An Analysis on Stock Market Intelligence and Research Approaches

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ABSTRACT

Business intelligence is becoming a major trend in financial world. One such area is stock market intelligence that makes use of data mining techniques such as association, clustering, artificial neural networks, decision tree, genetic algorithm, expert systems and fuzzy logic. These techniques can be used to predict stock price or trading signal automatically with acceptable precision. Although there has been a lot of research done in this area, still there are many issues that have not been explored yet and also it is not clear to new researchers where and how to start. Data mining can be applied on past and present financial data to generate patterns and decision making system. This paper gives brief overview of several attempts made by researchers for stock prediction by focusing on stock market analysis and defines a new research domain to understand the intelligence of stock market. This refers as stock market intelligence, which is to develop data mining techniques to support all aspects of algorithmic trading and also suggest a number of research issues in stock intelligence related to forecasting & its accuracy.

Keywords: Data Mining Algorithms, Stock market intelligence, stock data analysis.

1. INTRODUCTION

Stock prediction is an important topic in the field of finance as well as engineering and mathematics. Due to its financial gain, it has attracted much attention from academic and business. Nevertheless, stock market prediction comes with a challenging question of whether the stock price is predictable or not? So, the random walk hypothesis states that the price of stock is collocated by a random walk and hence the stock market is unpredictable. The debate about whether the stock market can be predicted or not has lasted for many years, but there has not been a consensus yet. However, many researchers have built their own stock price predicting systems, to some extent, for proving the stock market's predictability.

Stock price prediction has always been a subject of interest for most investors and financial analysts. Nevertheless, finding the best time to buy or sell has remained a very difficult task for investors because there are other numerous factors that may influence stock prices.

Under the assumption that the stock market could be predicted, there are two major categories of prediction methods: fundamental analysis and technical analysis.

Fundamental Analysis: It mainly depends on statistical data of a company. It includes reports, financial status of the company, the balance sheets, dividends and policies of the companies whose stock are to be observed. It also includes analysis of market data, strength and investment of company, the competition, import/export volume, production indexes, price statistics, and the daily news or rumors about company.

Technical Analysis: In stock 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 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 size. Simple Moving Average(MA) of last n days and Exponential Moving Average(EMA), here price of recent days has more weight in average. Analysts try to find out some mathematical formula which can map this input to the desired output.
For such a large amount of stock data, it is very suitable for computers to learn and predict. In this paper, we concentrate on reviewing recent development of prediction algorithm and models of machine intelligence. In addition, we propose a new term Stock Intelligence to define stock market analysis with machine intelligence techniques. Finally, several new research issues will be proposed.

2. Related Work

Many algorithms of data mining have been proposed to predict stock price. Neural Network, Genetic Algorithm, Association, Decision Tree and Fuzzy systems are widely used. In addition, pattern discovery is beneficial for stock market prediction and public sentiment is also related to predicting stock price. There is a certain correlation among them.

A review of previous studies on stock price forecasting shows the prevalent use of technical indicators with artificial neural networks (ANNs) for stock market prediction over the last two decades. Kunhuang and Yu [3] used backpropagation neural network with technical indicators to forecast fuzzy time series, the study findings showed that ANN has better forecast ability than time series model.

One of the well-researched and most important algorithm in the field of Data mining is Association Rule Mining (ARM), Clustering & Decision Tree for financial forecasting.

Strong rule generation is an important area of data mining. Association rule mining aims to obtain associations among item sets in data repositories. Now, Apriori algorithm play a vital role in identifying frequent item sets and generating rule sets from it. Decision trees are excellent for making financial decisions where a lot of complex data needs to be taken into account. They provide an effective framework in which alternative decisions and the implications of taking those decisions can be laid down and evaluated. They also form an accurate, balanced image of the risks and rewards that can result from a particular choice.

In this research, the problem of discovering association rules was first introduced in 1993 and an algorithm called AIS was proposed for mining association rules [5]. For last fifteen years many algorithms for rule mining have been proposed. Wanzhong Yang [1] also proposed one innovative technique to process the stock data named Granule mining technique, which reduces the width of the transaction data and generates the association rules. R.V.Argiddi [2] has proposed fragment based mining which deals mainly with reducing the time and space complexity involved in processing the data in association rule mining technique. As in granule mining, fragment based approach fragments the data sets into fragments for processing thereby reducing the input size of data sets fed to the algorithm. In contrast to granule mining, in fragment based mining the condition and decision attributes are summed for obtaining generalized association rules. Kannika Nirai Vaani M,E Ramaraj [4],[5] has now proposed new approach to generate association rules (E-Rules) i.e. Providing faster generation of frequent item sets to offer interesting and useful rules in an effective and optimized way with the help of Genetic Algorithm approach.

