Parameters for Stock Market Prediction

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Abstract

In recent years researchers have developed a lot of interest in stock market prediction because of its dynamic & unpredictable nature. Although there were lots of methods of prediction none of them is prove to produce satisfactory results. Machine learning techniques proved to be better than other methods because of its ability of nonlinear mapping. In this paper we survey different input parameters that can be used for stock market prediction with ANN. In this paper we will try to find out most important input parameters that have major impact on accuracy. From the survey we see that most of machine learning techniques make use of Technical variables over fundamental variables for a particular stock price prediction, while Microeconomic variables are mostly used to predict stock market index. But hybridized parameters give better result that applying only single type of input variables.

Keywords: stock market prediction, technical indicators, fundamental indicators, input parameters for stock prediction

1. Introduction

Share market is an important part of economy of a country. It plays an important role in growth of an industry that eventually affects economy of a country. Stock market is common platform for companies to raise funds for company by allowing customers to buy shares at an agreed price.

Many methods have been applied for stock market prediction ranging from times series forecasting, statistical analysis, fundamental analysis and technical analysis.[2] But due to non-linear nature of stock market prediction is very difficult task. Machine learning techniques like Artificial neural networks (ANN) has ability to map nonlinear nature and hence can be used effectively for time series analysis such as Stock market prediction. But to have a considerably good prediction ability it is important to train network properly with sufficiently large data so that on exposing it to real world considerable accuracy can be achieved.

In the task of training it is important to consider proper set of input variable because input set represents factors that will be used & factors that are going to affect prediction and nonlinear mapping.

So in this paper we survey different input parameters that can be used for input variables for stock market prediction. Firstly we will see the two types of analysis that are important from the point of view of machine learning techniques 1) Fundamental Analysis 2) Technical Analysis.

1.1. Fundamental Analysis:

Fundamental analysis mainly depends on statistical data of a company. It may include, audit reports, financial status of the company, the quarterly balance sheets, the dividends and policies of the companies whose stock are to be observed. It also includes analysis of sales data, strength and investment of company, plant capacity, the competition, import/export volume , production indexes, price statistics, and the daily news or rumors about company. Along with these parameters other parameters like book value, p/e ratio, earnings, return on investment(ROI) .etc. are very carefully observed to arrive at an estimate of future business conditions.[1]

Fundamental analysis find an intrinsic value of a stock and generates a buy signal if current value of stock is below intrinsic value. In fundamental analysis it is believed that market is defined 90 percent by logical and 10 percent by physiological factors. Main problem with fundamental analysis is that it helpful for long term trading [2].

1.2. Technical Analysis:

In stock market analysis there are two approaches first approach includes analysis of graphs where analysts try to find out certain patterns that are followed by stock but this approach is very difficult and very complex to be used with ANN. In second approach analyst make use of quantitative parameters like trend indicators, daily ups and downs, highest and lowest values of a day, volume of stock, indices, put/call ratios, etc. It also includes some averages which is
nothing more than mean of prices for particular window. Simple Moving Average(EMA) of last n days and Exponential Moving Average(EMA) where price of recent days has more weight in average[5]. Analyst try to find out some mathematical formula which can map these input to the desired output. This approach is easy compared to previous approach is suitable for ANN/Machine learning methods. That why most of the machine learning techniques prefer technical analysis data over fundamental analysis data as input to system. Now a days Artificial Neural Networks are regularly applied to financial domain which tries to learn pattern in financial data to do prediction.[4]

2. Literature Review
For stock market prediction selection of input features is important task. Most of the machine learning techniques are use technical indicators as input. In the following section we see some of the techniques used by researchers and input features used by them for prediction.

Zabir Haider Khan, Tasnim Sharmin Alin, Md. Akter Hussain[3] have used ANN for stock market prediction and have used 5 fundamental input variable which are general index(GI), Net Asset Value(NAV), profit per earning(P/E) ratio, Earnings per share(EPS) and share volume. They have applied these parameters to NN and compared there outcome.

