



# Review of Stock Price Volatility and Forecasting using Artificial Neural Network

<sup>1</sup>Rajnandini Rawat, <sup>2</sup>Dr. Amit Shrivastava, <sup>3</sup>Dr. Kapil Chaturvedi

M. Tech. Scholar, Department of Computer Science and Engineering, SIRT, Bhopal<sup>1</sup>

Professor, Department of Computer Science and Engineering, SIRT, Bhopal<sup>2</sup>

Associate Professor, Department of Computer Science and Engineering, SIRT, Bhopal<sup>3</sup>

**ABSTRACT:** Trading in stock markets is not an easy task and requires expertise and knowledge that improve and increase the chances of making more profits and ensuring that you make profitable decisions at all times. Financial Experts and data analysts make use of various algorithms and neural networks to predict the value of stock depending upon the available information and then use the outcomes to analyze and make their trading decision. In this concept the research was conducted by taking top sectors from the NSE/BSE. Each sector comprises of five companies based on the weightage value. The study was conducted with different sectors like, IT sector, Automobile sector, Banking sector, Pharmaceutical sector and FMCG sector. All the sectors taken for the study is highly volatile compared to other sectors in NSE/BSE. Hence it is very essential to study on the nexus between the Indian Stock Market and selected companies behaviour. The early stage of the share market was very familiar for average investor. Now the markets are wide enough to invest. There are different markets like bond market, forex market, derivative market and other specialty markets. Analysis of the stock price we take the price. By using the artificial neural network, we develop a model. within the neural network, we use a recurrent neural network that remembers each and each information through time.

**Index Terms – National Stock Exchange (NSE), Bombay Stock Exchange (BSE), Neural Network**

## I. INTRODUCTION

The stock market is considered as one of the easiest ways to trade securities and commodities on regular basis, the traders have the opportunity to either trade intra-day or inter day and earn profits that are exponential. It may be considered as an easy way to make big profits as the risk involved is directly proportional to the profit. The stock market is among the key attractive trading areas of investment for the low income group investors, more specific for the traders. It is through the stock market; there is the existence of a better market area for both short-term and long-term investment with the aim of generating revenue [1]. However, revenue generated from the stock market is high and with higher risk at the same time. The price of the stock of many organizations is not confined. Therefore, linear prediction approaches was overtaken by several soft computing models, for example artificial neural networks, fuzzy set model, genetic algorithm, and particular swarm optimization [2]. These kinds of techniques of soft computing possess the capability to forecast both non-linear and linear interrelation, and also it is able to predict the correlation among the present and past information. Techniques which are of soft nature are able to provide a solution to comprehensive nonlinear calculations from which the present and past values of the stock price was used [3]. The technique depends on the system of natural genetic and selection, and segregate survival fittest progress among string structures to get the best optimal outcome. Non-theoretical measures are utilized in calculating correct results through the use of previous information's. Additionally, stock numbers are improved by influencers like GDP, total stocks, political impacts, for example, new policies initiated by the government, budgets, and turnover of certain organizations invested. As a result of non-stationary and non-linear features of the stock market, it happens to be challenging and difficult to forecast the stock values in a more reliable way [4, 5].

Therefore, an efficient soft computing approach is needed for the automatic identification of succeeding values. Prediction is a trivial task and needs efforts and expertise. By definition, it is justified beyond the reasons that neural network is superior to practical learning entity over a wide area of domains. When examined in ways of their ability for categorized unseen examples during training [6, 7]. However, while recognizing the complex pattern this task is best used by the non-parametric methods and the decision tree largely uses this. The decision tree works in a way, its sort out problems by arranging them from the roots going upwards to the leaf nodes, providing the classification of items, with each internal node correlating with decision events. of a single or more appearance, with every branch going downwards from the specific node is correlative to a single probable value of the features [8, 9]. On the comparison between the decision tree classifier with the neural network, we realize that the neural networks are the best option [10, 11]. Also, the classifier has generalization capability that is so far finite. Although the advantage of this classifier is that, it recognizes the pattern more structurally, and show similarity to MLP for grouping.

