

## STOCK MARKET FORECASTING: A REVIEW OF LITERATURE

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### Abstract

Prediction of stock markets is a complex and challenging task due to price data generated is huge in volume, changes every second, sensitive to human emotions (fear), actions (Wars) and natural disasters (floods, famine, earthquake). Many Methods have been used to predict the stock price like Technical Analysis, Time Series, Fundamental analysis, etc. Prediction of stock price provides knowledgeable information about the status of the stock price and will also help in decision making for the investors. Much research has been carried out in prediction of stock prices using different approaches of Machine Learning techniques, Deep Learning, Sentiment Analysis etc. This paper explores and reviews some of the recent works carried out in predicting stock prices.

### 1.0. INTRODUCTION

The beginning of stock market and trading dates back to around 12th century Western Europe, particularly in Italy and France. Modern equivalent of the stock market started in Amsterdam (Netherlands) in the 17th century. The Dutch East Indian Company was the first company to offer its shares to be traded in the Amsterdam stock market. The stock market also known as the stock exchange is a marketplace where people (known as stock traders or investors) buy or sell shares (i.e. stock) of publicly traded companies. As the company's market value increases, the value of the stock also increases. Contrarily, the stock value decreases if the company's market value goes down. Stock traders make profit by buying stocks at a lower price and selling them when the price is higher. But the prices of the stocks are sometimes unpredictable and depend on several factors that are beyond the control of companies. E.g. factors such as natural disasters and wars have great effects on stock price fluctuations.

As no traders want to incur losses, predicting the future prices of the stocks in order to make a decision to sell or buy them has been a quest for every stock trader. From the beginning, prediction or forecasting of the stock prices is the biggest challenge faced by stock analysts. Therefore, this topic has attracted the attention of both business and academic communities.

Traditionally there are two major approaches used to predict the stock price. Fundamental analysis & Technical Analysis. Fundamental analysis is qualitative in nature and mainly based on the external factors like company profile, infrastructure, market sentiment, economic factors, political situation etc. Fundamental analysis will be helpful for predicting the stock price for the long term. Fundamental analysis is based on the below aspects:

- Gross Domestic Product (GDP)
- Consumer price Index.

- Prospect and Status of Industry.
- Operations of the company and its current financial status [1].

The Second approach, the technical analysis uses historical data like closing and opening prices, share traded volume, number of bulk trades, 50/100/200 day moving-average, etc. Technical analysis guides investors to the appropriate time to invest in stock and uses price charts to recognize the trends. The major drawback of this approach is that different analysts come with different sets of trade rules by analysing the same price charts.

The efficient market hypothesis (Fama), "states that a stock price behaves as a random walk [2]". Whenever any stock price can be forecasted then the stock market participants would use it to generate unlimited profits. This behaviour of the stock market participants will spoil the prediction pattern [3][4]. The efficient market hypothesis provides motivation for the development of new adaptive financial forecasting methods".

## 2.0. STOCK MARKETING OVERVIEW

In this section we will discuss the basics of the stock market and its importance, stock market index, stock exchange, etc.

### 2.1. Stock market Basics and its importance:

Stock market is the place where regular activities of buying, selling of shares of publicly held companies take place. The place where these kinds of financial activities take place is called a stock exchange. The term stock market and stock exchange are used interchangeably. In India, the stock market is controlled by a regulatory body known as Securities and Exchange Board of India (SEBI). Some of the leading exchanges around the world are -- NYSE, NASDAQ of US, London Stock Exchange of United Kingdom etc. As a primary market a company can issue the securities to the general public in the form of Initial Public Offer (IPO). By doing this the company can raise more money from the public for their future activities like expansion, reducing debt etc. Once the shares are allocated to the public (i.e. investors or shareholders) then the company will list those securities in stock exchange. Once the shares are listed in a stock exchange, the investors can purchase or sell shares from the exchange. Here the stock market acts as a secondary market where shares can be traded between investors at specified price. Exchanges act as the clearing house for each transaction eliminating the risk of transaction default [5]. A company listed on the stock exchange can also offer new or additional shares through further offerings at a later stage which is called an offer for sale or through rights issue. They may even buy back the share from shareholders or delist the trading. There are two types of stocks:

**Common Stocks:** These types of stock claim ownership in a company and also their dividend yield. If a company goes bankrupt and liquidates, the money will be first paid to creditors, bondholders, and preferred shareholders. Once these investors are paid then common shareholders will receive money.[6].

