LSTM and Moving Averages Comparison Research for Stock Price Forcasting

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***Abstract* — This research paper compares the utilization of machine learning techniques like Long Short-Term Memory (LSTM) and traditional methods including 100ma and 200ma for price prediction on different stocks. This study involves analyzing historical stock data with the Bombay Stock Exchange, furthermore, training an LSTM model to guess future stock prices, and based on that, comparing the predicted results with other methods. Overall, this research demonstrates the efficiency of using LSTM models for stock price prediction as well as the potential for incorporating additional data sources to further improve the accuracy of these predictions.**

Keywords—Alpha Vantage, 100-day moving average, 200-day moving average, open, high, low, close, volume, Long Short Term Memory.

I. INTRODUCTION

The history of stock exchanges begin when the Dutch East India Company in 1611 was listed on an official Stock Exchange. Since then, investors have been seeking new ways to learn about the companies listed on the stock exchanges and increase their investment returns. Investors used to rely only on historical knowledge to identify patterns and estimate share values. However, with over 30 million trading accounts in India and the industry increasing so quickly, conventional strategies are becoming obsolete [1].
Essentially, quantitative traders that carry a large amount of money in the stock market buy equities, derivatives, ETFs, futures, options and stock at a low price and then sell them at a high one. The eagerness for trend prediction in stock market prediction is classical phenomenon, but several organizations continue to debate on it. There are mainly two types of analysis of stock that investors do ahead of investing in any stock. The first is analysis of the fundamentals of the company or asset they are investing, in which they calculate the intrinsic value of stock as well as performance of the industry, reputation of the company, economy, sector growth and demand and so on to determine whether to put their money in the stock or not. Secondly they do Technical analysis to determine the correct time to entry in the stock which includes the study of market data such as past prices, trends and trading-volumes to predict the movement of stock.

Stock market is regarded as aggressive, uncertain, and non-linear in nature. Anticipating stock prices is a tough task as stock prices are influenced by a broad no of factors, which includes but is not limited to current supply of that product or service, the competition faced, financial results of past few quarters and the consumption of products or services provided, and so on. So to widen the profits and narrowing the losses, techniques for forecasting share values ahead of time by analysing movements over the last few months could be extremely useful for predicting stock market movements [2] [3]. Commonly, two methodologies are presented for anticipating a company's stock price: Technical analysis forecast ultimate stock prices by employing previous stock prices such as opening value, highest traded value, lowest traded value, closing value, volumes, and so on. The qualitative analysis is accomplished according to independent factors such as company reputation, revenue, operations cost, management decisions, profits and earning per share [4]. Progressive, sophisticated approaches based on either fundamental or technical research are currently used to forecast share values. The figures for stock price prediction market is enormous and non-linear. To deal with this variety of figures, an competent algorithm that can identify unseen trends and complex associations in this enormous data set is necessary. Machine learning techniques in this area had shown an boost in efficacy by 61–87 percent when compared to earlier methods [5].

Most foregoing work in the vicinity has used scholastic algorithms like simple regression, random walk theory (RWT) [7], relative strength index (RSI), and some linear models like autoregressive integrated moving average (ARIMA) [9], seasonal autoregressive integrated moving average model (SARIMA) and autoregressive moving average (ARMA) to predict stock prices. Late research indicates that machine learning can improve stock market predictions. Some neural network based techniques, such as shift invariant or space invariant artificial neural networks (SIANN), simulated neural networks (SNN), Feedback neural networks (FNN), and deep neural networks (LSTM) [5] [12], had given promising results.

A prosperous stock prediction can generate significant profits for both the investor and the business. Predictions might be made by cautiously reviewing the background of the relevant stock market because it is often claimed that it is chaotic rather than random. Machine learning can be used to adequately describe such processes. Financial trend analysis and forecasting of anticipated stock value trends and returns have long been important areas of investigation [13].

In this study, data from Alpha Vantage is used to apply supervised machine learning. Close, Open, Low, High, and Volume are the five variables—make up this dataset. Close, open, high, and low comprise several of the stock's bid prices at various moments with essentially plain labels. It is the

volume of the total block of shares that were transferred from one proprietor to the next within the deadline. Next, the prototype is evaluated using the test results.

