

Apple's Financial Outlook: A Comprehensive Analysis of its Stock Performance

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Abstract

As traders, investors, and analysts try to decide whether to buy, sell, or hold Apple Inc. shares, Apple Stock Prediction is a crucial component of the financial market. It is difficult to forecast the future value of Apple's stock due to market volatility and a variety of unknown events, including shifts in customer tastes, political unpredictability, and global economic trends. Therefore, it is essential to use a variety of techniques to find the most effective strategy for forecasting Apple's stock price. To ascertain the intrinsic value of a stock, fundamental analysis examines financial statements, market patterns, and economic conditions. This method looks at the sales, profit margins, and cash flow of Apple Inc. as well as its overall financial performance. On the other hand, technical analysis examines past market data, such as price and volume, to spot patterns and trends that can predict future price movements. Charts, graphs, and other visual aids are used in this strategy to pinpoint potential entry and exit positions for trading Apple's stock. Multi-Layer Perceptron is a kind of artificial neural network that mimics the actions of the human brain and has been successfully used to analyze large amounts of complex data. In contrast, XGBoost is a machine learning algorithm that makes predictions using previous data, making it perfect for predicting the future movement of Apple's stock.

Keywords: Stock prediction, Apple stock price prediction, Machine Learning research.

1. Introduction

In recent years, traditional financial institutions like banks have struggled to offer attractive returns on investment to investors. This is partly due to low-interest rates and other economic factors that have made investing in banks unattractive to many investors. As a result, many investors have turned to the stock market as a means of achieving higher returns on their investment. Investing in the stock market can provide a higher return on investment than traditional financial institutions, but it also comes with a higher degree of risk. Stock prices can be volatile and can fluctuate rapidly in response to changes in market conditions, economic trends, and other factors. As such, investing in stocks requires a high level of research, analysis, and risk management. When companies issue shares, they can gain access to capital that they can use to fund their expansion and growth. Investors who buy these shares become part owners of the company and can benefit from the company's success through dividends and appreciation in the value of the shares. However, generating a return on investment through stocks can take time, and it often requires patience and a long-term investment strategy. One of the key advantages of investing in stocks is the potential for rapid growth and high returns. However, this potential for high returns comes with a greater degree of risk than investing in traditional financial institutions. Investors must be willing to accept the risks associated with stock market investing and be prepared to weather short-term fluctuations in stock prices. In conclusion, the low return on investment in traditional financial institutions like banks has led many investors to seek out higher returns through stock market investing. While investing in stocks can provide rapid growth and high returns, it also comes with higher degree of risk with higher degree of risk.

2. Problem Statement

The primary focus of this research is to forecast stock trends, a critical aspect of investing in the stock market. To achieve this objective, the article employs two algorithms for comparison: the Multi-Layer Perceptron (MLP) and XGBoost. MLP is the first algorithm used in this study, while XGBoost stores historical data for prediction. The work also emphasizes the importance of utilizing stock-specific parameters such as date, open, high, low, close, and volume to improve the accuracy of stock trend predictions. Accurate forecasting can help investors make informed decisions, manage risks, and maximize profits. To evaluate the

predictive accuracy of each algorithm, various measures were calculated. The results of the analysis can assist investors in selecting the most suitable algorithm based on their investment goals and risk tolerance. The research can also contribute to the development of more effective stock trend prediction models in the future.

3. System Modules

A. Multi-Layer Perceptron

Various studies and research have utilized the MLP algorithm to predict the price movements of Apple's stock. This technique involves training the MLP on historical data and then utilizing it to make predictions about future price movements based on the patterns and trends in the data. In order to use MLP for Apple stock price prediction, past data such as opening and closing prices, daily trading volumes, and other financial indicators are used to train the neural network. After then, the MLP model's performance is maximized by choosing the right number of hidden layers, nodes, and activation functions for each layer. The MLP model can be used to forecast future price changes of Apple's shares based on the input data once it has been trained. The programme can forecast future price movements by spotting potential trends and patterns in the data. Comparing the performance of various algorithms, including MLP, XGBoost, and other machine learning models, is a frequent strategy for forecasting Apple's stock price using MLP. The goal of these comparisons is to determine which model is the most accurate and trustworthy at forecasting changes in the price of Apple's shares. While MLP is an effective tool for predicting Apple's stock price movements and offering insightful information about the financial markets, it's important to remember that stock price prediction is a difficult task, and no model or algorithm can produce flawless predictions. To achieve the greatest outcomes, it is essential to use a variety of models and methodologies in addition to professional research and industry knowledge.

