

## Market Forecasting Using Genetic Algorithms: A Review

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**ABSTRACT:** Keeping in mind the fluctuating nature of the stock market, its prediction becomes essential. Various techniques like – Hidden Markov Model, Neural Networks and Data Mining, are available for forecasting the future of the invested finances, but however, the generation of apt trading rules for stock market venture is a strenuous task. The goal is to achieve maximum accuracy in predicting the highest gain causing stock collection. Now, these techniques involve the extending of the past experiences of the shares into the future. However the rareness of some occurrences causes difficulty in creating a model that enables their detection. There are numerous problems that are encountered during this prediction phase, for example – when the machine has to deal with unbalanced classes, finding the best parameter combination to invest in, choosing the appropriate optimum technology, etc. Genetic programming comes to the rescue in such situations as it is designed to deal with such problems. This paper is basically a survey of a few techniques that have been used for stock market prediction till date. Also, the role of genetic algorithms in this field has been highlighted.

**Keywords:** Genetic Algorithms, Shares, Stock Market, Neural Networks.

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### I. INTRODUCTION

There are more than 70 stock exchanges in the world with a total market capitalization worth \$70 trillion. Ours is a money-driven generation, so, it's a common practice to invest a huge amount of money into the stock market. Its performance deeply influences not only individuals but also the whole nation's economy. However the only pinnacle feature of all stock markets is the uncertainty depending upon their long term and short term future state. This is a loophole in investment for the investor as the loss is almost unavoidable when shares are selected as the investment tool. So the only solution to avoid the loss is by reducing the blow of this uncertainty. Prediction or forecasting is one of the techniques used to do so. The attempt to build a rewarding technique for predicting the prices of stock has been the target for several predictors. The use of Genetic Algorithms has been on the rise for financial purposes. These are basically algorithms that imitate evolution and natural selection to solve vivid problems. Genetic Programming can simplistically be explained as an evolutionary technique whose population constitutes programs (decision trees). So, the basic goal of this programming is to train with a dataset to create a decision tree that models this data.

### II. STOCK MARKET

When being discussed, Stock market can be elaborated as a well-organized and regulated

financial marketplace, physical or electronic, where various securities like bonds, shares and notes are bought and sold at certain fixed prices that are governed according to demand and supply.

So, a stock market serves as both- Primary market where companies raise their capital and Secondary market where investors earn money by selling their securities. So, stock is nothing but a part of or a share of ownership of a company. So, technically if a company divides its ownership into a hundred parts and if an arbitrary investor purchases one of those hundred parts, then that person is regarded as the 1% shareholder of that company. The price of shares and other services hugely dominate the economic activities of any nation. When a company gets involved in selling of shares then the rise in its share price will increase growth of the company as well as its business investments. At the same time, the share prices will have impact on the wealth of households and their consumption. It is hence, necessary for the central banks to supervise ongoing market trends.

The rates or prices of stock are decided on the basis of the number of buyers and sellers available for that particular stock at that instance in the market. So, more the number of buyers higher will be the stock price and fewer the number of buyers lower will be the stock price. However, if the order does not match, it is bound to remain in the system waiting for new orders or updating of the previously present orders. The buy orders and sell orders are usually categorized into best buy

order and best sell order. The former is of the highest price whereas the latter is of the lowest price. So, the investor will sell the best buy orders at the highest possible price and the best sell orders at the lowest security price. With this logic, the system will match the corresponding orders and executes in to the traders system.

### III. LITERATURE REVIEW

A. Victor Devadoss et al. [1] – They suggested the usage of Artificial Neural Networks for stock prediction. Basically, it is an attempt to predict the closing prices of Bombay Stock Exchange (BSE). Here, the ANN network consists three layers – one input layer for providing values for operation as input, one hidden layer for performing operation and last but not the least, an output layer for desired output. Each neuron in this neural network takes different stock values like – last price, close price, high price, previous close, etc., as input for processing. Various indicators based on Percentage Error as well as Deviation help in improving the network's efficiency. These networks are capable of discovering non-linear relationships between various constituents without priory assuming any kind of relation between the input and output which makes ANN more preferred model for stock prediction across the globe.

D. A. Kumar et al. [2] – They pointed out the fact that although the ANNs have a high predictive power, they have a problem that drastic variations can be witnessed in the forecast due to slightest variations erupting in the data used for training purposes by the algorithms at work. So, when applied to time series model, they result into quite a many disadvantages. Back-propagation feed-forward network is utilized by the time series. The activation function is Sigmoid function, whereas, learning function is Gradient Descent Algorithm. This model is preferred when the noise is less.

Z. Hu et al. [3] – Here, it is explained that the Support Vector Machine is a widely used alternative technique for predicting variations in stock pricing. Various organization oriented criteria like net revenue, earnings for every share, etc. It is often seen that the exact determining of the market's condition or the figuring out of the parameters to be chosen to estimate the rise or drop in company's share is a difficult task. SVM, being a good non-linear pattern classifier is chosen to eradicate this problem. It's essential to note that the further addition of variables to this model may lead to a rise in accuracy.

M. Rout et al. [4] – The nature of honey bees have paved way to the creation of a meta-heuristic technique known as Artificial Bee Colony. This algorithm functions by selecting a

more preferable choice iteratively. So, this can be simplistically understood similar to the preference of the flowers holding more nectar over any other flowers by the bees while looking for food. Thanks to the endless efforts of researchers to design decentralized and adaptive algorithms that swarm intelligence is an evolving field of study nowadays. Both long as well as short lived stock investments can opt for this model. So this model provides high accuracy.

