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# An Implementation on Stock Market Price Prediction System using Machine Learning Techniques

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**ABSTRACT:** Prediction of stock prices is one of the most researched topics and gathers interest from academia and the industry alike. In the finance world stock trading is one of the most important activities. Stock market prediction is an act of trying to determine the future value of a stock other financial instrument traded on a financial exchange. This paper explains the prediction of a stock using Machine Learning. The technical and fundamental or the time series analysis is used by the most of the stockbrokers while making the stock predictions. The programming language is used to predict the stock market using machine learning is Python. In this paper we propose a Machine Learning (ML) approach that will be trained from the available stocks data and gain intelligence and then uses the acquired knowledge for an accurate prediction. The paper focuses on the use of Moving Average and Stacked LSTM based Machine learning techniques to predict stock values. Factors considered are open, close, low, high and volume. The models are evaluated using standard strategic indicators: RMSE. The low values of these two indicators show that the models are efficient in predicting stock closing price. We conducted comprehensive evaluations on frequently used machine learning models and conclude that our proposed solution outperforms due to the comprehensive feature engineering that we built. The system achieves overall high accuracy for stock market price prediction. This work contributes to the stock analysis research community both in the financial and technical domains.

**KEYWORDS:** Stock Market, Machine Learning, Prediction, LSTM, Python, Analysis, Feature Engineering.

## I. INTRODUCTION

### A. Information of Stock

A stock market is a public market where you can buy and sell shares for publicly listed companies. The stocks, also known as equities, represent ownership in the company. The stock exchange is the mediator that allows the buying and selling of shares. We all have heard the word stock one way or the other. Particularly stock is related with the associates and companies which are commercialized and are to settling in the world of marketization. The other word used for stock is share which is prominently used in day-to-day life. People even term it as an investment plan and it's something people see as a long-term investment that secures and provides an abundant funds during the retirement age. Market is unpredictable so are the resources and the factors that are taken to drive it off or on the set. It's never been on the same level and the pattern of the same is still unpredictable till the time. Some closeness and prediction method had been derived and approximates values and the rough figures are generated hoping for the best but all of the resource can't be trusted and are still unpredictable in nature.

### B. Stock Market Prediction

Stock market prediction and analysis are some of the most difficult jobs to complete. There are numerous causes for this, including market volatility and a variety of other dependent and independent variables that influence the value of a certain stock in the market. These variables make it extremely difficult for any stock market expert to anticipate the rise and fall of the market with great precision. However, with the introduction of Machine Learning and its strong algorithms, the most recent market research and Stock Market Prediction advancements have begun to include such approaches in analysing stock market data.

The probable stock market prediction target can be the future stock price or the volatility of the prices or market trend. In the prediction there are two types like dummy and a real time prediction which is used in stock market prediction system. In Dummy prediction they have define some set of rules and predict the future price of shares by calculating the average price. In the real time prediction compulsory used internet and saw current price of shares of the company.

*C. Stock analysis: fundamental analysis vs. technical analysis*

There are two types to analyse stocks which investors perform before investing in a stock, first is the fundamental analysis, in this analysis investors look at the intrinsic value of stocks, and performance of the industry, economy, political climate etc. to decide that whether to invest or not. On the other hand, the technical analysis it is an evolution of stocks by the means of studying the statistics generated by market activity, such as past prices and volumes.

Basis for Comparison	Fundamental Analysis	Technical Analysis
Meaning	Fundamental Analysis is a practice of analysing securities by determining the intrinsic value of the stock.	Technical analysis is a method of determining the future price of the stock using charts to identify the patterns and trends.
Relevant for	Long term investments	Short term investments
Function	Investing	Trading
Objective	To identify the intrinsic value of the stock.	To identify the right time to enter or exit the market.
Decision making	Decisions are based on the information available and statistic evaluated.	Decisions are based on market trends and prices of stock.
Focuses on	Both Past and Present data.	Past data only.
Form of data	Economic reports, news events and industry statistics.	Chart Analysis
Future prices	Predicted on the basis of past and present performance and profitability of the company.	Predicted on the basis of charts and indicators.
Type of trader	Long term position trader.	Swing trader and short-term day trader.

Table 1: Fundamental Analysis vs. Technical Analysis

Computational advances have led to introduction of machine learning techniques for the predictive systems in financial markets. In this paper we are using a Machine Learning technique i.e., Linear Regression, Moving Average, K-Nearest Neighbours, Auto ARIMA, Prophet, and LSTM based Machine learning techniques to predict stock values and we are using Python language for programming.

