis situation. It inspects the statistical properties of movements in a few stock lists in the Chinese stock market. The creators utilize a stochastic time viable neural network which uses slacked list data as inputs and put more weight on recent perceptions and less weight on old perceptions. It is contended that the model reflects the way speculators examine the market data and that closer past data has a stronger influence on future market movements. The authors report a good performance in terms of anticipating error for the time viable neural network model.

Gee-Kok Tong et al. [5], analyze the two well-known techniques for stock market prediction namely neural network and data mining. Both are having merits in their own way. Neural network is capable of extracting meaning information from large amount of data whereas the data mining is employed to get the future trends and pattern. Thus the author combines these two techniques that make the reliable prediction. She utilizes the ANN which is an efficient tool for designing the stock value. It selects the stock value of the selected stocks under the Bombay Stock Exchange to predict the closing value with highest accuracy. The paper reviews the recent articles for the stock market movement prediction in area of artificial intelligence and machine learning techniques. These articles are separated into the field of forecasting timeframe, evaluation techniques utilized, input variables and machine learning techniques used. Finally ANN is recognized as efficient machine learning technique in future stock market prediction.

C. Anand et al. [6], present different neural network model like Radial Basis Function NN, Layer Recurrent NN, Generalized Regression Neural Network, Back Propagation NN which are used to predict the long term and short term share of various IT sectors, Automobile sector, and Banking sectors. The results show that all the three models produced better results in their own way and finally conclude that the LRNN performs better than all other models. In the paper discussed the number of techniques for the stock market prediction in trading community. From those techniques, neural network is considered as best and the background of neural network and back propagation algorithm is reviewed. In addition to that, an alert system using back propagation NN for stock buying and selling is modeled. Hong Kong and Shanghai Banking Corporation (HSBC) is used to test this modeled system and it achieves hit rate of 70%. A hybrid approach which integrates the fundamental analysis and technical analysis variables for the stock market prediction based on the previous and current values. This improves the existing approach much efficiently. This technique is much useful to the investigators and the researchers for making the decision efficiently.

Hari Krishnan et al. [7], in Tapped Delay Neural Network (TDNN) with an adaptive learning and pruning algorithm was suggested to foresee the non-sequential time serial stock indexes. They have implemented the neural network to predict the returns of the BSE in daily basis. Multilayer perception network was utilized to fabricate the day by day return's model and the network was prepared using Error Back Propagation algorithm. The author found that the prescient force of the network model was impacted by the earlier day's return than the initial three-day's inputs. The study demonstrated that acceptable results can be attained when applying neural networks to anticipate the BSE Sensex. He suggests a neural network based stock market anticipation method. They utilize two sorts of neural networks a feed forward multilayer perception (MLP) and an Elman recurrent network. They found that MLP neural network is much better in foreseeing stock cost changes than Elman recurrent network and linear regression method.

III. NEURAL NETWORK

Machine Learning Techniques:-Anticipating the stock price trend by translating the appropriate chaotic market information has dependably been an attractive subject to both financial specialists and scientists. Among those familiar methods that have been utilized, machine learning techniques are exceptionally prominent because of the limit of recognizing stock trend from huge capacity of information that catch the stock price changes.

Supervised Learning

Regulated learning is two stage forms, in the initial step: a model is fabricated depicting a foreordained arrangement of information classes or ideas. The model developed by investigating database tuples portrayed by traits. Each tuple is expected to have a place with a predefined class, as dictated by one of the qualities, called to have a place with a reclassified class, as controlled by one of the traits called the class name characteristic. The information tuple are dissected to fabricate the model all things considered from the preparation dataset [17].

Unsupervised learning

It is the kind of learning in which the class mark of each preparation test isn't known, and the number or set of classes to be scholarly may not be known ahead of time. The prerequisite for having a named reaction variable in preparing information from the administered learning system may not be fulfilled in a few circumstances.

Data mining field is a highly efficient techniques like association rule learning. Data mining performs the interesting machine-learning algorithms like inductive-rule learning with the construction of decision trees to development of large databases process. Data mining techniques are employed in large interesting organizations and data investigations. Many data mining approaches use classification related methods for identification of useful information from continuous data streams.

