Stock Market Prediction: A Review

Mahesh M. Mahajan,

Department of Computer Engineering, R. C. Patel Institute of Technology, Shirpur

---***---

Abstract - Prediction is always consider as challenging task and more over if we are thinking about stock market prediction then it becomes even more difficult as it depend on fundamental, social, economic, political and many more other factors, hence it has been characterized as unpredictable, dynamic and nonlinear in nature. Stock market attracts attention of many traders, investors, companies because a good prediction model can lead to increase in profit and can reduce the risk of loss. It has also succeeded in seeking attention of scientific community, researchers to look at it as a research domain. Few of them have successfully design a methodology/model based on various kind of approaches like statistical, mathematical, Genetic Algorithm based approach, AI based and so on for stock market trend prediction. Among the methods used in the articles, research papers or other scientific databases, most used approach is Artificial Intelligent based methods like Machine learning and Deep learning. As a result, Artificial Intelligence-based approaches are the focus of this research review. Most of the research articles, research papers for this review are taken from scientific databases like Science Direct, IEEE access, Scopus indexed journals and few papers from other reputed publications are considered.

Key Words: stock market, artificial intelligence, deep learning, genetic algorithm.

1. INTRODUCTION

In earlier days, it was considered that, 'Stock market is not a cup of tea of common people.' However, due to advancement in technology now days it is on the fingertips of all the people. So now common peoples are showing interest in stock market for investment and profit and professionals are already into that. Along with that there is one more community which has shown more interest in stock market since last few years after the advancement in technology that is scientific community. Initially stock market trend prediction was unable to attract attention as research domain, it was consider only for profit purpose by few investors and companies. Even stock price prediction is considered as 'Random Walk States' where stock prices are independent of past history.[1] But still scientific community tries to predict the prices and has developed many

different methodologies based on various concepts. Stock market has been characterized as unpredictable, dynamic and nonlinear in nature. In general prediction of stock prices seems to be a challenging operation since it relays on several factors which induces volatility[2]. Hence to improve the profit and reduce the loss, advanced techniques has to be incorporated. For this process, recent trends over the past few years must be analyzed to monitor the stock market movements (Gandhmal and Kumar, 2019, Henrique, Sobreiro and Kimura, 2019) Accurate stock market models can give investors the information they need to make better data-driven decisions. These algorithms can aid traders in minimizing investment risk and identifying the most profitable equities. Furthermore, modern models allow non-traditional data such as previous stock prices and news to be used [5]. Two kinds of traditional methods for the prediction of stock are technical analysis and qualitative analysis [6]. Here technical analysis utilized historical stock price like opening and closing price, adjacent close values, volume traded of the stock for the future price prediction of the stock. Then the quantitative analysis based on external factors such as market situation, company profile, textual data, economic and political factors in the form of social media, new articles and blogs[7], but today, advanced AI (Artificial Intelligence) methods in accordance to the fundamental and technical analysis were utilized for stock price prediction. The most of the methods uses technical indicators for prediction even though it is still complicated to predict the future market trend. There are various stock market trend prediction, stock price forecasting, portfolio management, financial management methodologies or models are designed for stock prediction. This models are based on different theories like mathematical, statistical, AI based. So the main objective of this paper is to study the different methodologies used for prediction, the datasets required, algorithms which are used, various other techniques which are combined to serve stock price prediction models.

2. LITERATURE SURVEY

Generally, stock market is considered complex, dynamic, volatile and chaotic. Undoubtedly, the stock market's prediction is very challenging task in time-series estimation. In today's rapidly changing industrial environment, accurately predicting stock movements is both fascinating and challenging also trader's expectations, financial circumstances, administrative events, and certain aspects related to the market trends [3] makes it even more demanding. Several non-

economic and economic elements influence the behaviour of stock movements are also taken into account. Accurate stock market models can give investors the tools they need to make better data-driven decisions. These algorithms can assist traders in minimizing investment risk and identifying the most lucrative companies. Several review articles on financial issues are available, including stock market analysis and forecasting, currency exchange forecasting, and optimum portfolio selection, to name a few. Recent advancements in stock prediction like Bayesian model, Fuzzy classifier, Artificial Neural Networks (ANN), Support Vector Machine (SVM) classifier, Neural Network (NN)[3], Machine Learning approaches, such as Deep Learning, Text Mining Techniques, and Ensemble Techniques[5], necessitate an updated evaluation.

Further, the existing ANN (artificial neural network) techniques failed to offer satisfactory outcomes. Meanwhile, the advances in ML (machine learning) provided more encouraging results for language processing, According to recent study, researchers are aiming to utilize deep learning to forecast market prices. Because speech is a time series data and stock data is also a time series data, the approach has been successfully applied in the speech domain.