We have compared different methods to predict the price of stocks so the more accurate method can be analyzed. The methods we used for comparison are 100 days simple moving average (100ma), 200 days simple moving average (200ma) and LSTM (Long Short-Term Memory). We have also analyzed the predicted results and compared it by plotting graph.

II. BACKGROUND STUDY

Beside the introduction of new products such as stocks, bonds, options, and futures, the financial market has grown increasingly complicated. The stock market is the most common financial tool into which people put their money. Stock market is a market with large up and downs, with values fluctuating often because of a variety of variables such as economic and political developments as well as company-specific news.

Predicting the future price of a company is an important field of research for investors since it allows them to make informed investment decisions. Traditional financial models, such as the Black-Scholes model, have been employed in the past to forecast stock values. However, these models have not been particularly efficient in properly predicting stock values, and they do not take into consideration the complicated interactions between the various factors that impact stock prices.

Stock price prediction using machine learning:
Because of its capacity to understand complicated correlations between diverse elements that impact stock prices, machine learning has emerged as an advantageous tool for stock price forecasting. Machine learning techniques may produce accurate forecasts about future stock values by taking into consideration a wide range of elements, such as previous share values, financial measures, and news items.
Machine learning models are widely divided into two types: supervised learning and unsupervised learning. A model learns on the set of labelled data with the outcome variable known in supervised learning. Unsupervised learning involves training a model on a collection of unlabeled data and teaching the model to recognize trends in data.

Stock price prediction by supervised learning models:
Regression, support vector machines (SVM), and neural networks are supervised learning models that may be used to predict stock values.

For stock price prediction, regression models such as linear regression and logistic regression are often used. To create accurate forecasts regarding future stock values, regression models can take into consideration a wide range of elements, including past stock prices, economic indicators, and news items.

SVM models are another popular choice for stock price prediction. SVM models can consider a wide range of factors, including historical share values, financial measures, and news articles, to form accurate forecasting about ultimate share values. SVM models are particularly effective at identifying patterns in data that are not easily visible.

Another effective approach for stock price prediction is neural networks. To produce accurate forecasts regarding future share values, neural networks may use a wide range of data, including past stock prices, economic indicators, and news items. Neural networks are very good at detecting complicated patterns in data that are not readily obvious.
Models of Unsupervised Learning for Stock Price Prediction
Clustering and association rules are two unsupervised learning algorithms that may be used to forecast stock prices. Clustering techniques may be used to detect patterns in the data and classify it into comparable groups. To produce reliable forecasts regarding future stock values, clustering models can take into consideration a wide range of elements, including past stock prices, economic indicators, and news items.

Association rule models may be used to detect patterns in data and predict outcomes based on those patterns. To produce reliable forecasts regarding future stock values, association rule models can take into consideration a wide range of data, including past stock prices, economic indicators, and news items.

III. METHODOLOGY

Using the stock API offered by Alpha Vantage, we will first retrieve the most recent updates and data for a certain stock. This stage will be very beneficial because the function we're making will automatically and continuously update itself with the most recent information. Users can access a wide range of data, including real-time updates and historical information on stocks, currencies, and cryptocurrencies, thanks to Alpha Vantage's free stock APIs.

	open	high	low	close	volume
0	4354.9500	4444.0000	4329.1000	4369.3000	13095.0
1	4391.0500	4417.1500	4264.2000	4318.1000	8130.0
2	4370.0000	4420.0000	4321.0500	4408.5500	3176.0
3	4356.6000	4437.3500	4355.6000	4380.3000	7776.0
4	4350.8501	4436.0000	4350.8501	4397.2002	1884.0
...	...	...	...	...	...
4451	834.1420	834.1420	807.5272	812.3168	6260.0
4452	813.3562	834.9102	780.9124	819.9534	182350.0
4453	849.5054	853.5722	817.8748	826.6862	2090100.0
4454	840.4680	849.5054	836.0398	845.3030	88030.0
4455	840.4680	849.5054	813.3562	842.3208	16330.0

Figure 1. Stock Data Fetched from Alpha Vantage

A. 100-Days Moving Average

The closing price average over the past 20 weeks or 100 days is known as a 100-day Moving Average (MA). The mid-term price trends are represented by it. Investors can observe how the stock has performed over the past 20 weeks and determine whether the price trend is up or down by using a moving average over 100 days. This also provides them a sense of the mood of the market.

