



Hybrid Neuro-Genetic Data Mining Technique for Market Forecasting

KEYWORDS

Data Mining, Genetic Algorithm, Neural Network, Stock Price.

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ABSTRACT Share Market is an untidy place for predicting since there are no significant rules to estimate or predict the price of share in the share market because of fluctuating behavior of share price. The methods like technical analysis, time series analysis, fundamental analysis, and statistical analysis etc are all used to predict the behavior of price in the share market but none of these methods come up with a consistently acceptable prediction tool. The major concern of this study is to develop a system that can predict future prices in the stock markets by taking samples of historical prices. This study tries to help the stock market investors in deciding the better timing for buying or selling stocks based on the knowledge discovered from the historical prices of such stocks using neuro-genetic technique. This study will use the Artificial Neural Network for learning the historical data of Stock Market & make predictions for next few days. Genetic algorithm is used to optimize the weights of Neural Network so that it can learn better.

INTRODUCTION

With the increased economic globalization and rapid evolution of information technology, the financial data are being generated and accumulated at an unusual pace. As a result, there has been a need for automated approaches to effective and efficient utilization of massive amount of financial data to support companies and individuals in strategic planning and investment decision-making. Data mining techniques are used to discover hidden patterns and predict future trends in financial markets. The competitive advantages of use of data mining techniques include increased revenue and much improved decision making capability.

When studying financial markets the main issue is of course predicting price movements, but these are very noisy systems, being influenced by economical and political factors such as companies' earnings, political issues, news or natural disasters. As such they are extremely hard to predict, nonetheless investors widely use market analysis techniques to study and forecast market movements. These methods are technical analysis which studies the price and volume of the assets, using past information to predict the future behavior, and fundamental analysis that deals with various economic and politic factors, looking down from the global economy all the way to the company itself.

Time-series forecasting is a special type of classification on which we concentrate. Specifically, for any financial time series related to the performance of an individual stock, the goal is to predict the value of the time series k steps into the future.

Stock market prediction is the act of trying to determine the future value of a company stock or other financial instrument traded on a financial exchange. In the previous work the different techniques were proposed like SVM, ARIMA, GA, NN, Association Rule mining & different machine learning technique for prediction of stock market. Among these techniques we are combining the features of

GA & NN for stock prediction. Thus we propose a method to predict the stock price using a hybrid genetic approach combined with NNs. We describe a number of input variables that help the network to forecast the next day price, a GA is used for optimizing NN's weights

We present a new system that utilizes genetic algorithms (GAs) & Neural Network to predict the future performances of individual stocks. More generally, the system uses GAs for optimization of historical data. Then Neural Network is used to predict the future behaviour of stock market.

Genetic Algorithm

Genetic Algorithms (GA) are direct, parallel method for global search and optimization. GA is one of the most commonly used Evolutionary Algorithms (EA). The Genetic Algorithms are direct, efficient and stochastic method for optimization. As they use populations with allowed number of solutions (individuals), they are added in the group of parallel algorithms.

Main ingredients of GA are Chromosomes, Selection, Recombination and Mutation.

Selection - During each successive generation, a proportion of the existing population is selected to breed a new generation. Fitness-based process is used to select individual solutions where fitter solutions (as measured by a fitness function) are typically more likely to be selected. At this stage elitism could be used – the best n individuals are directly transferred to the next generation. The elitism ensures, that the value of the optimization function cannot get worst (once the extremum is reached it would be kept).

Crossover – The most common type is single point crossover. In single point crossover, we choose a locus point at which you swap the remaining alleles from one parent to the other. The children take one section of the chromosome from each parent. Chromosome is broken based on the randomly selected crossover point. This particular method is called single point crossover because only one

crossover point exists. Sometimes only one child is created, but generally both offspring are created and put into the new population. Crossover does not always occur. Sometimes, based on a set probability, no crossover occurs and the parents are copied directly to the new population.