**Preferred Stock:** These stocks have some degree of ownership in a company but do not have the voting rights. However, these kinds of investors will get a fixed dividend forever. Another advantage is that, in the event of liquidation or company goes bankrupt, the preferred shareholders are paid before the common shareholder.

Companies usually declare dividends to shareholders based on their profits earned as a reward. Buying and selling of stocks involves a capital gain if the investor sells the share at a higher price than the buying price. Similarly, there would be a chance of capital loss if the price of the share drops further, and an investor decides to sell it to avoid further loss. All the shareholders of the company have voting rights to select the board members who will be responsible to oversee the major decisions made by the company's management.

### 2.2. Stock Market Participants

Other than Individual Investors/traders there are different parties involved.

**Stockbrokers:** These are the licenced agents with whom individual persons register and are responsible for buying and selling of shares on behalf of individuals.

**Investment bankers:** They are responsible for handling the Initial Public Offer, Offer for Sale for a particular company. They will ensure once the public offer is completed the shares get duly listed in the respective exchanges.

**Portfolio Managers:** Usually High net worth Individuals invest through portfolio managers. These people are responsible for handling the portfolio of their clients. Portfolio managers make

the buy or sell decisions for the portfolio for which they are managing. Eg: Mutual fund companies, hedge funds etc.

**Custodian:** These are responsible for holding the shares purchased by the customer in a secure manner. They operate along with the exchange and would be responsible for transfer of shares when the buy or sell transactions happen.

### 2.3. Stock Market Participants

A stock market index is a measure used to evaluate the price of the stock market. It helps investors compare the current price level with the past performance. Usually, the index has a select set of stocks. Each index has its own calculation methodology. In case of India market BSE its index is computed using selected 30 Stocks. For NSE the computation of index is done by selecting 50 stocks. There is a broad-based index that captures the entire market like Dow Jones Industrial Average (DJIA) or Standard & Poor's 500 Index. It includes 80% of the total stocks traded in the US. The companies which will be part of the index will be reviewed frequently and are included or excluded as per the changing business environment. Different types of index exist as per weighting method :

**Price Weighting:** In this method we find the sum of share prices of each individual company and then divide it by the number of companies. Few of the Price weighted index are Dow Jones Industrial Average and Nikkei 225.

**Equal Weighting:** In this method each stock of the index has the equal weight. The performance of each company carries equally weight in contributing the value of the index.

**Capitalization weighting:** A capitalization-weighted index are based on total market capitalization of a particular company. Market capitalization of company is calculated by multiplying its outstanding shares of the company by the current price of a single share. Many of the indexes like NSE, S&P 500 etc use this strategy.

### 2.4. Types of Indices by coverage

The coverage of stock market index is not dependent on the weighting method.

**Country Coverage:** This type of index coverage covers the stock market of a particular country for example Nifty 50 in India, S & P 500 in US, FTSE 100 in UK etc.

**Regional Coverage:** This type of index coverage covers the stock market of a particular geographic region. For example, FTSE developed Asia Pacific Index, European Regional Index etc.

**Global Coverage:** This type of index covers the performance of the entire globe. For example, FTSE Global equity index.

**Exchange Based Coverage:** This type of index is based on the exchange. For example, Nasdaq 100, OMX Nordic 40 etc.

**Sector Based Coverage:** This type of index is based on the performance of a particular sector. For example, Nifty Bank Index, FMCG Index, IT Index etc.

**Indices and Passive Investment Strategy:** Passive investment strategy is instead of investing in the individual stock. The investor invests in the exchange traded fund. These exchange traded funds or ETF will track the respective index and can be traded daily during the market window.