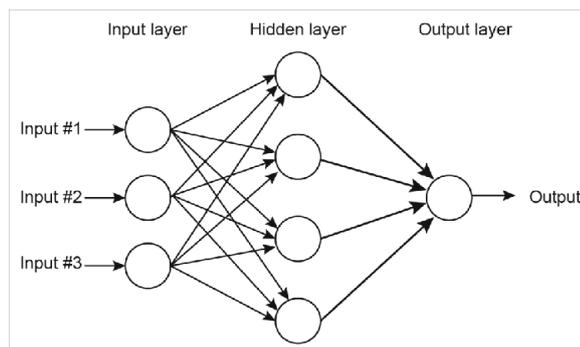


Figure 1. MLP Representation

B. XGBoost Regression

Due to its high accuracy in predicting stock prices and capacity for handling large datasets, XGBoost regression is used to forecast Apple's share price. Decision trees are used in the gradient boosting algorithm XGBoost to simulate the association between input features and target variables. Each tree that is added to the model in turn strives to fix the mistakes produced by the one before it. An extremely accurate model that can anticipate outcomes based on new data is produced by this approach. In order to estimate the price of Apple stock, XGBoost regression is used to analyze past data and find patterns and trends that could be used to predict future price changes. To create precise forecasts, the algorithm can take into account a variety of variables, including stock market patterns, business-specific information, and financial news. When compared to other machine learning algorithms, XGBoost has demonstrated superior performance in a number of tasks, including stock price prediction. Data scientists and financial analysts frequently utilise it because it is simple to deploy, can handle missing data and outliers, and can handle both. Because of its robustness, capacity for handling big datasets, and predictive accuracy, XGBoost regression is used to forecast Apple stock prices.

C. Flask Framework

For a number of reasons, the Python web framework Flask is employed in Apple stock price prediction. First off, Flask is a great option for small to medium-sized web apps since it is lightweight, simple to use, and offers lots of architectural flexibility. Furthermore, it provides crucial functions like routing, template rendering, and authentication that allow the application

to accept input, process it, and then return pertinent results. Flask's extensibility and modular nature make it simple to combine with other frameworks and modules used for financial analysis and forecasting. Thirdly, Flask supports a number of web protocols, including HTTP, WebSocket, and RESTful APIs, which are necessary for real-time updates and intersystem communication. For an application to predict stock prices accurately, it has to have access to real-time market data and other financial information. Fourth, Flask has outstanding database integration support, which is essential for applications requiring persistent data storage. To store historical data and other financial information that can be used to train machine learning models and produce forecasts, the application can employ a database. Last but not least, Flask is an open-source framework with a sizable development community. As a result, it is well-supported, well-documented, and offers a wide variety of plugins and extensions that can be used to enhance the application's functionality. Finally, Flask's lightweight and adaptable architecture, compatibility with a wide range of web protocols, superior database integration, and sizable developer community all contribute to its use in Apple stock price prediction. These capabilities provide the program access to real-time market data, allow it to be processed, and allow it to produce precise forecasts that may be applied to investment decisions.

```
import matplotlib.pyplot as plt
from itertools import cycle
import plotly.graph_objects as go
import plotly.express as px
from plotly.subplots import make_subplots
```

Figure 2. Flask Framework

4. Flowchart

1. At first, the dataset of apple stock price is used.
2. The dataset is now uploaded to the server.
3. The dataset is filtered in accordance with the needs, then a new dataset with attributes that correspond to the analysis to be performed is constructed.
4. The dataset is pre-processed before using it.

5. The testing dataset is analysed using the classified algorithm and made ready for split and test data.
6. Now it is made sure that the split data is being analyzed by the two used algorithms.
7. The results are obtained as accuracy metrics at the end.
8. Custom dataset can be entered in order to get custom results.

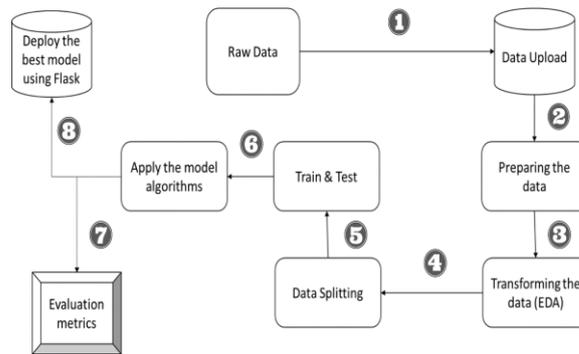


Figure 3. Apple Stock Price Prediction Flowchart

5. System Implementation

- **Collection of Data:** In my work of predicting stock prices, data collection is required. This involved gathering information on the stock price of Apple from diverse sources. The data utilized in this research consisted of a collection of Apple stock price data that included various features.
- **Pre-Processing the Data:** The format of the data selected might not be suitable for handling it effectively and a standardized method is used to perform for this step. In such cases, data cleaning becomes necessary to rectify missing data. There may be instances where the available data is incomplete and does not contain the necessary information to resolve the problem at hand. Additionally, it is possible to have access to a larger dataset than required, from which only relevant data must be carefully selected.

- **Extraction of features:** Feature extraction involves modifying the attributes of the data, whereas feature selection ranks the existing attributes based on their predictive relevance. In other words, feature extraction changes the attributes themselves, while feature selection only assesses their importance in predicting outcomes.
- **Evaluating the model:** When it comes to data science, it is not appropriate to evaluate the performance of a model by solely using the training data. This is because it can result in excessively optimistic and over fitted models. Therefore, two commonly used techniques in data science for assessing models are Hold-Out and Cross-Validation. These methods are used to minimize the risk of producing unreliable and over fitted models.

