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# Stock Price Prediction - A Novel Survey

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## Abstract

Stock market prediction is an art of predicting the future value of the particular stock on the basis of the current and the previous information available about the stock .Stock market prediction is very important as it involves more investment and returns in the field of academic and financial research. Even though it is highly volatile there are techniques available to predict its future value. one of the best method to predict the value of the future stock price is by using machine learning techniques. Fuzzy logic, Neural network and genetic algorithm are identified to be the leading machine learning technique in stock price prediction. common analysis method such as fundamental analysis, technical analysis are also discussed and compared with soft computing techniques. As it provides high range of accuracy and speed, usage of soft computing techniques are highly recommended.. The idea behind the prediction is to use less number of inputs data and to achieve the best result. This paper surveys more than 50 related articles that are publised under the topic stock price prediction. The selection of the papers are based on the various models in soft computing that are used to predict the stock price. At last we had introduced a new method of predicting the stock price by extracting and combining the best outcome of the models.

**Keywords:** Soft computing techniques, Machine learning, Fuzzy logic, Neural Network, Genetic algorithm, prediction.

## Introduction

Share market plays an important role about the economy of a country. It is a common platform for companies to raise funds for company by allowing customers to buy or shell shares at an agreed price. As more and more money is invested in this field, expecting the future stock price is an important criteria for the investers. The stock price parameters are highly fluctuating that's fall the stock price or raising the stock price. Fluctuations are affecting the investor's belief. The prediction of stock price is an important area of financial forecasting. Stock price prediction can be classified as a) fundamental analysis b)technical analysis and c)technological analysis.

### A. Fundamental Analysis

This method uses fundamental attributes of the stock to predict the future value. Fundamental analysis uses statistical data related to a company. The parameters may be audit reports, financial status of the company, the dividends, sales data,volume of import/export , price statistics and the daily news or rumors about company. Even the other parameters like book value, p/e ratio, earnings, return on investment(ROI) ,etc. are very carefully used to estimate the future stock price.

### B. Technical Analysis

Technical analysis may be of graphical approach and trend prediction approach. Graphical analysis uses graphs and comparison of releveant patterns in predicting the value. In trend approach analysis it uses quantitative parameters like various values of stock price on a day, highest and lowest values of a day, volume of stock, indices ratios, etc Simple Moving Average(SMA) of last n days and Exponential Moving Average(EMA). Due to the accuracy in prediction most of the machine learning techniques prefer technical analysis data over fundamental analysis data as input to system

### C. Technological Analysis

Technological approach uses the technical parameters with soft computing techniques in determining the stock price value. Artificial neural networks (ANNs) and fuzzy logic (FL) and genetic logic are the key technologies that have received growing attention in solving real world, nonlinear, time-variant problems. The several distinguishing features of ANNs make them attractive and widely used for forecasting stock price in the domain of business, economic, and finance applications.Fuzzy logic uses fuzzy rule and methods to predict the required pattern. Neural network provides learning from the input data and correctly infer unseen part of the population.Genetic algorithm can be well used to optimize the stock price.

## Literature Survey

Kyoung-jae Kim in [1] uses SVM to predict the stock price index. SVM is a promising method for the prediction of financial time-series because it uses a risk function comprising of the empirical error and a regularized term which is elicited from the structural risk minimization principle. Feasibility of applying SVM in

financial forecasting is also examined by comparing it with back-propagation neural networks and case-based reasoning. It can be seen that SVM is far more proficient than back-propagation neural networks and case-base reasoning. The results may be traceable to the structural risk minimization principle that SVM applies and thus leads to better generalization than conventional techniques.

Vedat Akgiray in [2] presents an innovative evidence time series behaiviour of stock price. It can be seen that daily return series display much higher level of statistical dependence and are impossible to be cast as linear white noise process.this paper shows analytically that an equitable return generating process is a first-order auto regressive process. Notably the GARCH i.e., generalised autoregressive conditional heteroschedastic porcesses are likely to fit the data aptly.

TL Chen, CH Chen, HJ Teoh in [3] implements the concept of the Fibonacci sequence, the structure of Song and Chissom's model and the weighted method of Yu's model. A 5-year period of TSMC (Taiwan Semiconductor Manufacturing Company) stock price data and a 13-year period of TAIEX (Taiwan Stock Exchange Capitalization Weighted Stock Index) stock index data are utilised by them as the primary dataset for the experiment. The forecasting performances are compared with Chen's (Forecasting enrollments based on fuzzy time-series, Yu's Weighted fuzzy time-series models for accurate forecasting. Eventually, it was terminated on the fact that the paper administers much greater accuracy.