### 3.0. THEORIES OF STOCK MARKET

There are many theories in stock market below are few of them which we will be discussing

**Efficient Market hypothesis:** The efficient-market hypothesis is an important theory in the mid-1960s [2,3,4]. This is a type of hypothesis in which a stock price reflects all the available information at that moment. This means that stock price is accurately valued until there are any further changes in valuation. Many investors like Warren Buffet have beaten the market by predicting the prices within the overall market.

**Fifty-Percent Principle:** This principle states that any stock which is in uptrend will have a price correction before continuing its uptrend. For example, if a stock has gained about 30 percent in a few days then there is a temporary correction of about 15 percent before it starts rising again. If a stock goes up by a significant amount, then some traders will want to turn the paper profits into real profits thereby causing a temporary correction. The declining stock price will cause panic among other investors there by pushing the price further down. The low price

will attract a new set of investors who will start investing in that stock and the price continues to rise further.

**Greater Fool Theory:** In this type of strategy the investor buys a particular stock thinking that at later stages he can sell the stock to another person at a higher price. This means that the investor can make money if there is someone else who will buy at a higher value [7]. Here the investment is done not because the stock price is of fair value or worth, but rather they believe that they can sell it to someone else at a higher price.

**Odd Lot Theory:** This type of theory is based on the sales of odd lots which are held by individual investors which will be used as an indicator for buying that stock. This theory is based on the assumption that small investors are usually wrong [8].

**Prospect Theory:** This theory is also called loss aversion theory. If the people are given a choice with two different strategies, then the people will pick the strategy which has less chance of ending in loss [9].

If a person is given a choice which is risky and may be leading to gains, then that person will choose a lower expected utility but with high certainty.

If the person is given a choice which is risky and may be leading to loss, then that person will choose lower expected utility as it can possibly avoid losses.

**Rational Expectations Theory:** This type of theory states that Person will invest or spend according to what he believes will happen in future. For Example, a trader or investor will think that stock price is going up. By thinking so he will buy that stock which will eventually lead to the increase of price of that particular stock. In other instances, investors think that stock is undervalued. Other like-minded investors also think that stock is undervalued thus leading to the increase of the price of stock.

**Short Interest Theory:** This theory suggests that high levels of short interest on a particular stock can cause the price rise of that stock. As a large number of traders begin to short a particular stock. These short sellers need to cover their positions before the end of the trading day as they need to purchase the stock in order to return those stocks to buyers there by increasing the stock price in the near future [10]. For example, many traders start the short selling of shares in the beginning thinking that they will purchase shares at the lowest price possible. As these trader's rush for the purchase of stock at the lowest possible price there is a sudden increase in demand leading to the increase of stock price.

**Random Walk Theory:** Below are a few of the points regarding Random walk theory [11].

- This theory suggests that using the past stock movement or trend we cannot predict the future stock price movement.
- The changes that occur in share price are independent of each other and belong to same distribution.
- There is no way an investor or trader can outperform the market without assuming the additional risks.
- Due to the poor information collected about a particular company the information can be misinterpreted due to this fundamental analysis is undependable
- Investment advisors or portfolio advisors add little or no value to investment portfolio.

#### 4.0. PREDICTION METHODS

Forecasting of stock prices is a highly challenging task. Many traders and investors in the stock market are always searching for a technique that could guarantee profit by predicting the stock price movements and minimize the risk of investing. Many Methods like Fundamental Analysis, Time series analysis, technical analysis etc are used to forecast the share price.

**Fundamental Analysis:** It is a method of measuring the company's intrinsic value by verifying economic and financial factors. It is a study of a company's infrastructure, company's background, product portfolio, financial results of the company, Whether the company is having any debt, competitors, and the prospects of the company [12].

**Time Series Analysis:** Traditionally time series is used to predict the future values of the stock price based on the previously observed historical values [13].

**Statistical Analysis:** Statistical analysis attempts to predict future price movements, providing traders or investors with the information needed to make a profit. Technical analysis uses charts which contain data like 50/100/200 day moving average. Price High/Low, Volume of stock traded etc. This information can be used to predict the movement of share price [14].