Mutation – After selection and crossover, we have a new population full of individuals where some are directly copied, and others are produced by crossover. In order to ensure that the individuals are not all exactly the same, we allow a small chance of mutation. We go through all the alleles of all the individuals, and if that allele is selected for mutation, we either change it by a small amount or replace it with a new value. Mutation is fairly simple. Mutation is, however, vital to ensuring genetic diversity within the population

Basic block diagram of Genetic Algorithm is

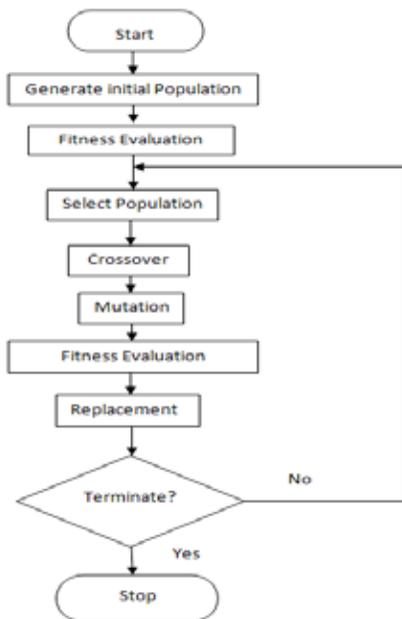


Fig. Genetic Algorithm

Genetic Algorithm is a randomized algorithm that could be run for a very long time to obtain an optimal solution.

Neural Network

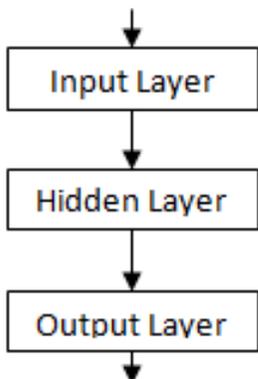


Fig Neural Network

The basic architecture of ANN is Multi- layer feed forward.

In this architecture, information flows in one direction only (from input to output). It consists of one input, one or more hidden and one output layer. Inputs are sent into units in input layer then weighted output from these units is taken as input in next hidden layer, weighted output of this layer is sent as input in next hidden layer and so on until output of last hidden layer is sent to output layer. Output layer gives the predicted output.

LITERATURE REVIEW

In the previous research, different techniques were presented for historical stock data analysis & stock market price prediction.

Yung-Keun Kwon and Byung-Ro Moon [1] proposed a new technique to predict the stock price using a hybrid genetic approach combined with recurrent NNs. For that they described a number of input variables that help the network to forecast the next day price. Technical indicators or signals that were developed in deterministic trading techniques are used for input variables. The back propagation algorithm is prone to get stuck in local minima and highly depends on the initial weights; a GA is used for optimizing NN’s weights.

Kai Keng Ang, Chai Quek [2] used neuro-fuzzy systems and neural networks for forecasting stock price difference on artificially generated price series data. In that they proposed a novel rough set-based neuro-fuzzy stock trading decision model called stock trading using rough set-based pseudo outer-product (RSPOP) which synergize the price difference forecast method with a forecast bottleneck free trading decision model. This proposed stock trading forecast model uses the pseudo outer-product based fuzzy neural network using the compositional rule of inference with fuzzy rules identified using the RSPOP algorithm as the underlying predictor model and simple moving average trading rules in the stock trading decision model.

Jorge Fonseca, Rui Neves, Nuno Horta [5] proposed an investment strategy using Genetic Algorithms applied to the stock market. In order to build a portfolio of promising stocks they have done fundamental analysis by using indicators such as earnings volatility and growth, Price-to-Earnings ratio and Price/Earnings to Growth ratio. In addition with this technical indicators such as moving average crossovers and Relative Strength Index are used to adapt the portfolio to the market’s trends.

Ramin Rajabioun and Ashkan Rahimi-Kian [3] proposed a genetic programming model in which ,first a precise mathematical model is obtained for four competing or cooperating companies stock prices and then the optimal buy/sell signals are ascertained for five different agents which are trading in a virtual market and are trying to maximize their wealth over one trading year period. The model is so that gives a prediction of the next 30th day stock prices.