**II. PROBLEM STATEMENT**

The stock market appears in the news every day. You hear about it every time it reaches a new high or a new low. The rate of investment and business opportunities in the Stock market can increase if an efficient algorithm could be devised to predict the short-term price of an individual stock. Previous methods of stock predictions involve the use of Artificial Neural Networks and Convolution Neural Networks which has an error loss at an average of 20%. In this project, we will see if there is a possibility of devising a model using Stacked LSTM which will predict stock price with a less percentage of error. And if the answer turns to be YES, we will also see how reliable and efficient will this model be.

*A. Goal and Objectives:*

- To determine the future value of a company stock or other financial instrument traded on an exchange.
- In the current emerging competitive market, predicting the stock returns as well as the company's financial status in advance will provide more benefits for the investors in order to invest confidently.
- Forecasting and predicting the trends of market.
- To help the investors to understand when and what stocks can be purchased for the growth of their investment.

*B. Statement of scope*

Stock market prediction is the act of trying to determine the future value of a company stock or other financial instrument traded on an exchange. The successful prediction of a stock's future price could yield significant profit. This project requires investigating trends in stock market and factors affecting the stock prices. This project aims at predicting stock market by using financial news, Analyst opinions and quotes in order to improve quality of output. It proposes a novel method for the prediction of the stock market closing price.

*C. Software context*

To develop algorithms, we require Python 3.5 in Google Colab. It is used for data pre-processing, model training and prediction.

*D. Major constraints*

Generally speaking, forecasting the price of a stock is comparatively easier than predicting a stock price, which is much more difficult. For prediction, the model needs to have multiple inputs. This can include major political and economic events and assessing their impact on the stock price. Also, aspects that are tough to capture, such as the market's mood, psychology, and herd mentality, need to be quantified and fed to the model. If the user can do so, then for sure, the model can predict the stock price. The reason is that even when the components involved for successfully predicting the stock value range from physical to psychological, driven by human motives that can often be irrational, there are still patterns that the Machine Learning model can capture.

**III. RELATED WORK**

Stock is unpredictable and liberal in nature. The follow of the same is impressive and reluctant in nature. Finding the predictability and getting the nearest is the best hit goal for the same. The exact and accurate estimation of the same is never-less possible. There are various constraints that in-fluctuate the pricing and the rate of stock. Those constraints had to be taken in consideration before jumping to the conclusion and report derivation.

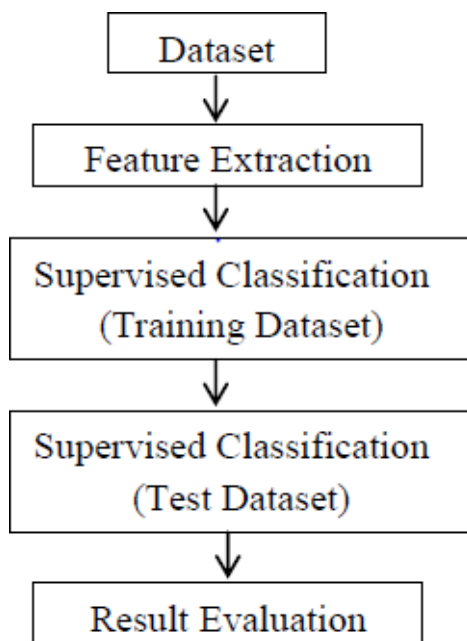


Fig. 1: System Flow

Here as described in the figure above, the proposed system will have an input from the dataset which will be extracted featured wise and Classified underneath. The classification technique used is supervised and the various techniques of machine level algorithms are implemented on the same. Training Dataset are created for training the machine and the test cases are derived and implemented to carry out the visualization and the plotting's. The result generated are passed and visualized in the graphical form.

*A. Moving Average*

'Average' is easily one of the most common things we use in our day-to-day lives. For instance, calculating the average marks to determine overall performance, or finding the average temperature of the past few days to get an idea about today's temperature – these all are routine tasks we do on a regular basis. So, this is a good starting point to use on our dataset for making predictions.

The predicted closing price for each day will be the average of a set of previously observed values. Instead of using the simple average, we will be using the moving average technique which uses the latest set of values for each prediction.



In other words, for each subsequent step, the predicted values are taken into consideration while removing the oldest observed value from the set.