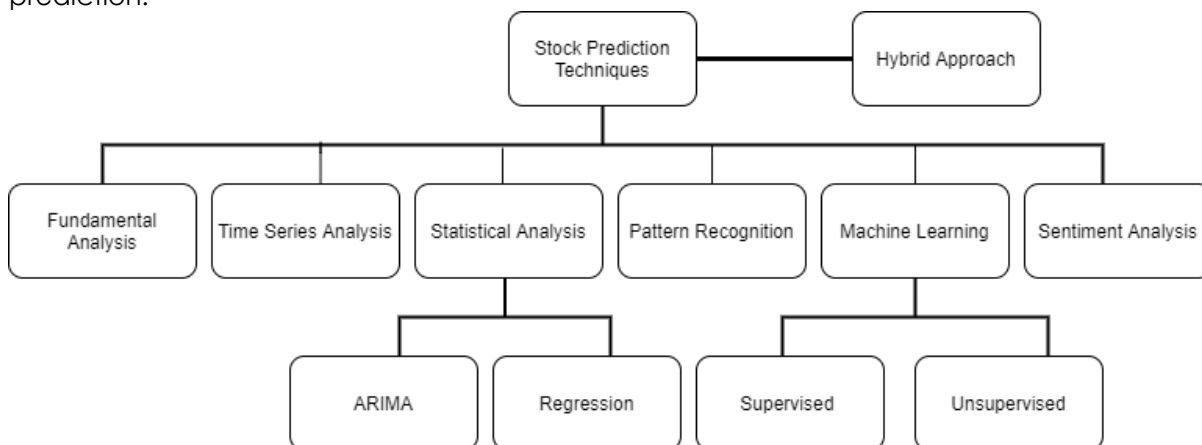
An underlying assumption of technical analysis is that the market has processed all available information and that it is reflected in the price chart.

**Pattern Recognition:** This technique mainly focuses on the detection of patterns or trends in data. Prediction is performed using the charts constructed over time. Patterns help the investors to identify the future evolution of stock [15].

**Machine Learning:** Machine learning tasks are classified as supervised and unsupervised learning. The goal of machine learning is to train an algorithm to automatically map the input data and predict the output data[16]. Several Machine Learning algorithms exist for prediction of stock market data such as Decision Tree, Random Forest, SVM, LSTM etc.

**Sentiment Analysis:** In this process stock market prediction can be done based on the news feeds or tweets of the public traded company [17].

**Hybrid:** In this different kind of approaches are clubbed together to predict the stock prices, for example statistical & pattern recognition, Sentiment Analysis & Machine Learning etc. The advantage of this approach is improved performance & improved accuracy for prediction.



**Figure 1.** Stock Prediction Techniques

## 5.0. STOCK MARKET PREDICTION LITERATURE REVIEW

Bharadwaj et al has performed sentiment analysis using Python script for the stock market data using the live feed from TimesofIndia.com. They have used the Sensex and Nifty Index data from different time intervals and found that for a particular time interval Sensex and Nifty data remains Constant [18]. Rajendra N. Paramanik & Vatsal Singhal have constructed two different market sentiments Positive & Negative using text-based sentiment analysis of the stock market. They have proposed a Generalized Autoregressive Conditional Heteroskedasticity model of conditional volatility by incorporating the market sentiments for the period of 14 Years. They have found out that the impact of negative sentiment is more than positive sentiment, they also found that there are noise trades in Indian Stock market [19].

Aparna Nayak et al have developed a predictive model where stock price of the next day is predicted by considering the price movement of the stock & its traded volume. They have applied multiple prediction algorithms like decision boosted tree, Logistic Regression & Support Vector machine. As the dataset considered for the analysis is sparse, they were able to find that decision boosted tree was performing better compared to Logistic regression & Support Vector machine [20]. Mahdi pakdaman nae used different Neural networks algorithm to predict the stock price. They found that to predict the stock price for next day none of the methods MLP neural network or elam recurrent network are better than regression model. The authors also concluded that the prediction error using MLP neural network is lower than both Elman network and linear regression method. By Predicting stock price using Feed Forward MLP is almost similar in comparison with the real values [21].

