



## Stock Market Prediction Using Machine Learning

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**Abstract**—Stock market is contemplated as one of the most important factors of a country's economic development. There are vigorous fluctuations in stock market prices which makes it most determining and influential part. Fluctuations in stock values affects the financial investor's beliefs and thus there is a need to forecast the stock values. By applying proper techniques and methods of analysis we can build prediction model which can help investors, buyers and sellers understand and decide when to invest, buy and sell the shares. So, our main objective is to build a prediction model which forecasts the stock market values. More accurate and efficient predictions may yield significant profits, stabilize world's financial condition to some extent. We have build a predication model on basis of machine learning algorithms, which makes the predictions efficient and significant. In this paper we have shared about how we built a ml based model. So after surveying and studying about eight such related papers we found that stock market values can be predicted upto great extent using machine learning by its various algorithms and we may get idea about whether stock market prices will be high or low. We have used certain machine learning algorithms on historical stock prices to predict stock market values. This paper focuses on the use of Regression and LSTM based Machine learning to predict stock values. Factors considered are open, close, low, high and volume.

**Keywords**—machine learning, artificial neural network (ann), recurrent neural network (rnn), LSTM, regression.

### INTRODUCTION

In this paper we have built a stock prediction model using machine learning. Now let's understand what actually the machine learning is:

- **Machine Learning:**

Basically machine learning means a type of artificial intelligence which learns itself from the data provided and then works on it and applies that learning on a system without any need for humans.[10]

The Machine Learning Algorithms are classified as:

1. *Supervised Learning:*

In supervised learning, the machine is trained using labeled data. Then the machine is compared with new data, so that supervised learning algorithm analyzes the training data and thus produces the outcome through labeled data.[11]

2. *Unsupervised Learning:*

In unsupervised learning, the machine is not trained using any sort of labeled data. Instead, it sorts the data according to their similarities and patterns and groups them accordingly. It doesn't give any correct

output but gives inferences from datasets.[11]

### 3. *Semi-Supervised Learning:*

In semi-supervised learning, a little amount of labeled data is used and a large amount of unlabelled data is used. It lies between supervised and unsupervised learning. The machines using these algorithms actually improve the learning accuracy. [11]

### 4. *Reinforcement Learning:*

In reinforcement learning, the errors or rewards are discovered, actions are produced by interacting with the environment. This algorithm allows the machines to automatically determine the ideal behavior of the system within a particular context to optimize the performance of machines.[11]

So, in this paper we have used supervised machine learning algorithms that are Regression and LSTM.

**1. Artificial Neural Network:** Artificial neural networks are widely used in stock market prediction. Human neurons are the basic functional unit of artificial neural networks. Neural networks can tackle an issue without an earlier learning of the connection amongst input and output, so these are also called as self-adjusting methods. Special function called as the activation function is used to map the input variables with output variables. In real time, neural networks have a capacity to change its network parameters (synaptic weights) neural networks are data-driven models and for real-world prediction problems like stock prediction etc. Data-driven models are considered to be beneficial.[11]

**2. Recurrent Neural Network:** It is a class of neural networks tailored to deal with temporal data. The neurons of RNN have a cell state/memory, and input is processed according to this internal state, which is achieved with the help of loops within the neural network. There are recurring module(s) of 'tanh' layers in RNNs that allow them to retain information. However, not for a long time, which is why we need LSTM models.[12]

**3. LSTM:** It is a special kind of recurrent neural network that is capable of learning long term dependencies in data. This is achieved because the recurring module of the model has a combination of four layers interacting with each other. An LSTM module has a cell state and three gates which provides them with the power to selectively learn, unlearn or retain information from each of the units. The cell state in LSTM helps the information to flow through the units without being altered by allowing only a few linear interactions. Each unit has an input, output and a forget gate which can add or remove the information to the cell state. The forget gate decides which information from the previous cell state should be forgotten

for which it uses a sigmoid function. The input gate controls the information flow to the current cell state using a point-wise multiplication operation of 'sigmoid' and 'tanh' respectively.

Finally, the output gate decides which information should be passed on to the next hidden state.[12]

### LITERATURE SURVEY

Before getting into actual project we first surveyed and found around eight stock market prediction related research papers and studied those papers thoroughly and then we decided that from where and what type of data need to be collected and processed, on which machine learning algorithms we should work and how to apply sentiment analysis accordingly and those papers we have briefly stated in our paper.