Yusuf Perwej, Asif Perwej [9] proposed a method to predict the daily excess returns of Bombay Stock Exchange (BSE) indices over the respective Treasury bill rate returns. They have applied the prediction models of Autoregressive feed forward Artificial Neural Networks (ANN) to predict the excess return time series. For the Artificial Neural Networks model using a Genetic Algorithm is constructed to choose the optimal solution

Kyoung-jae Kim, Ingoo Han [10] proposed a genetic algorithms (GAs) approach to feature discretization and the determination of connection weights for artificial neural

networks (ANNs) to predict the stock price index. GA not only searches for the optimal or near-optimal solutions of connection weights in the learning algorithm but also looks for the optimal or near optimal thresholds of feature discretization for the dimensionality reduction. GAFD discretizes the original continuous data according to the GA-derived thresholds and simultaneously assigns the genetically evolved connection weights.

Hyun-jung Kim , Kyung-shik Shin [11] proposed the effectiveness of a hybrid approach based on the adaptive time delay neural networks (ATNNs) and the time delay neural networks (TDNNs) with the genetic algorithms (GAs) in detecting temporal patterns for stock market prediction tasks. By evaluating the fitness of different sets of the number of time delays and network architectural factors at the same time, they proposed a solution for the ATNN and TDNN model.

O. Valenzuela, I. Rojas, F. Rojas, H. Pomares, L.J. Herrera, A. Guillen, L. Marquez, M. Pasadas [12] proposed a hybrid ARIMA-ANN model for time series prediction. This model combines the ARIMA models, and the power of ANNs.

In literature review we have reviewed different techniques for stock market prediction such as ARIMA, GA, NN, Association Rule mining & different machine learning technique for prediction of stock market.

METHODOLOGY

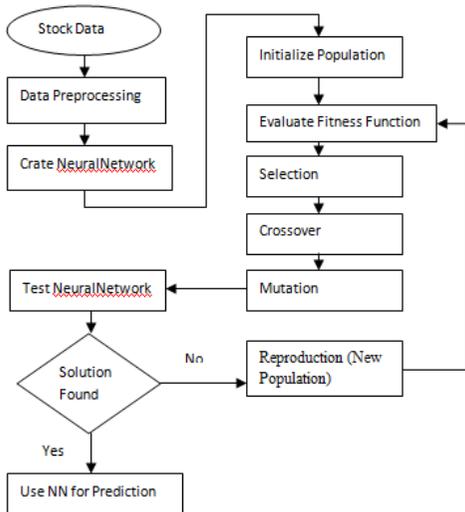
Our proposed methodology is a two stage model. In first stage we create artificial neural network & learn it with stock market historical data .The Genetic algorithm is used to optimize the weights of neural network so that it can learn the pattern of stock market very efficiently. In the second stage we use the learned neural network to predict the future nature of stock market that is whether it goes up ,down or it remains steady for next few days.

then it stops Genetic Algorithm otherwise GA continues until termination condition is met. Once we get solution we save the NN & Use it for future prediction which is second stage of proposed methodology.

CONCLUSION

As researchers and investors strive to out-perform the market, the use of Neural network algorithm to forecast stock market prices will be a continuing area of research. The goal is to increase the yield from the investment. It is already proved through research that the evaluation of the return on investment in share markets through any of the traditional techniques is tedious. We have proposed the hybrid neuro-genetic technique to predict stock market price. Genetic algorithm is used for optimization of weights of neural network & NN is used for prediction.

In conclusion we can say that if we train our system well efficiently with historical data set it will generate more accurate & error free prediction.



The above diagram shows the first stage of proposed methodology where we create the Artificial NN which is recurrent NN. The weights of NN are sent to Genetic algorithm as an input which initializes its population with the weights. Then GA does the selection, crossover & mutation on population & returns the best population with weights of NN. The optimized weights are set to NN & it is tested for the desired output .If desired output is found

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