Mehar Vijn et al used Artificial Neural network & Random Forest Techniques for predicting the closing prices of stock price on the next day. Financial data like Stock price high, low, current closing price of 5 companies which belong to different sectors has been taken for predicting the closing price of subsequent day. Comparative analysis based on RMSE, MAPE and MBE values has been performed which clearly indicates that Artificial Neural Network gives better prediction of stock prices as compared to Random Forest [22]. Svetlana Borovkova & Ioannis Tsiamas Proposed a LSTM neural network strategy for Intraday trading predictions. They

have studied various large cap stocks from US Markets. The Proposed model outperforms two similar models Lasso & Ridge Logistic Regression [23].

Nabipour et al analysed the data from Tehran stock exchange from 4 different sectors Petroleum, Finance, Non- Metallic Minerals & basic metals for the period of 10 years and Various machine learning models like decision tree, random forest, artificial neural networks (ANN) etc were used to predict stock price for the duration of r 1, 2, 5, 10, 15, 20, and 30 days in advance. They found that the LSTM technique performed well compared to other techniques with lowest error and best ability to predict the stock price for Tehran Stock exchange [24]. Hegazy et al proposed a machine learning model which is hybrid of nature and includes particle swarm optimization (PSO) algorithm and LS-SVM. This hybrid algorithm is used for stock price prediction of a few selected large cap stocks from US Stock markets using different financial technical indicators. The Levenberg-Marquardt (LM) algorithm is used for comparison with LS-SVM and LS-SVM-PSO models [25]. According to author's the proposed hybrid algorithm PSO-LS-SVM parameters can be easily tuned. Comparative studies show that the performance of PSO-LS-SVM is better and achieves lowest error value.

Tingwei Gao , Yueting Chai performed analysis on Standard & Poor's 500, NASDAQ, and Apple (AAPL) using Recurrent Neural Network model to validate and evaluate the performance of their proposed approach. Their model uses LSTM with technical indicators and stock marketing data which will be used to forecast the stock price. This model gives higher accuracy of prediction compared to other models been compared [26]. Jingyi Shen & M. Omair Shafiq performed the analysis on 2-year data collected from Chinese Stock Market. They used feature engineering, financial domain knowledge, and prediction algorithms for predicting the short-term price trends of the stock. As the data had a lot of features, they used recursive feature elimination techniques to select the effective feature set and used long short-term memory (LSTM) for short term prediction [27].

Qiu and Song proposed a method to predict the price movement of the Japanese stock market based on an optimized artificial neural network model. The authors propose an hybrid approach called GA-ANN model that utilize genetic algorithms together with artificial neural network based models [28]. Pimenta et al. used a data set from Brazilian stock exchange market (BOVESPA) and used a combination of multi-objective optimization, genetic programming, and technical trading rules. They have used the historical period data and leveraged an automated investing method by using multi-objective genetic programming and applied it in the stock market. The Only drawback is they did not perform a comparison study with other existing models [29].

Various Machine Learning techniques have been used to predict the prices of the stock market like Support Vector Machine (SVM), reinforced learning etc. Shen et al proposed a new technique that resulted in prediction accuracy of 74.4% in NASDAQ, 76% in S&P500 and 77.6% in DJIA of the US stock market. They performed Correlation analysis which indicates strong interconnection between the US stock index and other global markets [30].

Rene D. Estember, Michael John R. Maraña Used Geometric Brownian Motion (GBM) as a forecasting method to predict the stock prices in Philippines Stock Exchange. Authors have performed the comparative study with Artificial Neural Network and found that the average percentage error was lower, and accuracy was higher considering duration for three years. Compared to ANN methods GBM method showed a good potential for forecasting stock prices at a short-term period. Furthermore, the GBM method showed a lower standard deviation indicating the accuracy and effectiveness as a forecasting technique [31].