A moving average is quite easy to calculate. The closing prices for each day (day 1, day 2, day 3, etc.), added together, are then divided by the total number of days. As a result, for 100 days, n's MA value will be 100.

B. 200-Days Moving Average

The mean of the closing prices over the past 20 weeks or 200 days is known as a 200-day Moving Average (MA). The mid-term price trends are represented by it. Investors can observe how the stock has performed over the past 20 weeks and determine whether the price trend is up or down by using a moving average over 200 days. This also provides them a sense of the mood of the market.

A moving average is quite easy to calculate. The closing prices for each day (day 1, day 2, day 3, etc.), added together, are then divided by the total number of days. As a result, for 200 days, n's MA value will be 200.

C. LSTM (Long short term memory)

Fundamentally, the fully connected network LSTM design belongs toward the recurrent neural network family (RNNs). The presence of feedback loops distinguishes RNNs from other deep neural networks. The disappearing and inflating gradient problem that plagues RNNs, prevents the system from ever converging to the point of the least error by either causing it to halt learning or maintain learning at a very high rate. The LSTM network topologies are found to be particularly well adapted for modelling intricate sequential data, including texts and time series, as vanishing or inflating gradient difficulties are never a problem.

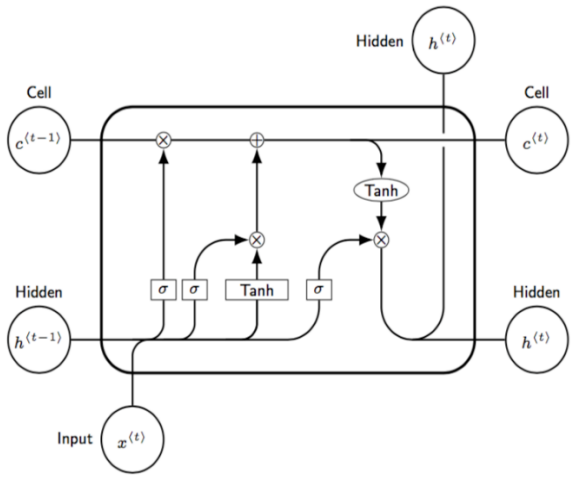

Figure 2. Long Short-Term Memory

These networks are made up of gates that control and regulate the information flow across these cells and cells that store the network's prior state data. Input gate, Output gate, and forget gate are the three different gates that are employed in LSTM networks. Retaining only the details that are important as long as this present window exists and deleting past information that is no longer relevant are both made possible by forget gates. The fresh data that is used to determine the network's current state is regulated by the input gates. The network's memory cells cleverly blend that past data on the state from the already stated forget gates with the network's current source input that is obtained from the input gate. The results of the network are finally produced by the output gates at the designated time slot. The model's predicted value for the current slot can be thought of as the output.

This research builds a sequential model by piling four LSTM layers with different dropouts on top of one another. The first layer is Input layer which provide data to the LSTM layers, and further there exist four LSTM layers with different Dropouts so that it can give us unique predicted value.