Pei-Chann Chang, Chen-Hao Liu in [4] used a TSK model i.e. a Takagi–Sugeno–Kang type Fuzzy Rule Based model is developed for predicting the stock price. The technical index is implemented as the input variables and the consequent part is a combination of these very variables. This paper examins the fuzzy rule based model on the Taiwan Electronic Shares from the Taiwan Stock Exchange (TSE). Through the process of performing in-depth tests, the price variation for stocks from different sectors has been determined with accuracy close to 97.6% in TSE index and 98.08% in MediaTek. The results are very promising and can be enforced in a real-time trading environment which turn will provide the stock price prediction during that specific trading period.

Ching-Hsue Cheng, Tai-Liang Chen, Liang-Ying Wei in [5] shows that in the stock market, technical analysis is a powerful method for predicting stock prices. Admitting, professional stock analysts and fund managers mostly make abstract judgments, based on detached technical indicators, non-professionals have to face difficulty while applying this forecasting technique because there exist disproportionate number of technical indicators to be taken into consideration. There have been gaps found in many of the past forecasting models: (1) statistical assumptions about variables are needed for time series models like the autoregressive moving average model (ARMA) and the autoregressive conditional heteroscedasticity (ARCH), to yield forecasting models comprising of mathematical equations, and these are difficult for the stock investors to follow; and (2) the rules driled from the artificial intelligence (AI) algorithms, such as neural networks (NN) and others are tedious to comprehend.

In a pursuit to overcome these gaps, a hybrid forecasting model, has been introduced using multi-technical indicators to forecast the stock price trends. As a

supplementary,four proposed procedures in the hybrid model are included to provide skillful rules for forecasting. These are derived from the elicited rules with a imense support value. This is achieved by working with the toolset based on rough sets theory (RST): (1) select the essential technical indicators, decidedly related to the future stock price are selected among a set of popular indicators. (2) the cumulative probability distribution approach (CDPA) is applied and the entropy principle approach (MEPA) is curtailed for segregation of the technical indicator value and daily price fluctuation into linguistic values. Thus this approach is planted on the characteristics of the data distribution (3) an RST algorithm is exploited to excerpt linguistic rules from the linguistic technical indicator dataset; and (4) genetic algorithms (GAs) are taken advantage of in the next process. This is done to refine the elicited rules to obtain better prediction accuracy and stock return. The efficacy of the proposed model has been authenticated with two types of evaluations designed for testing the performance. They are the accuracy and stock return. A six-year period of the TAIEX or the Taiwan Stock Exchange Capitalization Weighted Stock Index has been utilised as the experimental dataset . Eventually, the results show that the proposed model is far more admirable in terms of accuracy in comparison to the two forecasting models which are the RST and GAs. The stock return assessment have shown that the profits obtained from the proposed model surpass the three models which are respectively the buy-and-hold, RST and GA.

Werner P.M. De Bondt in [6] enlightens the fact that non-experts expect the supposed past 'trends' in prices to linger. Thusly, these non-experts are assured in bull markets and at the same time despondent in bear markets. The corresponding subjective probability distributions are altered in the opposite direction. Susbsequently, prior performance governs the perceived risk.

George S. Atsalakis, Kimon P. Valavanis in [7] introduced a neuro-fuzzy system comprised of an Adaptive Neuro Fuzzy Inference System (ANFIS) controller. This governs the stock market process model, and is identified by use of an adaptive neuro-fuzzy technique which is obtained as well as appraised for different stocks. The weak form of the Efficient Market Hypothesis (EMH) is thrown a challenge by the results which are attained. This is because the obtain results demonstrate much more improved predictions, in comparison to other approaches, of short-term stock market trends, particularly the next day's trend of stocks. The inputs for ANFIS controller and the stock market process model are selected based on a correlative study of fifteen disparate combinations of past stock prices. This is performed to achieve a set of stock market process model inputs that provide the best stock trend forecasting for next day in terms of minimum Root Mean Square Error (RMSE). Thenceforth, Gaussian-2 shaped membership functions are chosen over bell shaped Gaussian and triangular ones inorder to fuzzify the system inputs. Real case studies which are performed using input data from emerging and well developed stock markets – the Athens and the New York Stock Exchange (NYSE) – so as to train and assess the proposed system delineate that the proposed technique and the prediction accuracy are far more preferable compared to the buy and hold strategy and several other experimented approaches.