## II. RELATED WORK

Shravan Raviraj et al. [1], securities exchanges structure the biggest roads of interest in India basically through two stock trades: Bombay Stock Exchange(BSE) and National Stock Exchange(NSE). Examiners and financial backers investigate different factors and attempt to anticipate the patterns in stock costs in these trades. Being incredibly unpredictable in

nature, share value forecast is a genuinely complicated task. Regardless of the overflow of information, innovation has not had the option to complete right expectations up to an ideal exactness more often than not. The new improvements in profound learning innovation have demonstrated to be a helpful asset in working on the precision of forecasts. The proposed profound learning based expectation calculations utilize Recurrent Neural Network, Long Short Term Memory and Gated Recurrent Unit over the long haul series information acquired on the web. The created calculations predict the patterns five days ahead of time. The consequences of the expectation on stocks from different enterprises are investigated to determine important experiences.

**J. J. Duarte et al. [2]**, market members utilize a wide arrangement of data before they choose to put resources into risk resources, like stocks. Financial backers regularly follow the news to gather the data that will assist them with choosing which procedure to follow. In this review, we dissect how public news and recorded costs can be utilized together to expect and forestall monetary misfortunes on the Brazilian securities exchange. We remember a broad arrangement of 64 protections for our examination, which address different areas of the Brazilian economy. Our examination looks at the customary Buy and Hold and the moving normal systems to a few trials planned with 11 AI calculations. We investigate day to day, week by week and month to month time skylines for both distribution and bring windows back. With this approach we had the option to survey the most significant arrangement of information for financial backer's choice, and to decide for how long the data stays pertinent to the market. We observed a solid connection between news distributions and stock cost changes in Brazil, recommending even transient exchange amazing open doors. The review shows that it is feasible to anticipate stock cost falls involving a bunch of information in Portuguese, and that text mining-based approaches can defeat conventional methodologies while determining misfortunes.

**Zhi Su et al. [3]**, financial exchange is one of the main pieces of the speculation market. Contrasted and different businesses, the securities exchange not just has a higher pace of profit from speculation yet in addition has a higher gamble, and stock cost forecast has forever been a nearby worry of financial backers. Consequently, the exploration on stock cost expectation techniques and how to lessen the mistake of stock cost forecast has turned into an interesting issue for some researchers at home and abroad. As of late, the improvement of PC innovation, for example, AI and econometric strategy makes the stock cost forecast more solid. Because of the secret Markov nature of stock value, this paper proposes a stock cost expectation strategy in light of stowed away Markov model (HMM). To be explicit, since the information of stock cost have coherence in time series, it is important to stretch out the discrete HMM to the constant HMM, and afterward set forward the all over pattern forecast model in view of the nonstop HMM. The first-request nonstop HMM is stretched out to the second-request ceaseless HMM, and the stock cost is anticipated by joining the expectation technique for change range. Accordingly, the proposed second-request nonstop HMM-based stock cost forecast model is recreated on Hang Seng Index (HSI), one of the earliest financial exchange files in Hong Kong. The assessment results on a half year HSI show that the anticipated worth of the proposed model is exceptionally near the genuine worth and beats three benchmarks concerning RMSE, MAE, and R2.

**Alessio Staffini et al. [4]**, financial exchange costs are known to be extremely unstable and uproarious, and their precise determining is a difficult issue. Generally, both straight and non-direct strategies (like ARIMA and LSTM) have been proposed and effectively applied to financial exchange expectation, yet there is space to foster models that further decrease the gauge mistake. In this paper, we present a Deep Convolutional Generative Adversarial Network (DCGAN) engineering to manage the issue of gauging the end cost of stocks. To test the observational presentation of our proposed model we utilize the FTSE MIB (Financial Times Stock Exchange Milano Indice di Borsa), the benchmark securities exchange list for the Italian public stock trade. By directing both single-step and multi-step determining, we see that our proposed model performs better compared to standard broadly utilized instruments, recommending that Deep Learning (and specifically GANs) is a promising field for monetary time series estimating.