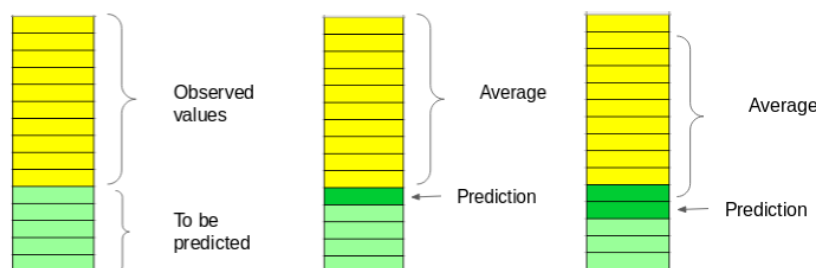


Fig. 2: Moving Average

### B. Long Short-Term Memory (LSTM)

LSTMs are widely used for sequence prediction problems and have proven to be extremely effective. The reason they work so well is because LSTM is able to store past information that is important, and forget the information that is not. LSTM has three gates:

- The input gate: The input gate adds information to the cell state.
- The forget gate: It removes the information that is no longer required by the model.
- The output gate: Output Gate at LSTM selects the information to be shown as output.

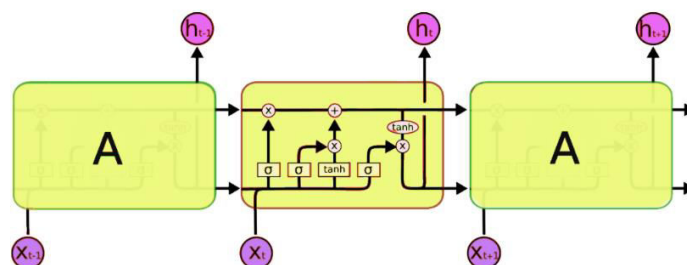


Fig. 3: Long Short-Term Memory (LSTM)

#### Applications of LSTM

- Language modelling
- Machine translation
- Handwriting recognition
- Image captioning
- Image generation using attention models
- Question answering
- Video-to-text conversion
- Polymorphic music modelling
- Speech synthesis
- Protein secondary structure prediction

Recurrent Neural networks bring persistence of memory in learning process in contrast to traditional neural networks leading to its profound use in tasks like speech recognition and language model. (References needed). They have a memory cell which is used to store historical information, instrumental in finding trends and relations in the data. However, there is problem of vanishing gradient in RNN where there is exponential decay of loss function with time. This leads to difficulty in training models with long term temporal dependency because information in 'memory' is stored over time in the model. LSTM overcomes this problem by using special units in addition to memory units comprised of multiple gates. These gates control when information enters, when it outputs and when information is forgotten. This allows the model to learn long term dependencies as these gates overcome vanishing gradient problems.

#### IV. PROJECT PURPOSE

Stock market prediction is a prediction system software that illuminate the risk that undergoes during the investment in stock market. It predicts the stock rates and its rate of exchange acknowledging the basic understanding and the statistical analysis in front of users. The main theme of the project is to predict the turning curves and bring the predictability method and undergo the process and algorithms to conclude to a viable resource source. This project helps in bridging the resources and empowering the people to know and trade the most out of stock and understand the generation and the vulnerabilities that has to be seen and predicted. The enhancement of the same is done with the resource graph which makes a user or the customer to analyses the same and take the needs and important details before dealing and consider those things for the yield that the person is willing to invest on. Forecasting of the stock prediction is done for the upcoming week. The predictability itself is a challenge and that's the main purpose of the project.

#### V. EXPERIMENTAL RESULT

##### Stock Market Prediction

First Stock Ticker

AAPL

Data from 2017 - 2022

	close	high	low	open	volume	adjC
count	1,259,000	1,259,000	1,259,000	1,259,000	1,259,000	1,259,000
mean	151.8554	153.7687	149.7039	151.6478	54,293,681.6743	81.2
std	68.9924	69.1006	67.5313	68.0994	40,413,644.9921	45.0
min	106.9400	110.1900	103.1000	104.5400	11,382,045.0000	33.2
25%	148.9230	149.7950	147.4050	148.7000	25,283,649.5000	42.6
50%	172.7900	174.3000	171.2800	172.5400	36,917,795.0000	57.1
75%	209.4330	211.9450	207.5100	209.8800	76,310,915.0000	124.4
max	306.0900	315.1400	300.3300	314.7900	332,607,183.0000	181.1