6. Results and Discussion

The analyzed data is put in a form of a graphical representation to understand better. In this the dataset of only the year 2014 has been taken and by taking Fig 4, the representation is based on the open and close attributes indicating the starting price as open and the maximum price as close for a specific time frame.

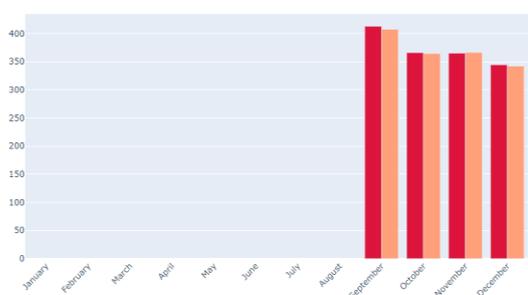


Figure 4. Open and Close Dataset

From the dataset entered the detailed analysis indicate that the attribute high is for the highest price and low would be the lowest price of the particular time frame.

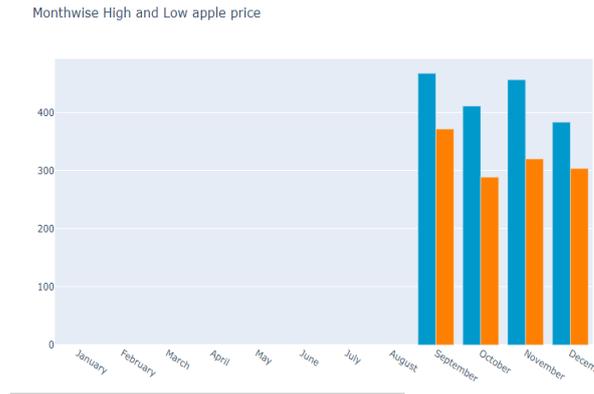


Figure 5. High and Low

Likewise, the detailed analysis for all the four datasets used are together as shown in Fig 6 in a particular time frame.



Figure 6. Comparison of all the Attributes

All the graphical representation are analyzed based on the dataset mention on TABLE 1. In which the data contains only the values of the year 2014. The dataset contains 105 rows by 5 columns with 525 datasets. Also, the data is split as train and split data with a ratio of 7:3.

Table 1. Representation of the Dataset in this Model

	Date	Open	High	Low	Close
0	2014-09-17	465.864014	468.174011	452.421997	457.334015
1	2014-09-18	456.859985	456.859985	413.104004	424.440002
2	2014-09-19	424.102997	427.834991	384.532013	394.795990
3	2014-09-20	394.673004	423.295990	389.882996	408.903992
4	2014-09-21	408.084991	412.425995	393.181000	398.821014
...
100	2014-12-26	319.152008	331.424011	316.627014	327.924011
101	2014-12-27	327.583008	328.911011	312.630005	315.863007
102	2014-12-28	316.160004	320.028015	311.078003	317.239014
103	2014-12-29	317.700989	320.266998	312.307007	312.670013
104	2014-12-30	312.718994	314.808990	309.372986	310.737000

105 rows x 5 columns



Figure 7. Accuracy Comparison

From the Fig 7, the orange bar represents the XGboost regressor and the pink bar represents the MLP regressor. According to the analysis, it is evident that the XGBoost regressor algorithm outperforms the MLP Regressor on their performance values obtained from the dataset. The XGBoost algorithm has an accuracy of 90%, while MLP has an accuracy of 80%. Therefore, based on this analysis, the most suitable algorithm for the dataset used for prediction would be XGBoost.

7. Conclusion

The difficult process of forecasting stock prices calls for the analysis of a great amount of information, such as past prices, business news, and economic indicators. By finding patterns and links in these datasets, machine learning algorithms have demonstrated promise in the prediction of stock values. The Multi-Layer Perceptron (MLP) and XGBoost are two frequently

employed stock price prediction algorithms. A common artificial neural network used for pattern recognition and prediction tasks is the MLP algorithm. It is made up of numerous layers of interconnected nodes that process incoming data and produce predictions as an output. To forecast future price changes, MLP can be trained using historical stock price data and other pertinent information. Because MLP can capture non-linear relationships between various variables, it has been demonstrated to be effective at forecasting stock prices. In contrast, the ensemble learning method XGBoost integrates different decision trees to produce predictions. It functions by building a sequence of decision trees, each of which fixes the errors of the one before it. Due to its high accuracy and speed, XGBoost has been widely used in stock price prediction. It can be used for both classification and regression tasks. Numerous studies have demonstrated that when comparing the precision of MLP and XGBoost. According to the findings, MLP was more accurate than XGBoost at forecasting stock values. It is crucial to remember that a number of variables, including the quality of the data, the selection of input features, and the market circumstances, can affect how accurate machine learning algorithms are at predicting stock prices. Therefore, before using machine learning techniques to predict stock prices, careful data analysis and feature selection are required. Finally, the XGBoost method outperforms the MLP algorithm with a 90% score for accuracy.

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