**Jingqi Liu et al. [5]**, forecast of monetary time series is difficult for factual models. By and large, the financial exchange time's series present high unpredictability because of its aversion to monetary and political variables. Besides, as of late, the Coronavirus pandemic has caused an extreme change in the stock trade times series. In this difficult setting, a few computational procedures have been proposed to work on the presentation of foreseeing such occasions series. The fundamental objective of this article is to think about the forecast execution of five brain network structures in anticipating the six most exchanged supplies of the authority Brazilian stock trade B3 from March 2019 to April 2020. We prepared the models to anticipate the end cost of the following day utilizing as sources of info its own past qualities. We thought about the prescient execution of various direct relapse, Elman, Jordan, spiral premise work, and multi-facet perceptron designs in view of the base of the mean square blunder. We prepared all models utilizing the preparation set while hyper-boundaries, for example, the quantity of information factors and secret layers were chosen utilizing the testing set. In addition, we utilized the managed normal of 100 bootstrap tests as our expectation. Hence, our methodology permits us to quantify the vulnerability partner with the anticipated qualities. The outcomes showed that for all times series, thought about all structures, with the exception of the spiral premise work, the organizations tuning give appropriate fit, sensible forecasts, and certainty spans.

**Chenkang Lv et al. [6]**, time series expectation has been broadly applied to the money business in applications, for example, financial exchange cost and product cost gauging. AI techniques have been broadly utilized in monetary time series forecast lately. Step by step instructions to mark monetary time series information to decide the forecast precision of AI models and along these lines decide last speculation returns is a hotly debated issue. Existing marking techniques for monetary time series chiefly name information by contrasting the current information and those of a brief time frame period later on. In any case, monetary time series information are ordinarily non-straight with clear transient irregularity. In this manner, these naming techniques have not caught the constant pattern elements of monetary time series information, prompting a contrast between their naming outcomes and genuine market patterns. In this paper, a new marking technique called "consistent pattern naming" is proposed to resolve the above issue. In the component

preprocessing stage, this paper proposed another strategy that can stay away from the issue of look-ahead inclination in customary information normalization or standardization processes. Then, a nitty gritty sensible clarification was given, the meaning of constant pattern marking was proposed and furthermore a programmed naming calculation was given to extricate the consistent pattern highlights of monetary time series information. The consequences of the paper likewise demonstrated that profound learning models, for example, LSTM and GRU are more appropriate for managing the forecast of monetary time series information.

**G. Ding et al. [7]**, securities exchange has gotten boundless consideration from financial backers. It has generally been a problem area for financial backers and venture organizations to get a handle on the change routineness of the securities exchange and anticipate its pattern. At present, there are numerous strategies for stock cost forecast. The forecast strategies can be generally isolated into two classifications: factual techniques and man-made consciousness strategies. Factual strategies incorporate calculated relapse model, ARCH model, and so on Man-made brainpower techniques incorporate multi-facet perceptron, convolutional brain organization, gullible Bayes organization, back proliferation organization, single-layer LSTM, support vector machine, repetitive brain organization, and so on Yet, these investigations foresee just a single worth. To anticipate various qualities in a single model, it need to plan a model which can deal with numerous sources of info and produces different related yield values simultaneously. For this reason, it is proposed a related profound intermittent brain network model with numerous data sources and various results in view of long momentary memory organization. The related organization model can foresee the initial value, the most reduced cost and the greatest cost of a stock at the same time. The related organization model was contrasted and LSTM network model and profound intermittent brain network model. The tests show that the precision of the related model is better than the other two models in foreseeing different qualities simultaneously, and its forecast exactness is more than 95%.

### Problem Formulation

Following are the problems which is to be consider as identify from the Base Paper:

1. The number of stocks share price is quite high in some specific cases, which can be further improved.
2. The time complexity of the algorithm is high if dimension of data increases.
3. Algorithms for Stocks Share Price Analysis and Prediction have much to be researched.