Fig. 4: Dashboard

Candle Stick Chart



Fig. 6: Chart in Candle Stick Format

##### Closing Price vs Time Chart

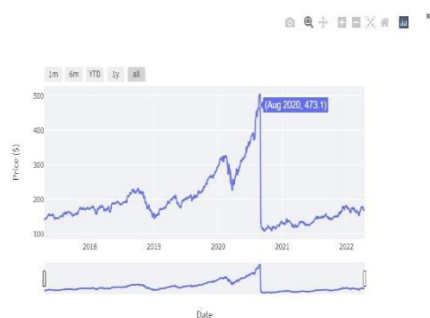


Fig. 5: Graph for Closing Price vs Time Chart

##### Closing Price vs Time Chart with 100MA

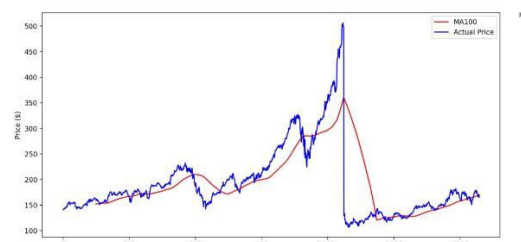


Fig. 7: Graph for Closing Price vs Time Chart with 100 MA

##### Closing Price vs Time Chart with 100MA & 200MA

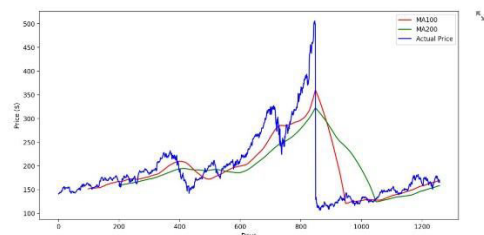


Fig. 8: Graph for Closing Price vs Time Chart with 100 MA &amp; 200 MA

##### Predictions vs Original

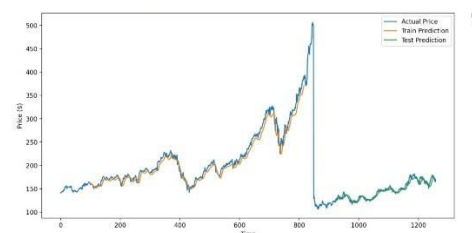
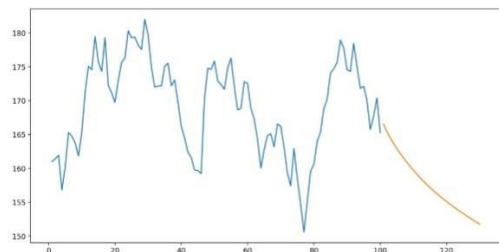


Fig. 9: Graph for Predications vs Original

Stock Market Forecasting for next 30 days



Forecasting for next 30 days

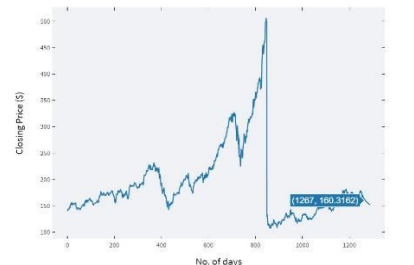


Fig. 10: Hovered Graphs for Forecasting of next 30 Days

Forecasted values for next 30 days

	Forecasted Prices
0	166.5381
1	165.4586
2	164.5224
3	163.6924
4	162.9357
5	162.2299
6	161.5620
7	160.9251
8	160.3162
9	159.7338
10	159.1769
11	158.6446
12	158.1357
13	157.6489
14	157.1828

15	156.7358
16	156.3065
17	155.8933
18	155.4947
19	155.1095
20	154.7363
21	154.3740
22	154.0215
23	153.6777
24	153.3419
25	153.0132
26	152.6909
27	152.3744
28	152.0633
29	151.7570

Fig. 11: Data Displayed for Forecasted values of next 30 days in tabular format

## VI. FUTURE SCOPE

Stock Market are the best alternative for business to grow and it's a side way income for the individuals who are ready to invest and earn from the same. The term stock had been in picture ever since and it's growing in bulk every day. There are thousands of investors investing on the same and making the fortune out of it. The project can be further continued to gain the effectiveness of the prediction with addition implementations of the content that can involve real time scenario and the way of executing and processing the real time scenario. Various constraints have to be added and performance of the same can be acylated in the future time for the effective results. The expected form of the display is graph whereas from the same the more appearance and setting of the display can be integrated and a pie-chart and a custom graph can further be implemented on the same.

## VII. CONCLUSION

Stock Market are the best alternative for business to grow and it's a side way income for the individuals who are ready to invest and earn from the same. The term stock had been in picture ever since and it's growing in bulk every day. There are thousands of investors investing on the same and making the fortune out of it. The project can be further continued to gain the effectiveness of the prediction with addition implementations of the content that can involve real time scenario and the way of executing and processing the real time scenario. Various constraints have to be added and performance of the same can be acylated in the future time for the effective results. The expected form of the display is graph whereas from the same the more appearance and setting of the display can be integrated and a pie-chart and a custom graph can further be implemented on the same.

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