Ramin Rajabioun and Ashkan Rahimi-Kian[6] created a genetic programming (GP) based prediction model which considers interaction between companies and results generated by five agents each created with different strategy like buy/sell maximum allowed stock, use of Mean Variance analysis(MVA), Random walk theory, MVA with less risk, MVA with risk taking resp. to predict future price. They compared results of GP with MLP and Neuro-Fuzzy network to show that GP performs better. They has used daily opening price, daily closing price, daily highest price, daily lowest price and daily exchange volume as input features which comes under technical indicators.

Tsai, C.-F. and Wang, S.-P.[7] have shown how Hybrid machine learning methods outperforms that techniques alone. They combined ANN with Decision Tree(DT) to improve accuracy of ANN in the task of prediction. They created four models ANN, DT, ANN+DT, DT+ANN and DT+ANN+DT and verified these models against data collected from TEJ database. After collecting all related variables they applied Principal Component Analysis(PCA) for filtering out unwanted or unrelated variables and finally 53 variables are selected. After apply all four models on data, Hybrid system gives better results than other models. In particular they have found out twelve different decision rules for predicting rise or fall. From decision tree we can see most of the indicators used in rules are microeconomic indicators like Export growth rate, product export, import amount from USA, export PI increase rate, import growth rate, CPI, etc.

Nguyen Lu Dang Khoa1, Kazutoshi Sakakibara2 and Ikuko Nishikawa2[8] applied back propagation algorithm with time and profit based adjusted weight factors. They have used Feed-forward neural network and simple Recurrent neural network for modified training algorithm. Results show that recurrent neural network with modified back propagation performs better. In this paper they tried to select as few independent inputs as possible. They have used input indicators as inflation rate, GDP, relative strength index, directional index, daily high, daily low, closing price and moving averages.

Y.R.Ramesh Kumar and Prof.A.Govardhan, [9] try to use user experience which he gain through market along with the technical analysis and precious methods to enhance the profit. They claims user forget his previous experience and make same mistakes again and again because his/ her judgments are purely instinctive. In this task they first use neural network with technical indicator like opening price, highest price, closing and lowest price and supportive data warehouse as inputs, to generate a buy/sell signal. Supportive data ware house contains previous experiences and information about market movement which will help in prediction. After generating signal transaction is made its effect is recorded as profit or loss along with required information. They have compare this to other techniques to find out better method.

Wei Huang, Kin Keung Lai, Yoshiteru Nakamori, Shouyang Wang, Lean Yu[10] have given a detail description of which input variables can be used for predicting stock market index price. They have also applied different ANN models for prediction and compared their results. According to them there are two approaches for prediction first one is relationship between market price and microeconomic indicators. Second approach takes into account non-linear relation between stock price, trading volume and dividends. They have surveyed on application of ANN to stock market index forecasting where they tried to find different variables that have impact on stock index. Chen[11] has provided information about how variables like default spread, term spread, one-month T-bill rate, lagged industrial production growth rate and dividend–price ratio affect stock price index. He also has shown their ability to predict future stock price. Fama and French[12] identified three common risk factors: the overall market factor, factors related to firm size and book-to-market equity, which seem to explain average returns on stocks and bonds. Kohara[13] have used five microeconomic indicators for prediction TOPIX(Tokyo stock exchange price index) he has also
used US dollar to Yen exchange rate, three month interest rate, crude oil price and New York Dow Jones average of closing price of 30 industrial stocks because according to him TOPIX stock prices are often influenced by New York stock prices. There is a set of macroeconomic indicators that can be used for stock index prediction term structure of interest rates (TS), short term interest rate (ST), long term interest rate (LT), consumer price index (CPI), industrial production (IP), government consumption (GC), private consumption (PC), gross national product (GNP), gross domestic product (GDP) and they are easily available also[10].

Adebiyi Ayodele A., Ayo Charles K., Adebiyi Marion O., and Otokiti Sunday O.[14] have suggested use of hybridized parameters i.e. variables of both technical and fundamental analysis. They have selected total 18 inputs and applied them to different neural networks (such as 18-24-1, 18-18-1, 18-22-1) and compared results with those networks with only technical variables. Out of 18 input variables 10 are technical variables which are opening price, closing price, highest price, lowest price and trading volume of last two days. Remaining 8 input variables are fundamental variables which are price per annum of last two years, news/rumors to buy/sell stock of last two days, book value of last two years and financial status of company for last two years. In this paper they have shown how hybridized parameters outperforms technical parameters.