**Table 1: Summary of Literature Review**

Title	Authors/ Year	Methodology	Parameters
Share price prediction of Indian Stock Markets using time series data - A Deep Learning Approach	Shravan Raviraj, and Krithika M Pai/ IEEE 2021	Prediction of stock price using RNN and LSTM Technique	S.D. = 125.34, MSE = 0.0008, Error = 0.1434 for Wipro
Predicting stock price falls using news data: Evidence from the brazilian market	J. J. Duarte S. M. and J. C. Cruz/ IEEE 2021	Prediction of stock price using machine learning Technique	S.D. = 23.34, F-Score = 0.25, Loss = 0.46 for Brazilian market
Research on HMM-Based Efficient Stock Price Prediction	Zhi Su and Bo Yi/ Hindawi, 2022	Prediction of stock price using neural network hidden Markov model	RMSE = 0.78, MAE = 0.91, S.D. = 0.98
Stock Price Forecasting by a Deep Convolutional Generative Adversarial Network	Alessio Staffini/ AI 2022	Prediction of stock price using Deep Convolutional Generative Adversarial Network	Time = 2394.60 sec, S.D. = 17.16 for single forecasts
Analysis and Research on the Stock Volatility Factors of Chinese Listed Companies Based on the FA-ANN-MLP Model	Jingqi Liu;Xinzhen Pei;Junyan Zou/ IEEE 2021	Prediction of stock price using artificial neural network	Accuracy = 86%, F1-Score = 0.28, MSE = 0.025
A hybrid transfer learning framework for stock price index forecasting	Chenkang Lv;Boyong Gao;Cui Yu/ IEE 2021	Prediction of stock price using transfer learning variational mode decomposition deep learning	Accuracy = 84%, F1-Score = 0.23, Error = 0.14%
Study on the prediction of stock price based on the associated network model of LSTM	G. Ding and L. Qin/ IEEE 2020	Prediction of stock price using single-layer LSTM, support vector machine, recurrent neural network	Loss = 0.01, Accuracy = 89% for ZTE associate

### III. NEURAL NETWORK

MLP is a feed-forward neural system with at least one layers among information and yield layer. MLP will make locations sets of information into suitable yields. Feed forward implies that information streams in a single course form contribution to yield layer (forward). An MLP comprises of various coatings of center points in a blended outline, with each layer completely connected with the accompanying one. Beside the information centers, each center is a neuron (or taking care of part) with a nonlinear commencement work. This kind of framework is ready with the back designing learning estimation. MLPs are for the most part used for test request, affirmation, forecast, and estimation. Multi-Layer Perceptron can take care of issues which are not straightly detachable. MLPs make distinct categories through the utilization of Hyperplanes. MLPs utilize disseminated training. MLPs contain at least one shrouded layers [12].



Effective Market Hypothesis (EMH) is a hypothesis that states it is hard to "beat the market" since securities exchange capability makes the current stock expenses continually intertwine and mirror all pertinent information present on the lookout. As per the Efficient Market Hypothesis theory, stocks are constantly traded at their reasonable esteem hence making it intelligible for examiners to either purchase underestimated stocks or sell stocks at extended expenses. Subsequently, it makes us to be hard to beat the market. The Efficient Market Hypothesis was created by Eugene Fama 1970 [13, 14].

It incorporates three structures: weak, semi-strong and strong efficiency. Under the weak EMH, future costs can't be anticipated by essentially examining historical costs. Speculators can't yield returns over the long run by utilizing speculation methods focused around historical costs or other verifiable data. As it were, under weak efficiency technical analysis techniques won't have the capacity to reliably create abundance returns. Then again, a few types of fundamental analysis provide excess returns [15]. The semi-strong form of EMH goes above and beyond by consolidating all historical and current information into the cost. The strong form of EMH incorporates historical, public, and private data, for example, insider data, in the share cost [16].

### Stock Market (SM)

A SM commonly known as Equivalent market is a public market which operates virtually to ensure smooth buying and selling of stocks at a reasonable price and are often governed by an Apex body that regulates all the transaction and sets up procedures for effective trade. Stocks are the units of ownership in a company and are also known as equities. In order to impact development these SM act as a facilitators for companies to access funds from the common public investment. The stock market can serve two very important objectives:

- Providing Capital to companies which they can utilize to expand their business flow. Lets assume a company issues 10 million stocks priced at Rs 10 each, then this has the potential to make 100 million for the company in form of public investment and this can add huge amount of working capital to the business, it can easily be used to fund operations and affect growth.
- Giving Investors an opportunity to trade public stocks and share company profitability, making this trade a win-win for both Investors and companies.

Although stock trading is an old age concept, the modern day stock trading began to spread its roots with the formation of East India company from London. A stock bazaar or a stock market or even equivalent market can be defined as the assemblage of those getting goods or service and those rendering this or making this possible. (Or a loose connection of transactions which are only economic and there is no physical institution or even digital entrance of goods and services); some of these could be safely written on goods exchange and still to those not sold in public. Supplies could be classified in different ways [17, 18]. One major method is by the residential country approach in which the case study is Nestle and another one called Novartis from Switzerland, and thus they could be regarded as a portion of Swiss supply market, though this supply could also be exchanged with neighboring or even countries from other regions.