George S. Atsalakis et al. [5] - This paper comes up with the idea of forecasting stock prices with the help of wave analysis. Focussing on predicting the variations of the stock rates is of utmost importance according to this paper. The fibonacci sequence is combined with Elliot wave concept, here. Although this concept avails fuzzy description of the market rather than the accurate estimation, it helps in improving the whole forecasting attempt.

Binoy B. et al. [6] – In this paper, the idea of utilizing a hybrid version of fuzzy estimation, decision trees and neural networks in order to predict the future of stocks is introduced. So here, the creation of a mechanised stock price variation forecasting system by utilizing a neuro-fuzzy system that is hybridised with decision trees is suggested. They tested this system on several international stock markets. When compared with numerous other pre-existing systems, this experiment proves that this system avails more accuracy than any of them.

Fazel Zarandi et al. [7] – The process of stock rate studying using a fuzzy logic based system is recommended by this paper. Input in the form of technical indices are taken by this model. These input values directly impact the output values for creating the further generations of input values. Genetic algorithms are used to further tune them. This method mainly aims at achieving error minimization, flexibility and robustness. So this model is used to forecast more profitable trading in stock markets.

### IV. GENETIC ANALYSIS

Genetic analysis is basically a branch of soft computing that deals with solving problems on the basis of concepts related to the theory of evolution in a more optimized manner. So, Genetic Algorithms (GAs) are a subclass of Evolutionary Computing techniques that aim to solve problems which need optimization. They were invented by John Holland, back in the 1970s and are basically based on Darwin's theory of evolution.

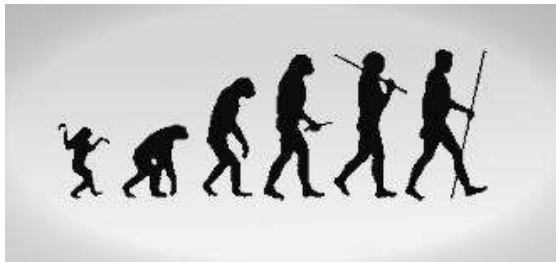


Fig - 1 - Evolution of humankind

In a genetic algorithm, the goal is to work on a huge collection of nominee results to reach a more accurate result. Every nominee result possesses certain characteristics, referred to as its chromosomes, which can be changed according to the situation's demands.

The iterative process of improvement starts with several arbitrarily created entities, arranged in the form of a collection. Note that every iteration's collection is referred to as the generation. It is a must that in every generation, the fitness of every entity is thoroughly checked; while dealing with an optimization problem, the objective function's value is referred to as the fitness. After selecting highly fit entities out of the collection in hand, a fresh collection is created by modifying the genome of these entities. The algorithm's following iteration takes up this generation as its input. However, once a situation where the highest limit of possible generations or the adequate level of fitness is faced, termination of the algorithm occurs.

A bits array is usually opted to represent every nominee result. General crossover options are easily accessible due to the definite size of the arrangement of the parts of the considered genetic depiction. The main reason for the choice of constant size is for reducing the complexity in implementing crossovers. Since, graph related arrangements get opted for evolutionary programming and tree related arrangements get opted for genetic programming, the option of a mixture of trees as well as linear chromosomes is chosen in case of gene expression programming.

Hence, a genetic algorithm starts with the creation of a collection of results after clearly outlining both – fitness function as well as genetic arrangement and then, continues to improvise the results by iteratively applying all the four operators, namely - mutation, crossover, inversion and selection.

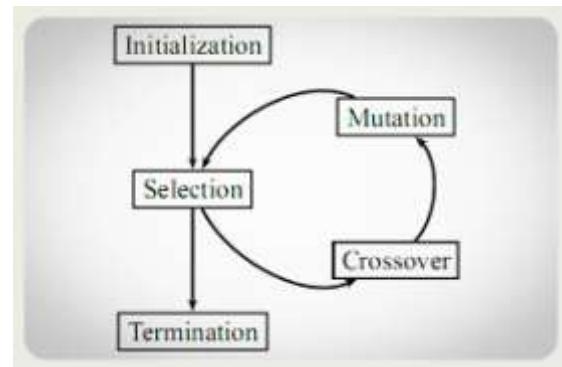


Fig - 2 - Genetic Operators

It has been noted that genetic algorithms are a very useful concept to analyse and classify the data in various fields. They can be preferably utilized in the form of an optimizer which can in turn be helpful in decreasing or increasing a few response measures for building artificial neural networks.

The predictors used for the stock market are basically Artificial Neural Network based systems that help in analysing the pattern of variation in the stock prices over a period of time; the set of values chosen as the parameters are calculated using genetic algorithms. There are numerous companies that develop software using this technique to predict stocks and hence, benefit the independent investors. There are several software that target the big trading companies too.

In a nutshell, the process of solving problems by utilizing the nature's technique can be termed as genetic algorithms. The identification of the accurate values for the trading rules is simplified for the stock investors, which in turn helps them to predict the right set of profitable stocks. Nonetheless, it is essential to note that the accuracy of the forecasting completely depends upon the values of the parameters chosen and hence, stating that the mere usages of these algorithms guarantee a profitable prediction would be extremely wrong.

## V. CONCLUSION

Stock market prediction helps the organization and also the stake holder to keep track of the trend of the market. It also helps to decide whether to sell, buy or withhold the stock so as to maximize the profit. This paper comprises of a brief comparative study of various techniques that are used to predict the stock market giving a brief description of each and also the concept of Genetic Analysis and its role in the prediction of stock market.

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