K-Nearest Neighbor (KNN):- The KNN algorithm is a strategy for characterizing items based on closest training samples in the feature space. KNN is a sort of example based on learning, or lazy learning where the function is just approximated locally and all calculation is conceded until classification. The stock estimation issue can be mapped into a closeness based classification. The past stock information and the test information are mapped into a set of vectors. Every vector shows N dimension for each stock. The estimation model considers opening value, high value, low value and closing value of the market list as autonomous variables and the following day's closing value as the dependent variable. The KNN algorithm distinguishes "k" nearest neighbors in the training set in terms of the Euclidean distance regarding the day for which expectation is to be carried out. When knearest neighbors are identified, the estimation for that day is figured as the average of the following day's closing values of those neighbors. 1.4.3 Genetic Algorithm GAs is universally useful, parallel searching techniques for solving complex issues. Based upon genetic and evolutionary standards, GA meets predictions by more than once adjusting the number of inhabitants in artificial structures through the application of genetic operators. GAs requires just well-organized data, not gradient data or other inner learning of an issue. GAs has traditionally been utilized in optimization, with a couple of improvements, can perform estimation and forecast also. In the stock markets, genetic algorithm are most normally used to discover the best combination values of parameters in a trading rule, and they can be incorporated with ANN models intended to pick stocks and distinguish trades.

Naive Bayes Classifier:- Classifier technique is functioned based on Bayesian theorem. The designed technique is used when dimensionality of input is high. Bayesian Classifier is used for computing the possible output depending on the input. It is feasible to add new raw data at runtime. A Naive Bayes classifier represents presence (or absence) of a feature (attribute) of class that is unrelated to presence (or absence) of any other feature when class variable is known. Naïve Bayesian Classification Algorithm was introduced by Shinde S.B and AmritPriyadarshi (2015) that denotes statistical method and supervised learning method for classification. Naive Bayesian Algorithm is used to predict the heart disease. Raw hospital dataset is employed. After that, the data gets preprocessed and transformed. Finally by using the designed data mining algorithm, heart disease was predicted and accuracy was computed.

Support Vector Machine:-SVM are used in many applications like medical, military for classification purpose. SVM are employed for classification, regression or ranking function. SVM depends on statistical learning theory and structural risk minimization principal. SVM determines the location of decision boundaries called hyper plane for optimal separation of classes as described in figure 1. Margin maximization through creating largest distance between separating hyper plane and instances on either side are employed to minimize upper bound on expected generalization error. Classification accuracy of SVM not depends on dimension of classified entities. The data analysis in SVM is based on convex quadratic programming. It is expensive as quadratic programming methods need large matrix operations and time consuming numerical computations.

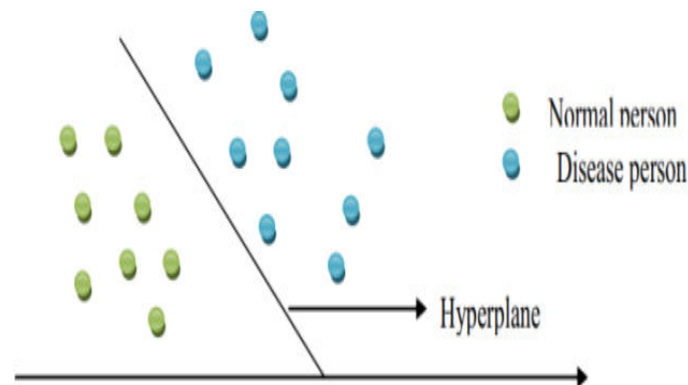


Fig. 1: Support Vector Classification

Artificial Neural Networks:- Recently most widely used method for making estimation in stock markets that sometimes include technical analysis, is Artificial Neural Networks (ANN). ANN encapsulates a set of threshold capacities associated with one another with versatile weights that are prepared on past information in place that they may be utilized to make estimation later on. These methods are often denounce for the stochastic nature of their weight initialization, the way that they can't be ensured to give bullish solution (they fail to converge on global optima) and that they are inclined to over fitting.

IV. CONCLUSION

Stock price prediction is a vital task for financial decision making and investment. But, stock market is a highly risky place for investment as they are volatile. Various research works have been carried out in order to forecast the market to make revenue utilizing various techniques ranging from fundamental analysis, statistical analysis to technical analysis by different results. However, these techniques do not provide intense investigation that is essential and thus it is inefficient in forecasting stock prices. The forecasting of stock market values has always been a difficult task. It has been perceived that the company's stock prices does not primarily depend upon the economic status of the country and is not directly associated with the economic development of the country or a specific area. Thus the forecasting of stock prices has become more challenging than ever before. The stock value of a particular day are affected by several reasons such as political events, organization related news, natural disaster and so on. The rapid data processing of the events with the aid of advanced technology has made the stock prices to change rapidly. Therefore, financial institutions, stock brokers and large scale investors have to sell and buy the stocks within the shortest permissible time. The recent advancement in data mining techniques provide valuable tools for forecasting chaotic environments like stock market by capturing their nonlinear behavior.

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