Xiao Zhong & David Enke have used the hybrid approach to predict the movement of SPDR S&P 500 ETF s. They have designed classification mining procedures based on hybrid machine learning algorithms. After pre-processing of raw data, the ANNs and DNNs, each acting as classifiers, are then used with both the entire untransformed dataset and the PCA-represented datasets to forecast the daily market returns [32]. Lv et al. have evaluated various machine learning (ML) algorithms and observed the daily stocks movement considering transaction cost and no transaction cost. As per authors while considering transaction cost traditional machine algorithm will have better performance with directional evaluation indicators. For no transaction cost DNN models have better performance. Their work was focused on the techniques of modelling rather than on the feature selection and sentiment analysis problems [33].

Pang et al. proposed a deep long short-term memory neural network (LSTM) with embedded layer and the long short-term memory neural network with automatic encoder to

predict the stock market. Embedded layer and the automatic encoder were used to vectorize the data. The experimental results show that the deep LSTM with embedded layers is better. The model was able to produce the accuracy 57.2 and 56.9%, respectively, for the Shanghai A-shares composite index. For Individual stocks they are 52.4 and 52.5%, respectively [34]. Kraus and Feuerriegel used LSTM approach. Text mining through financial news and the stock market data were used with transfer learning [35]. Zhou et. al. used GAN for minimizing Forecast error loss and Direction prediction loss (GAN-FD) model for stock price prediction and compared their model performances against ARIMA, ANN and Support Vector Machine (SVM) [36].

Leonardo dos Santos Pinheiro and Mark Dras explore recurrent neural networks with character-level language model pre-training for both intraday and interday stock market forecasting. The used to predict Standard & Poor's 500 index, both for individual companies and the overall index [37]. Manna Majumder and MD Anwar hussian presented a computational approach for predicting the S&P CNX 50 Index. This model is based on a neural network. The Model predicts the direction of the index at the time of closing. The model predicts the price of the index value of the stock market. The model has used the pre-processed data set of closing value of S&P CNX 50 Index. The data set encompassed the trading days from 1st January 2000 to 31st December 2009 for a period of 9 years. The model has been validated across 4 years of the trading days. The authors compared the performance of the model using various out of sample performance measures. The Highest accuracy of the prediction of this model is close to 89.65% with the average accuracy of 69.72% over a period of 4 years [38].

Hossain et al. proposed a deep learning-based hybrid model that is based on two DNN architectures: LSTM and GRU. The authors used the S & P 500 dataset which consists of 66 years of data from 1950 to 2016. The approach followed by authors is passing off the input data to generate First level prediction. This Prediction is then passed to GRU Layer to get the result. This method achieved a Mean Squared Error (MSE) of 0.00098 in comparison with other neural network approaches [39]. Abidatul et al. have proposed an Improved Multiple Linear Regression (IMLR) model. The model was created as a mobile application based on the android platform used for prediction stock prices. The proposed model uses multiple linear regression with moving average. Collection of data is done through yahoo finance for the Indonesia Stock Exchange. The model is trained and tested on the Indonesia Stock Exchange (IDX) The app was built in such a way that it will help the user to observe daily stock values and real time stock price prediction. Results show that the IMLP gives better results as compared to the common MLR [40].

Awajan et al. compared the performance of several forecasting methods by applying them to six stock markets of different countries like US S&P, Australia, Srilanka, Malaysia, France, Netherlands and found that the empirical mode decomposition Holt-Winters's method (EMD-HW) provided more accurate forecasts than other models. The Comparison is based on RMSE, MAE, MAPE, TheilU, and MASE forecasting error measurements [41]. Patil, P et al. proposed a new approach using graph theory and CNN, which leveraged spatiotemporal relationship information between different stocks by modelling the stock market as a complex network. They have used two ways to generate the graph correlation-based and causation-based graphs by taking input both stock indicators and financial news. The authors concluded that graph-based models outperform other traditional and statistical model for stock prediction [42]. Sim, H.S. et al. proposed a CNN network that uses 9 different technical indicators to verify the applicability of the CNN method in the stock market. The authors analysed that for predicting stock price using CNN the technical indicators have no positive impact [43].