George S. Atsalakis, Kimon P. Valavanis in [8] asserts the fact that the path to success in stock market prediction obtainining finest outcomess with minimal input. Taking the stock market model ambiguity, soft computing approaches are applicable competitor for the purpose to taking the stock market relations providing momentous forecasting outcomess without earlier familiarity of input data statistical distributions. In this paper more than 100 relevant published works have been surveyed that target on neural and neuro-fuzzy techniques derived and implemented to predict stock markets. Further, classifications are performed in terms of input data, prediction techniques, achievement appraisal and the various measures for performance used. Through the process of surveying this papers, it is can be seen that soft computing mechnisms are universally acknowledged for the purpose of studying and judging the stock market characteristic feature.

Patrick thomas in [9] asserts that one of the primary goals of technological analysis is the knowledge of how investment in technological innovation can ensure an enhanced economic bottom line. As fact has it, relationship between investments in technology and subsequent economic performance have not been analysed in a legitimate way. Using this void to his advantage Patrick Thomas in this paper administers such an analysis by professing how quantitative R&D and technology indicators can be used to predict price of any stock of a company. The ambition of doing this is to exploit a unique patent database, and the science and technology indicators materialised from the data present in that database. This is a matter of technological proficiency and economic performance and is thus worth delving into.

The quality of a company's technology is emulated in its patent portfolio. This very issue forms the basis of this search. Previously it has been shown by research that a company with a considerable chunk of authoritative patents is far more inclined to technological success than a company possesing weak patents. The analysis further reveals that the chances of success of a company like this are enormous in capital markets.

R.J. Kuo, C.H. Chen, Y.C. Hwang in [10] presents the idea that the stock market, is a much complex environment. Usually it is seen that the various analytical researches which have been conducted in this field have concerned the technical indexes only and not the qualitative factors such as the political effect. However, these factors portray a very decisive role in the environment of the stock market. On that account, the concept of developement of a genetic algorithm based fuzzy neural network (GFNN) has been introduced in this very paper to codify the knowledge base of fuzzy inference rules which can be used to calibrate the qualitative effect on the stock market. It is further unified with the technical indexes through the artificial neural network (ANN). Example is taken from the Taiwan stock market inorder to judge the proposed methodology. The obtained results illustrate that the neural network in consideration of both the quantitative and qualitative factors outdoes the one considering only the quantitative factors. This trend of the obtained results can be seen both in terms of certainty of buying-selling points and performance behaiviour of buying-selling.

Kimoto, T., Asakawa, K. Yoda, M., Takeoka, M. [11] introduced a concept of a buying and selling time indicator for stocks on the Tokyo Stock Exchange. The

modular neural networks are the fundamental basis of this concept. A set of learning algorithms and forecasting methods were materialised for the TOPIX i.e., Tokyo Stock Exchange Prices Indexes prediction system. Definitive predictions were elicited using this system, and the reproduction for stock trading exhibited an exceptional profit.

Theodore Modis in [12] interpreted the nature of stocks of a company based on the hypothesis that Darwinian nature competition governs the stock market. This interpretation was based on the assumption, according to which the stocks were assumed as species. This very method demands the investigation of dollar values and the share volumes, which are traded everyday in the stock market, by the means of logistic growth functions. In a stark contrast to stock prices these variables, adhere to the law of natural growth in competition. This law just like every natural law, without exception is equipped with predictability. There are various unanticipated intuitions which crop up regarding the stock market. According to the calculations done it is implied that there is no impending collapse in the near future but no important growth in the market should be anticipated either. The DJIA is supposed to hover around 9500 thus illustrating huge arbitrary excursion around this level for a few years. Usage of the Volterra-Lotka equations establishes the fact that the 1987 crash transformed the stock-bond synergy. This transformation was from a symbiotic relationship to a predator-prey with stocks substituting as predators. A book by T. Modis has been further published based on this research work.

Esmaeil Hadavandi, Hassan Shavandi, Arash Ghanbari in [13] enlightens the fact that stock market prediction is a challenging job in financial time-series forecasting. The fundamental idea which works most inorder to fruitful stock price forecasting is obtaining the best results using least convoluted model of the stock market and minimal input data. Beginning on these note, to attain the above mentioned goals this article introduces an unified approach which is based on genetic fuzzy systems and artificial neural networks. This combines the two concepts for developing a stock price prediction system. Initially, they use stepwise regression analysis also known as the SRA to detect the factors which have affect the stock prices the most. Thenceforth, raw data is arranged into $k$ clusters by dint of self-organizing map or SOM neural networks. Eventually, all clusters are provided as input to the independent GFS models which are able to extract the rule base and subsequently perform data base tuning. The efficiency of this very approach is judged by employing the approach on stock price data gathered from various sectors such as the IT and Airlines sectors. The results are related with preceding stock price forecasting techniques applying mean absolute percentage error. The achieved results demonstrate the fact that the presented approach surpasses all the earlier techniques.Hence it can be concluded that this approach is an applicable tool for stock price prediction issue.