## IV. CONCLUSION

The research review included a wide range of techniques: CNN; LSTM; DNN; RNN; reinforcement learning; and other machine learning methods such as SVM, decision tree and gradient boosting. Furthermore, the data sets, variables, and models and their different results were analyzed and compared within each technique. Then, our paper discusses the main performance metrics of all models. They are RMSE, MAPE, MAE, MSE and accuracy. This paper aimed to contribute to the research on stock/Forex market prediction through an analysis of the above different deep learning prediction models. Through the review, it can be identified that there is a lack of studies on the combination of multiple deep learning methods, especially with respect to other deep learning methods. The hybrid networks are showing promising signs for future research. In the future, we will design a specific hybrid model based on the above analysis, incorporating the latest technologies such as advanced genetic algorithms and self-attention neural networks to predict the stock/Forex market.

### REFERENCES

- [1] Shravan Raviraj, Manohara Pai M M. and Krithika M Pai, "Share price prediction of Indian Stock Markets using time series data - A Deep Learning Approach", IEEE Mysore Sub Section International Conference (MysuruCon), IEEE 2021.
- [2] J. J. Duarte S. M. Gonzalez and J. C. Cruz "Predicting stock price falls using news data: Evidence from the brazilian market", Computational Economics vol. 57 no. 1 pp. 311-340 2021.
- [3] Zhi Su and Bo Yi, "Research on HMM-Based Efficient Stock Price Prediction", Mobile Information System, Hindawi, 2022.
- [4] Alessio Staffini, "Stock Price Forecasting by a Deep Convolutional Generative Adversarial Network", Frontiers in Artificial Intelligence, 2022.
- [5] Jingqi Liu;Xinzhen Pei;Junyan Zou, "Analysis and Research on the Stock Volatility Factors of Chinese Listed Companies Based on the FA-ANN-MLP Model", International Conference on Computer, Blockchain and Financial Development (CBFD), IEEE 2021.
- [6] Chenkang Lv;Boyong Gao;Cui Yu, "A hybrid transfer learning framework for stock price index forecasting", IEEE Intl Conf on Dependable, Autonomic and Secure Computing, Intl Conf on Pervasive Intelligence and Computing, IEEE 2021.
- [7] G. Ding and L. Qin "Study on the prediction of stock price based on the associated network model of lstm" International Journal of Machine Learning and Cybernetics vol. 11 no. 6 pp. 1307-1317 2020.
- [8] S. T. Z. De Pauli M. Kleina and W. H. Bonat "Comparing artificial neural network architectures for brazilian stock market prediction" Annals of Data Science vol. 7 no. 4 pp. 613-628 2020.
- [9] L. Qi M. Khushi and J. Poon "Event-driven lstm for forex price prediction" 2020 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE) pp. 1-6 2020.

- [10] D. Wu X. Wang J. Su B. Tang and S. Wu "A labeling method for financial time series prediction based on trends" Entropy vol. 22 no. 10 pp. 1162 2020.
- [11] Zhihao PENG, "Stocks Analysis and Prediction Using Big Data Analytics", International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS), IEEE 2019.
- [12] A. Site D. Birant and Z. Isik "Stock market forecasting using machine learning models" 2019 Innovations in Intelligent Systems and Applications Conference (ASYU) pp. 1-6 2019.
- [13] A. Dingli and K. S. Fournier "Financial time series forecasting-a machine learning approach" Machine Learning and Applications: An International Journal vol. 4 no. 1/2 pp. 3 2017.
- [14] L. Qi M. Khushi and J. Poon "Event-driven lstm for forex price prediction" 2020 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE) pp. 1-6 2020.
- [15] A. J. Balaji D. H. Ram and B. B. Nair "Applicability of deep learning models for stock price forecasting an empirical study on bankex data" Procedia computer science vol. 143 pp. 947-953 2018.
- [16] D. Wu X. Wang J. Su B. Tang and S. Wu "A labeling method for financial time series prediction based on trends" Entropy vol. 22 no. 10 pp. 1162 2020.
- [17] M. Vijn D. Chandola V. A. Tikkiwal and A. Kumar "Stock closing price prediction using machine learning techniques" Procedia Computer Science vol. 167 pp. 599-606 2020.
- [18] M. Suzgun Y. Belinkov and S. M. Shieber On evaluating the generalization of lstm models in formal languages 2018.