Robert P. Schumaker, Hsinchun Chen[15] tried to find out influence of news article on stock price. They have analyzed news articles related to the stock and find out the meaning of article and supplied it as input parameter along with stock quotes to Support Vector Machine(SVM) and error is calculated by Mean Square Error(MSE).

Leonardo C. Martinez, Diego N. da Hora, Joao R. de M. Palotti, Wagner Meira Jr. and Gisele L. Pappa [16] have given another approach for increasing profit by predicting highest and lowest price instead of closing price. According to them we can make more that one transaction per day by observing current stock price and comparing with highest/lowest price. They have used 33 input variables which are applied to ANN. Out of 33 input variables 10 are lowest and highest price of last 5 days, 10 are opening and closing price of last 5 days, 2 are Exponential Moving Average(EMA) of highest and lowest price of last 5 days, 2 are EMA of opening and closing price of last 5 days, 4 are bollinger band(BB) of highest and lowest price of last 5 days, 4 are BB of opening and closing price of last 5 days and 1 for opening price of current day. They have compared there system with other existing systems and have shown how this technique can maximize use profit.

3. Discussion

In the following section we will discuss about different parameters and their use for a particular type of prediction. Following table summarizes the prediction target and the respective parameters used by many researchers.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Prediction Target</th>
<th>Techniques</th>
<th>Input Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Stock price</td>
<td>ANN</td>
<td>Fundamental parameters</td>
</tr>
<tr>
<td>2)</td>
<td>Stock price of a company</td>
<td>Genetic Programming</td>
<td>Technical parameters</td>
</tr>
<tr>
<td>3)</td>
<td>Stock market index</td>
<td>ANN + DT</td>
<td>Micro-economical parameters</td>
</tr>
<tr>
<td>4)</td>
<td>Stock price of a company</td>
<td>ANNFNN, RNN</td>
<td>Hybrid parameters (Technical + Micro-economical)</td>
</tr>
<tr>
<td>5)</td>
<td>Stock price of a company</td>
<td>ANN</td>
<td>Technical parameters + User experience</td>
</tr>
<tr>
<td>6)</td>
<td>Stock market Index</td>
<td>ANN</td>
<td>Micro-economic indicators</td>
</tr>
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<td>Stock price of a company</td>
<td>ANN</td>
<td>Hybrid parameter (Technical + Fundamental parameters)</td>
</tr>
<tr>
<td>8)</td>
<td>Stock price of a company</td>
<td>SVM</td>
<td>Technical parameters + News articles</td>
</tr>
<tr>
<td>9)</td>
<td>Highest and lowest price of a stock</td>
<td>ANN</td>
<td>Technical parameters + EMA + BB</td>
</tr>
</tbody>
</table>

Table 1: Comparision of parameters

From above we can see that technical variables are used by almost all researchers irrespective of technique used for prediction. So it is clear technical parameters are the one which has major impact on stock price & stock index. Although most of techniques applied for prediction are Artificial neural network(ANN) alone or with combination of other method. ANN are predominantly used is stock prediction compared to other techniques.

4. Conclusion

In this complex task of stock market prediction input parameters plays an important factor as the choice of improper input variable may lead to lower accuracy.
Some parameters have big influence on stock price while some have less influence and hence it is important to select correct set of inputs. Mostly Technical analysis variables are used predominantly in machine learning techniques. Some tried to use different variable like fundamental variables, microeconomic indicators, news articles, etc. We found that while predicting stock market index microeconomic indicators have major influence over other. On the other hand while predicting stock price other factors have major influence. In case of using news articles it is important to find correct meaning that news article otherwise it will worsen prediction ability. From this survey we can conclude that hybridized parameters like combination of technical and fundamental variable give better prediction accuracy over application of standalone parameters.

5. References


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