List of few papers

S.N.	Name of author	Title of paper	Publisher/ Year of Publication
1	Dattatray P. Gandhmal, K. Kumar	*Systematic analysis and review of stock market prediction techniques*	Publisher - Elsevier, Year - 2019
2	Mehar Vijh, Deeksha Chandola, Vinay Anand Tikkiwal, Arun Kumar	*Stock Closing Price Prediction using Machine Learning Techniques*	ScienceDirect, Publisher - Elsevier, Year - 2020
3	Adil MOGHAR, Mhamed HAMICHE	*Stock Market Prediction Using LSTM Recurrent Neural Network*	ScienceDirect, Publisher - Elsevier, Year - 2020
4	O Bustos, A. Pomares-Quimbaya	*Stock market movement forecast: A Systematic review*	Publisher - Elsevier, Year - 2020

DNN has been introduced as a trend prediction classifier for stock multimedia [8], and Google stock multimedia data i.e. chart data of 2843 days from NASDAQ is taken as input to predict stock price. Moreover, the primary objective of the study is to determine that DL (Deep Learning) could improve the predicting accuracy of stock market.

The study compared DNN (Deep Neural Network) + (2D) 2 PCA with the existing methods and identified that the suggested method performs significantly better than prevailing techniques at 4.8% of accuracy. Additionally, the outcomes of the proposed method has been compare with RNN (Recurrent Neural Network) and observed 15.6% improvement in accuracy [8]. Similarly, this study[14] used min-max scaling tool and has achieved more than 99% of accuracy. The study verified that the min-max scaling produced improved results for prediction as well as recognition. Even though, the min-max scaling is sensitive to the outliers, the study failed to observe in the comparative analysis.

The LSTM is a recurrent neural network (RNN). RNNs are a powerful form of artificial neural network that can remember the input internally. This makes them ideal for dealing with problems requiring sequential data, such as a time series[11], which is good for stock market prediction. Study also shows that a stateless LSTM model performs better than stateful LSTM due to higher stability[12]. Predicting future movement from the stock prices was challenging for several researchers. Moreover, various studies analyzed the stock prices and to gain profit. This study [13] suggested a hybrid model for predicting stock prices by utilizing neural language processing, DL (Deep Learning) as well as ML (Machine Learning). The study selected NIFTY 50 index values of NSE and collected the daily prices from a period between 2015 and 2017. With respect to the time period, the study built different predictive methods utilizing ML. For the prediction of time movements, the study utilized several classification techniques for predicting stock's closing prices. Also, the study built LSTM (Long and Short Term Memory) on the basis of DL for the prediction of stock's closing price, as well as compared prediction accuracies of ML methods with LSTM model. Finally, the study tested the suggested method by utilizing cross verification method based on SOFNN (self-organizing fuzzy neural network) and identified interesting outcomes.

3. ANALYSIS

This section is dedicated for analysis of various kinds of methodologies used for stock market trend prediction. After going through the research papers search by using keywords 'stock market', 'stock market prediction', 'stock market forecasting', 'financial forecasting', 'stock market trend prediction' few to note. The search gone through different publication like science direct from Elsevier, IEEE Access, Springer and other reputed scopus indexed journal some of the papers are listed in table 1. It is found that there are many different kinds of techniques based on various approaches. This techniques can be classified based on many parameters

like input dataset, results produced, parameters used, data preprocessing methods used, methodologies used, tools used for evaluation, stock exchanges used so on. Table 2 shows few stock exchanges used or studied by researchers. So the classification can be done in many ways here analysis is done based on research area of the method used.

The mathematicians use statistical approaches to predict future stock price. Historical data and hypotheses such as normalcy postulates are included in fuzzy based models. Several stock market prediction approaches, such as fuzzy time series data, real numbers, and fuzzy set design are based on traditional time series. For stock market prediction, fuzzy time series data is used to handle linguistic value data and produce exact forecasting outcomes. These techniques are commonly used to anticipate nonlinear and dynamic information in dynamic environments like tourism demand and financial markets[18]. Few scientist of scientific community focused on Genetic Algorithms as one of the solution to the problem. Where a genetic classifier can be used to regulate the activation of a feed forward artificial neural network in order to execute a locally scoped forecasting activity. Different information is provided to genetic and neurological components: The former works with inputs that encode information derived through technical analysis, whereas the latter works with other relevant inputs, such as historical stock prices[19]. Soft computing methods are also considered by some expert to predict stock market trend like few researchers has integrated generic fuzzy systems with ANN to predict stock price where all clusters will be fed into independent GFS models with the ability of rule base extraction and database tuning[20].