Those papers are:

#### *Stock market prediction using machine learning classifiers and social media, news:*

1. Theme: To study and analyze the impact of financial news data and social data on stock market prediction accuracy for ten subsequent days using certain algorithms. [1]

2. Proposed Method: They proposed a framework for stock market forecasting using financial news and social media. The proposed system relies on each aspect of the data and the system itself for achieving accurate predictions. So, the proposed system for stock prediction is divided into eight subsystems. [1]

3. Experiment & Result: The experimental results show that using social media and financial news, highest prediction accuracies of 80.53% and 75.16% are achieved respectively. Also the paper shows that New York and Red Hat stock markets are difficult to predict, New York and IBM stocks are more affected by social media, whereas in London and Microsoft stocks by financial news. Random forest classifier is found to be more efficient and highest accuracy of 83.22% is achieved.[1]

#### *Stock Market Prediction Using Machine Learning Algorithms :*

1. Theme: To find the best model to predict the values of The stock market. In this paper they are going to present a more feasible method to predict the stock market fluctuations with higher accuracy. [2]

2. Proposed Method: This paper focuses on predicting the stock value using random forest and SVM.

3. Experiment & Result: Results shows that on collecting raw data apply data mining techniques and random forest algorithm to process data and accuracy is found to be 0.808.

#### *Research on Stock Price Prediction Method Based on Convolutional Neural Network :*

1. Theme: To build a model CNN (Convolution Neural Network)-based in-depth learning method for predicting stock prices.

2. Proposed Model: This paper proposes a stock price prediction model based on convolution neural network, which has automated-learning ability. After combining the characteristics features of CNN and Thai stock market, the data set is trained and tested after

pretreatment. [3]

3: Experiment & Result: On that basis, three stocks namely BBL, CAPLL and PTT are listed on the Thai Stock Exchange and are tested and compared with the actual stock price. The results show that the model based on CNN can effectively identify the variations in stock prices and predict it which can provide valuable reference for stock price prediction. The Paper says that model has high accuracy can be satisfactorily help in financial world. [3]

*Study on the prediction of stock price based on the associated network model of LSTM:*

1.Theme:To design a model using deep network parallel predict the opening price, the lowest price and the highest price of a stock on the next day according to the historical stock prices and other data constraints.

[4]

2. Proposed Model: They have proposed an associated deep recurrent neural network model by providing multiple inputs and multiple outputs based on a long short-term memory network. The associated network model has the capability to predict the opening price, the lowest price and the highest price of a stock parallel. The associated network model was compared with the LSTM network model and deep recurrent neural network model. The feasibility and accuracy of the Associated Net are verified by comparing the model with the LSTM network model and the LSTM deep recurrent neural network model. [4]

3. Experiment & Result: Experiments show that the average accuracy of the Associated Net model found to be better than the remaining two models and it can also predict multiple values parallel. The average accuracy of each predicted value is over 95%. [4]

#### A. An innovative neural network approach for stock market prediction

1. Theme: This paper aims to build an innovative neural network model to get better stock market predictions.

2. Proposed Model: They proposed the 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. In these two models, they use the embedded layer and the automatic encoder, respectively, to vectorize the data, in a bid to forecast the stock via long short-term memory neural network. [5]

3. Experiment & Result: The experimental results show that the deep LSTM with embedded layer is better. Specifically, the accuracy of two models is 57.2 and 56.9%, respectively, for the Shanghai A-shares composite index. Furthermore, they are 52.4 and 52.5%, respectively, for individual stocks. They demonstrate research contributions in IMMT for neural network - based on financial analysis. [5]

#### B. Survey on Combined Swarm Intelligence and ANN for Optimized Daily Stock Market Price:

1. Theme: This paper makes a survey of the use of Swarm Intelligence in a stock market application. The paper initially describes the details of a stock market, SI and its various types of algorithms and finally shows some recent SI algorithm based approaches that can be used for stock market prediction. [6]

2. Proposed Model: To improve the efficiency of SI and make optimized results, SI is combined with other approaches like Artificial Neural Network (ANN), Machine Learning ML etc.

3. Experiment & Result: They found that by combining SI and ANN the model produces more accurate and optimized results for stock price prediction than the combination of SI and machine learning. [6]

#### C. Developing a Prediction Model for Stock Analysis:

1. Theme: To use Neural Networks to predict the best stock price. In this work, various prediction algorithms are studied and analyzed to build a prediction model.

2. Proposed Model: This paper proposes the uses linear regression and neural networks. To build a stock prediction model. The prediction model will be based on monthly prediction and daily prediction to forecast the next day market price. This model predicts the open value of the next day in the market.

3. Experiment & Result: A comparative study of the three algorithms that are: Multiple Linear Regression, Support Vector Machine and Artificial Neural Network are done and found that the stock price is predicted by sentiment analysis with the best forecasting algorithm. [7].

#### D. Stock Trend Prediction Using News Sentiment Analysis:

1. Theme: This paper is about taking non quantifiable data such as financial news articles of a company and predicting its future stock trend with the help of news sentiment analysis. They have assumed that news articles have an impact on the stock market, so they have attempted to study the relationship between news and stock trends. [8]

2. Proposed Model: They have created three different classification models which depict polarity of news articles to check whether positive or negative and to build a model they use SVM and naive bayes as testing classifiers.