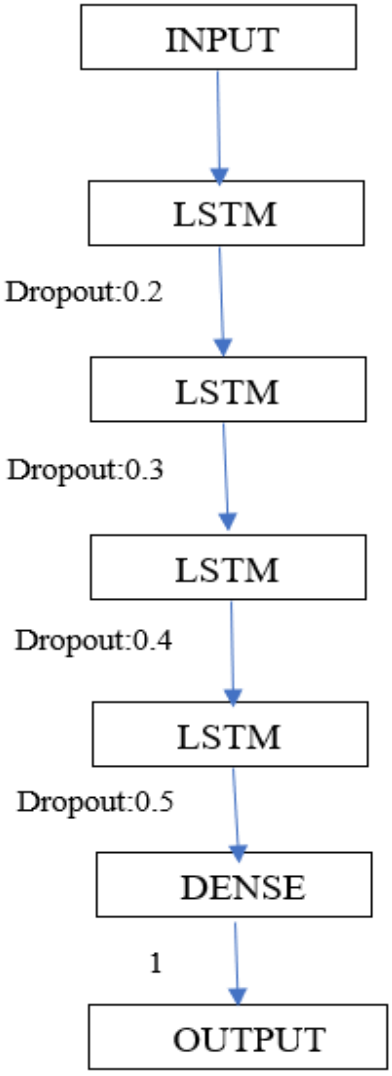

Figure 3. LSTM Layers

IV. RESULTS

Performance metrics and forecasts made using various forecasting techniques are demonstrated and compared. The result of the comparison led us to conclude that machine learning technique LSTM gives superior results compared to the moving average techniques.

A. 100-Day Moving Average

In this we can depict from the graph that the 100 day moving average (100ma) figure out the mid-term price trends over the past 20 weeks and determines whether the price trend is up or down and based on that they can analyze the stock.

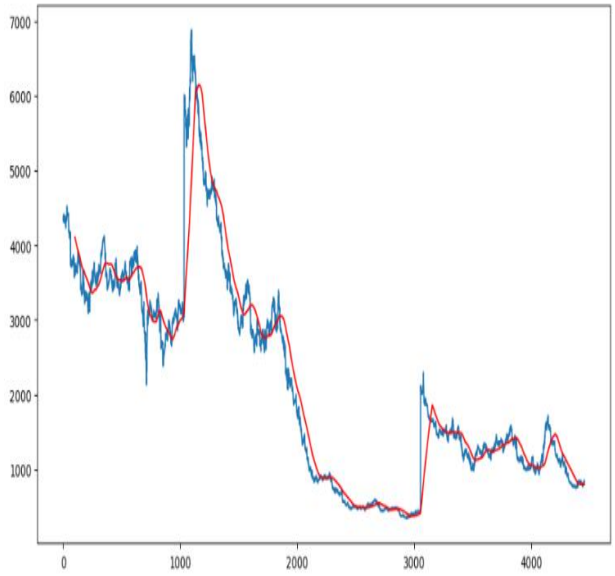

Figure 4. (a) 100ma

B. 200-Day Moving Average

It is a moving average of a security's or index's closing prices over the previous 200 trading days. Traders and investors frequently utilise the 200 day simple moving average to evaluate overall trend of market or of a specific security.

If a security's current price is higher than its 200 day simple moving average, than it is regarded as an upwards trend; if it is lower than its 200 day simple moving average, it is considered an downwards trend. This information may be used by traders and investors to make trading choices, such as purchasing or selling a security.

A security's 200 days simple moving average may also be employed as a resistance level or support level. If the price of a security goes below its 200 day simple moving average, it may operate as support level, restraining additional price declines. If, on the other hand, the price of a security rises above its 200-day moving average, than it may operate as barrier, preventing the price from increasing higher.

Although the 200 day simple moving average is a well known technical indicator, it should not be employed in isolation. Before making any trading choices, traders and investors should evaluate additional technical indications as well as fundamental research.

In this we can depict from the graph that the 200 day simple moving average (200ma) figure out the mid-term price trends over the past 20 weeks and determine whether the price trend is up or down and based on that they can analyse the stock.

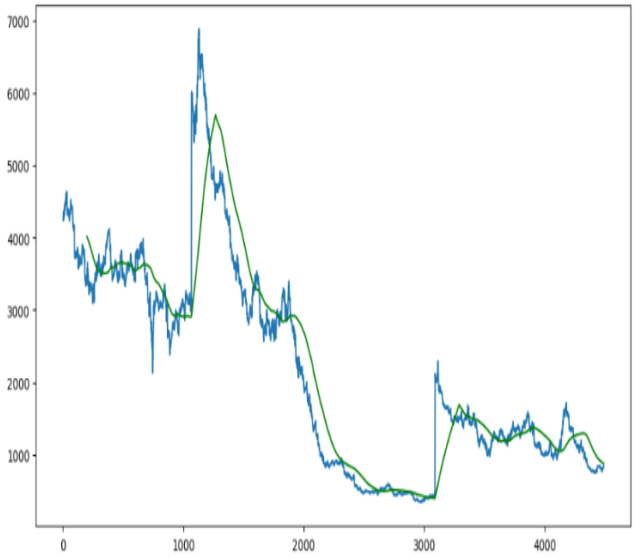

Figure 4. (b) 200ma

C. LSTM (Long short-term memory)

We have created LSTM models by training it on the 'Close' values of different stocks so that it can give us the best predicted result. We have use four LSTM layers with different Dropouts and a Dense layer with unit one.