REFERENCES

1. E. F. FAMA and K. R. FRENCH, Size and Book-to-Market Factors in Earnings and Returns, The Journal of Finance, vol. 50, no. 1, pp. 131–155, 1995, doi: 10.1111/j.1540-6261.1995.tb05169.x.
2. A. Thakkar and K. Chaudhari, Fusion in stock market prediction: A decade survey on the necessity, recent developments, and potential future directions, Information Fusion, vol. 65, pp. 95–107, Jan. 2021, doi: 10.1016/j.inffus.2020.08.019.
3. D. P. Gandhmal and K. Kumar, Systematic analysis and review of stock market prediction techniques, Computer Science Review, vol. 34. Elsevier Ireland Ltd, Nov. 01, 2019. doi: 10.1016/j.cosrev.2019.08.001.
4. B. M. Henrique, V. A. Sobreiro, and H. Kimura, Literature review: Machine learning techniques applied to financial market prediction, vol. 124. Elsevier Ltd, 2019, pp. 226–251. doi: 10.1016/j.eswa.2019.01.012.
5. O. Bustos and A. Pomares-Quimbaya, Stock market movement forecast: A Systematic review, Expert Systems with Applications, vol. 156. Elsevier Ltd, Oct. 15, 2020. doi: 10.1016/j.eswa.2020.113464.
6. A. Derakhshan and H. Beigy, Sentiment analysis on stock social media for stock price movement prediction, vol. 85, no. June. Elsevier Ltd, 2019, pp. 569–578. doi: 10.1016/j.engappai.2019.07.002.
7. M. Vijh, D. Chandola, V. A. Tikkiwal, and A. Kumar, Stock Closing Price Prediction using Machine Learning Techniques, in Procedia Computer Science, 2020, vol. 167, pp. 599–606. doi: 10.1016/j.procs.2020.03.326.
8. R. Singh and S. Srivastava, Stock prediction using deep learning, Multimedia Tools and Applications, vol. 76, no. 18, pp. 18569–18584, Sep. 2017, doi: 10.1007/s11042-016-4159-7.
9. W. Chen, C. K. Yeo, C. T. Lau, and B. S. Lee, Leveraging social media news to predict stock index movement using RNN-boost, Data and Knowledge Engineering, vol. 118, pp. 14–24, Nov. 2018, doi: 10.1016/j.datak.2018.08.003.
10. J. Zhao, D. Zeng, S. Liang, H. Kang, and Q. Liu, Prediction model for stock price trend based on recurrent neural network, Journal of Ambient Intelligence and Humanized Computing, vol. 12, no. 1, pp. 745–753, Jan. 2021, doi: 10.1007/s12652-020-02057-0.
11. S. Mehtab and J. Sen, A Robust Predictive Model for Stock Price Prediction Using Deep Learning and Natural Language Processing.
12. M. Agrawal, A. U. Khan, and P. K. Shukla, Stock price prediction using technical indicators: A predictive model using optimal deep learning, International Journal of Recent Technology and Engineering, vol. 8, no. 2, pp. 2297–2305, Jul. 2019, doi: 10.35940/ijrteB3048.078219.
13. S. Jain, S. Shukla, and R. Wadhvani, Dynamic selection of normalization techniques using data complexity measures, Expert Systems with Applications, vol. 106, pp. 252–262, Sep. 2018, doi: 10.1016/j.eswa.2018.04.008.
14. J. Figueiredo, S. P. Carvalho, D. Goncalve, J. C. Moreno, and C. P. Santos, Daily Locomotion Recognition and Prediction: A Kinematic Data-Based Machine Learning Approach, IEEE Access, vol. 8, pp. 33250–33262, 2020, doi: 10.1109/ACCESS.2020.2971552.
15. I. K. Nti, A. F. Adekoya, and B. A. Weyori, A comprehensive evaluation of ensemble learning for stock-market prediction, Journal of Big Data, vol. 7, no. 1, Dec. 2020, doi: 10.1186/s40537-020-00299-5.
16. E. Chong, C. Han, and F. C. Park, Deep learning networks for stock market analysis and prediction: Methodology, data representations, and case studies, vol. 83. Elsevier Ltd, 2017, pp. 187–205. doi: 10.1016/j.eswa.2017.04.030.
17. M. Nabipour, P. Nayyeri, H. Jabani, S. Shahab, and A. Mosavi, Predicting Stock Market Trends Using Machine Learning and Deep Learning Algorithms Via Continuous and Binary Data; A Comparative Analysis, IEEE Access, vol. 8, pp. 150199–150212, 2020, doi: 10.1109/ACCESS.2020.3015966.
18. M. Y. Chen and B. T. Chen, A hybrid fuzzy time series model based on granular computing for stock price forecasting, Information Sciences, vol. 294, pp. 227–241, Feb. 2015, doi: 10.1016/J.INS.2014.09.038.
19. G. Armano, M. Marchesi, and A. Murru, A hybrid genetic-neural architecture for stock indexes forecasting, Information Sciences, vol. 170, no. 1, pp. 3–33, Feb. 2005, doi: 10.1016/J.INS.2003.03.023.
20. E. Hadavandi, H. Shavandi, and A. Ghanbari, Integration of genetic fuzzy systems and artificial neural networks for stock price forecasting, Knowledge-Based Systems, vol. 23, no. 8, pp. 800–808, Dec. 2010, doi: 10.1016/j.knosys.2010.05.004.