Checkley et al used the sentiment analysis from microblogging sites and intraday stock price data to predict the stock price returns. They have analysed the data of two years of these companies Apple, IBM, Amazon, Google & Goldman Sachs. They collected data for every two minutes and the sentiment data was also collected for the same span. The authors applied Granger Causality Analysis to find the link between Tweet Sentiment & Stock Price movement. They were able to predict the market volatility & Volume then the direction of the market [44]. Wu et al proposed a new model using text mining which uses economic news for the prediction of the Taiwan Stock market returns. The authors converted the textual news into numerical values and passed on to the regression models along with the macroeconomic attributes to examine the role of news articles in predicting stock price returns. The model uses specific keywords to calculates the positive, negative & neutral words in the news text and converts them into three news attributes and passed on as input for the regression model. The authors

were able to find that the negative news have more influence on the stock market than the positive news [45].

Maqsood, H et al proposed a new model using CNN that uses Stock price & Sentiment Analysis as the input. The Authors compared their model with SVM & Linear Regression. They were able to analyse that not all the significant events will have an impact on the stock prices. The impact is higher in case of the local events while predicting the stock performance [46]. Selvin, S. et al use three different techniques CNN, LSTM, and RNN to forecast the price of companies listed in NSE. As CNN was able to identify the directional change trend the authors were able to conclude that CNN is the best architecture to predict the price of the stock.[47].

## **6.0. CHALLENGES & OPEN PROBLEMS**

Financial Market Prediction & analysis is a challenging & interesting topic. As more & more data is available it has become a challenging task to analyses & predict. Many Researchers have proposed different prediction techniques in the field of live market prediction, Algorithmic trading/prediction, Long-term Stock Prediction, Intraday Stock Prediction, Short Term Stock prediction, etc. Many Brokerage houses use Algorithmic trading. Most of the trading volumes for the Fund houses are generated by Algorithms & not by humans. The main advantage of this is reduced cost, no dependency etc. Many retail investors either have to purchase these services from a fund house or the fund house needs to manage the investor's portfolio. The Major drawback is that as the algorithmic trading doesn't depend on Sentiment Analysis a series of sell events can lead to trigger panic selling due to this market overreacting. Regarding the Live testing many researchers claim that they have proposed the technique/algorithm for real time stock market prediction. Back testing of these algorithms works fine. Many events such as price variations, political conditions are not considered.

Many Research works have been carried out on focusing of short-term forecasting of stock prices. Prediction of Weekly or monthly compared to longer term. Artificial Neural Network approaches such as the LSTM and RNN are evaluated and compared against different Machine Learning approaches in predicting the stock prices. Many researchers have focused on the sentiment analysis based on Twitter data or news data. We cannot rely on Social media data alone as fake news are posted on the websites by multiple different sources. Annual or Quarterly reports of the company is a better alternative source and can be used for stock prediction.

## **7.0. RESEARCH AGENDA**

Multiple Techniques for the Stock Market Prediction has been analysed. Most of these techniques use dataset from foreign stock exchanges compared to Indian Stock Exchange. Also, the forecasting is done for a shorter interval compared to Long term. Machine Learning plays a very important role in stock forecasting. Machine Learning and Artificial Neural network techniques are far more accurate compared to other models and algorithms [48,49]. Machine Learning techniques along with the sentiment analysis play important role in prediction of stock prices.

## **8.0. CONCLUSION**

Stock Markets provide a good platform for investment and trading. People have opportunity to invest in multiple options of stock market like mutual funds, index funds, shares etc. User Sentiment plays an important role in movement of the stock price. Stock prices can move up and down based on the sentiment of investors/traders. In this paper we discussed different approaches for the stock market analysis and forecasting. A literature review as carried out for different methods and techniques used for the stock market forecasting. We also discussed regarding the challenges and open problems for the stock market forecasting.

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