## Proposed Methodology

Our new proposed methodology introduces a concept which is entirely based upon the Genetic Fuzzy Systems or the GFs in which the input data is fed to the system as crisp

inputs. These crisp inputs are further fuzzified using the triangular and trapezoidal membership functions thus providing the chromosomes. The R-type trapezoidal function is used in this case to maximise the accuracy.

Thenceforth, the obtained data is evaluated for fitness and the fittest parents are selected for performing the process of the crossover and mutation. Then the crossover and mutation is performed on this data and the resultant data is merged with the initial set of input data. Now, tournament selection is employed inorder to elect the best 100 records from the set of merged data. This is followed with repeated iterarations of these data inorder to ensure System Training. Eventually this will deliver the top 10 records and the Fuzzy rules as the final output.

Then, the stocks are ranked based on the highest probability of increase in price of the stocks.

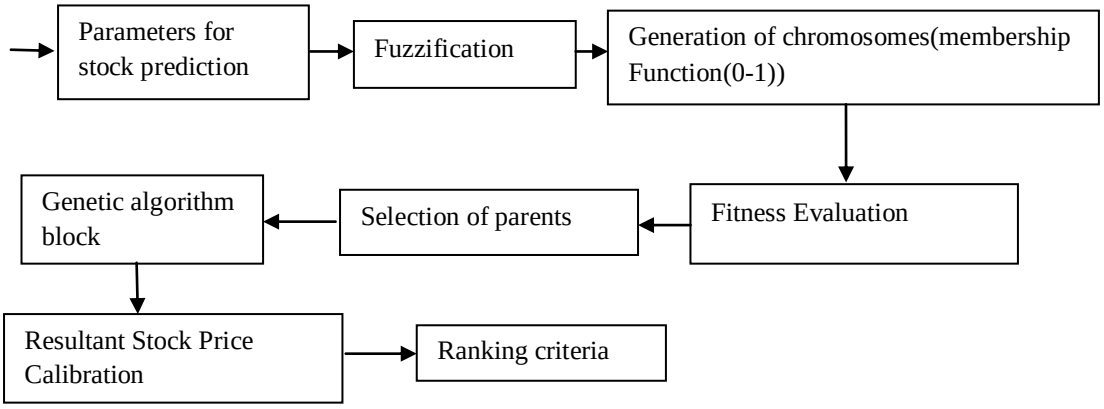


**Figure 1:** Block Diagram for proposed methodology

## Conclusion

There exist different approaches to predict the stock market. These include the fundamental, technical and technological approaches respectively. The fundamental analysis is based on the time-series forecasting while the technological analysis is based on the technical with soft computing methds. These methods are developed using various concepts of soft computing such as the Fuzzy Logic, Genetic Algorithms, Artificial Neural Networks and the hybrid of two or more systems such as the Genetic Fuzzy hybrid systems. This paper primarily surveys the relevant work done in the field of stock market forecasting and strives to attain a better idea about the stock market prediction mechanism. The stock market forecasting is a challenging job in the real world. That is why there has been extensive research work carried out in this area. This research work includes all the three above mentioned approaches i.e., the fundamental, technical and technological approach. Surveying all the relevant research works helps in understanding both the current scenario and the earlier

scenario which has prevailed in the stock market. This perception of the stock market is very important for the future prediction process of the stock market. Especially this helps to learn the various dominanant factors of the stock market which governs the characteristic behaiviour of the stock market. Alongwith those factors there are also distinctive stock market models which also dominates the overall behaiviour of the stock market and the knowledge of which facilitates the prediction process.

In the light of the knowledge gained from the relevant work done in this area it is conspicuous that much work has been done using the technological analysis rather than the fundamental and technical analysis. The technique which has been presented in this paper also uses technological analysis in the course of materialising itself but this technique distinguishes itself from the others by using the Genetic Fuzzy Systems in a way that delegates greater accuracy. Hence it can be concluded as a technique good enough to be favoured inorder to insure accuracy and at the same time escalate the bottomline.

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