From the above literature review, technical indicators with different data mining techniques had been widely used, while there are only few studies of the use of fundamental indicators. The impact of fundamental analysis variables has been largely ignored like Price-earnings ratio, Moving average, rumors etc. But Prashant S. Chavan , Prof. Dr. Shrishail. T. Patil [10] has said that hybridized parameters gives better & more accurate results that applying only single type of input variables. A.A. Adebiyi , C.K. Ayo, M.O Adebiyi and S.O. Otokiti [11] has proposed predictive model has the potential to enhance the quality of decision making of investors in the stock market by offering more accurate stock prediction using hybrid parameters. They used ANN for this but their performance is not always satisfactory. Robert K. Laia , Chin-Yuan Fanb, Wei-Hsiu Huang b, Pei-Chann Chang [6],[9] has proposed forecasting model that integrates a data clustering technique, fuzzy decision tree (FDT) and genetic algorithm (GA) to construct a decision-making system based on historical data and technical indices.

Public information such as news, blogs, twitter mood, social networking sites and stock articles can also affect stock market trend. Web has been treated as a great source of financial information; many papers proposed stock price predicting approaches based on analyzing web sentiments using text mining. Fung et al. (2002) predicted stock trend changes by analyzing news articles with data mining and text mining techniques and a new statistical based piecewise segmentation was proposed. Schumaker and Chen [12] examined different textual representations of news articles to predict future stock price, which was compared to linear regression with SVM. Bollen et al. [13] analyzed the daily text content in Twitter by mood tracking tools, and investigated to utilize these public mood time series for predicting the changes of DJIA closing values, which is based on a self-organizing fuzzy neural network.
3. COMPARATIVE ANALYSIS OF EXISTING TECHNIQUES

Summarize all the data mining techniques into the following three methods according their different goals and information used to achieve it. Collectively all these methods are part of stock market intelligence as shown in Table 1. & Framework for stock market intelligence is represented in Fig.1 below.

- First, classic machine intelligence techniques are used for stock market prediction directly. This category only considers technical indicators, fundamental factors, and other features of stocks as input, and then it uses neural network, rule-based methods, genetic algorithm and other techniques to predict stock market.

- Second, although chart pattern discovery is like semi-finished product for stock market prediction, the benefit of chart pattern is its visualization and interpretability that are not found in neural-network-based systems. Interactions between chart pattern discovery systems and investors are allowed and an automatic decision-made system is feasible.

- Third, by assuming that there exists a certain relationship between stock price trend and investor sentiments, it is an applicable approach to predict stock market through mining the sentiment or expert’s analysis indicators from public text information. For the public information based method, text mining seems to be the most important technique. Not only the text information, but also other social media like twitter, facebook etc. could also be mined to predict stock market.

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<thead>
<tr>
<th>Method</th>
<th>Input Data Used</th>
<th>Goal</th>
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<tbody>
<tr>
<td>Classical market intelligence</td>
<td>Technical indicators, Fundamental factors etc.</td>
<td>Predicting stock price trends or trading points or signals</td>
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<tr>
<td>techniques</td>
<td></td>
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<tr>
<td>Pattern Discovery</td>
<td>Only Historical stock data</td>
<td>Discovering charts or graph</td>
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<tr>
<td>Based on Public Information</td>
<td>Public information, expert’s</td>
<td>Predicting stock price trends</td>
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Table 1: Different Approaches for Stock Market Intelligence

Fig 1: Framework for Stock market intelligence

4. CONCLUSION

Summarized the recent improvements in stock market price prediction from several different perspectives including classic market intelligence techniques, pattern discovery and public web information used for stock data analysis. Neural networks, association rule, genetic algorithms, fuzzy logic and rule based methods were used in previous research papers. Patterns & rule based algorithms are widely used by investors to analyze the stock trend and sentiment, expert opinion polls are known to be useful for predicting stock prices.
To do better focus on research, this paper defines the term of Stock market Intelligence to describe all the techniques and methods for stock market analysis & incorporate to approaches of combining technical indicators, fundamental indicators and expert’s opinion, public information to improve stock price prediction using ANN model.

References