We have fitted the model by training it to 100 epochs and based on the constructed model we get the predicted price corresponding to the original closing price.

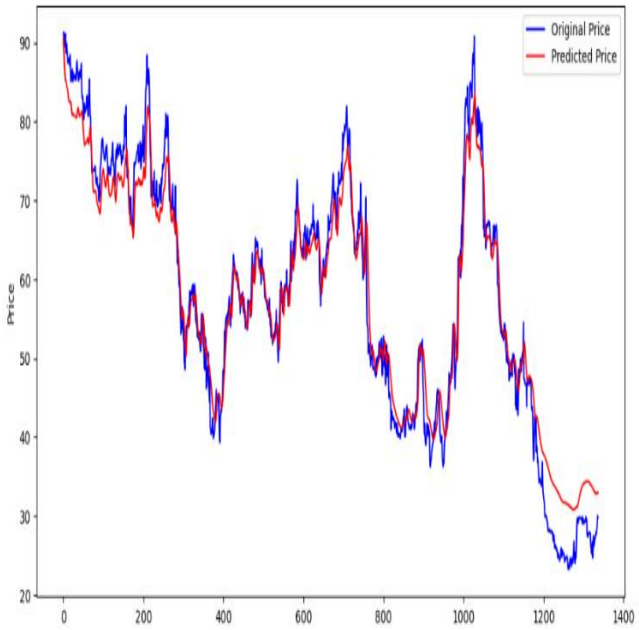

Figure 4. (c) Original Price Vs Predicted Price

V. CONCLUSION

Stock market prediction is a relatively new phenomenon, and there are mainly two types of analysis of stock that investors do ahead of investing in any stock. The first is analysis of the fundamentals of the company or asset they are investing, in which they calculate the intrinsic value of stock as well as performance of the industry, reputation of the company, economy, sector growth and demand and so on to determine whether to put their money in the stock or not. Secondly they do Technical analysis to determine the correct time to entry in the stock which includes the study of market data such as past prices, trends and trading-volumes to predict the movement of stock. Machine learning can be used to adequately describe such processes, and this study uses data from Alpha Vantage to apply supervised machine learning to analyze the stock market. Five variables are included in the dataset: close, open, high, and low, which comprise several of the stock's bid prices at various moments with essentially plain labels.

The prototype is evaluated using the test results, and comparisons are made using different methods. Stock market is regarded as aggressive, uncertain, and non-linear in nature. So to widen the profits and narrowing the losses, techniques for forecasting share values ahead of time by analysing movements over the last few months could be extremely useful for predicting stock market movements. Commonly, two methodologies are presented for anticipating a company's stock price: Fundamental Analysis and Technical analysis. Progressive, sophisticated approaches based on either fundamental or technical research are currently used to forecast share values.

Machine learning techniques in this area had shown an boost in efficacy by 61–87 percent when compared to earlier methods. Recent analysis announce that machine learning can enhance stock market predictions, with some simulated neural network based techniques, such as FNN, SIANN, RNN, and LSTM, providing encouraging results.

A relative evaluation among statistical methodologies, both in terms of prediction performances and accuracy, and machine learning approaches, following the analysis of each approach separately, reveals machine learning approaches to be the most accurate for predicting stock values.

Due to an improvement in forecast accuracy, both tactics have produced favorable results. Inspiring findings from recently created machine learning algorithms for stock prediction point to their use in lucrative trading strategies. As a result researchers have been led to the findings that stock market estimations can be produced more successfully and more precisely by utilizing machine learning techniques.

By using a dataset that is substantially bigger than the current one, it will now be possible to use it. In the future, the stock market's methods and approach could be greatly improved. The accuracy of our estimation techniques would consequently improve. Moreover, additional machine learning techniques could remain investigated to look at the accuracy rate resulting from them.

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