3: Experiment & Result: Experiments are conducted to evaluate various aspects of the proposed model and efficient results are obtained in all of the experiments. The accuracy of the prediction model is more than 80% and in comparison with news random labeling with 50% of accuracy; the model has increased the accuracy by 30%. [8]

#### PROPOSED SYSTEM

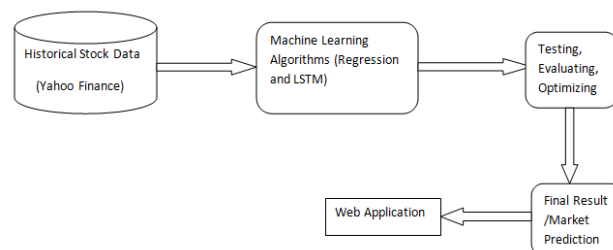


Figure 1.Proposed System

This is our designed architecture . We took dataset of historical stock prices of a company .The historical data taken from yahoo finance was used to apply machine learning algorithms and the algorithm applied we got our predicted values.

Algorithm: LSTM

**1.Import the required libraries:**

import math



```
import pandas_datareader as web
import numpy as np
import pandas as pd
```

**2. Get the Historical Stock data from Yahoo :**

Date	High	Low	Open	Close	Volume	Adj Close
2012-01-03	179.479996	175.550003	175.889999	179.029999	5110600	179.029999
2012-01-04	180.500000	176.070007	179.210007	177.509995	4205200	177.509995
2012-01-05	178.250000	174.050003	175.940002	177.610001	3809100	177.610001
2012-01-06	184.649994	177.500000	178.070007	182.610001	7008400	182.610001
2012-01-09	184.369995	177.000000	182.759995	178.559996	5056900	178.559996
...	...	...	...	...	...	...
2021-05-27	3260.360107	3230.040039	3256.000000	3230.110107	2561200	3230.110107
2021-05-28	3247.989990	3219.699951	3242.000000	3223.070068	2329800	3223.070068
2021-06-01	3250.979980	3209.060059	3243.500000	3218.649902	2430000	3218.649902
2021-06-02	3235.000000	3208.000000	3223.100098	3233.989990	2014500	3233.989990
2021-06-03	3214.439941	3184.030029	3204.229980	3187.010010	2398300	3187.010010

Figure 2. Historical dataset of 'AMZN' from Yahoo Finance

3. Visualize and plot graph of closing price history.
4. Create new dataframe using only 'Close' column.
5. Convert the new dataframe using numpy.
6. Get number of rows to train the model.
7. Scale the data to bring uniformity in data.
8. Create training dataset and split it.
9. Build LSTM Model.
10. Using optimizer and loss compile the model.
11. Train the model.
12. Similarly create testing dataset and split it.
13. Predict model price values.
14. Find the root mean squared error.
15. Plot graph of predicted values.

**RESULT:**

Finally, we get a stock prediction model which we represented in form of a web app which makes investors, sellers and buyers to check stock market trends.



Figure 3. Closing Price Graph

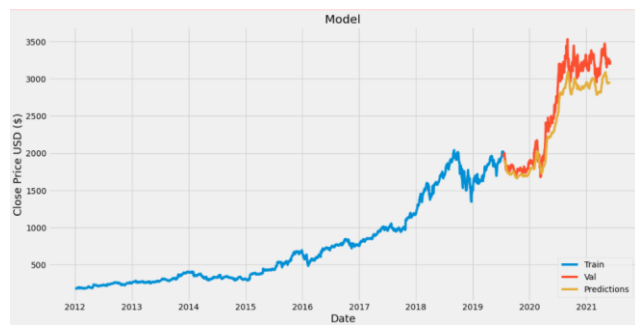


Figure 4. Predicted Graph

Date	Close	Predictions
2019-07-18	1977.900024	1897.236450
2019-07-19	1964.520020	1897.180542
2019-07-22	1985.630005	1894.302368
2019-07-23	1994.489990	1892.570923
2019-07-24	2000.810059	1892.341675
...	...	...
2021-05-27	3230.110107	2945.312256
2021-05-28	3223.070068	2946.120117
2021-06-01	3218.649902	2944.849609
2021-06-02	3233.989990	2942.376953
2021-06-03	3187.010010	2941.187256

Figure 5. Predicted Output

**CONCLUSION**

Use of recently introduced machine learning techniques in the prediction of stocks have yielded promising results and thereby marked the use of them in profitable exchange schemes. It has led to the conclusion that it is possible to predict stock market with more accuracy and efficiency using machine learning techniques.

In the future, the stock market prediction system can be further improved by utilizing a much bigger dataset than the one being utilized currently. This would help to increase the accuracy of our prediction models. Furthermore, other models of Machine Learning could also be studied to check for the accuracy rate resulted by them. In this project, we have built a stock predicting model which is presented in the form of a web app. The predicting model is based on Machine Learning algorithms like LSTM, which indicates future stock prices of the company. This model is designed and built to help the investors, traders to invest their money for good profits which will decrease the chances of losing their money in the stock market also it will save time for the investors for choosing the proper stocks.

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