International Journal of Engineering Research and Sustainable Technologies
Volume 3, No.3, Sep 2025, P 09- 17
ISSN: 2584-1394 (Online version)

STOCK FORECASTING WEB APPLICATION WITH MACHINE LEARNING

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DOI: htpps://doi.org/10.63458/ijerst.v3i3.118 | ARK: https://n2t.net/ark:/61909/IJERST.v3i3.118

Abstract

In this project we created a web application for stock forecasting that uses machine learning techniques to give users insights into stock prices in advance. The application integrates realtime stock data from financial APIs and uses Python for both machine learning and web development, making it easy to access the most recent information. The LSTM (Long ShortTerm Memory) algorithm is a kind of recurrent neural network and it is the main component of the application that analyses historical stocks data and projects future prices. Here we used Frontend technologies like HTML, CSS, and JavaScript (Angular) power the user-friendly single-page interface of the Flask or Django framework-built web interface. And here we use other model like SARIMA, Random Forest,Prophet Any appropriate database system,such as SQLite, can be used for data management. Using scikit-learn or TensorFlow libraries, machine learning functionalities are implemented, allowing the development of reliable forecasting models. The libraries Matplotlib, Plotly, or D3.js make it easier to visualise stock data, which improves user comprehension and decision-making.Alpha Vantage and other financial market APIs and yfinance library provide real-time stock data, guaranteeing the application's relevance and dependability in fluctuating market conditions. From this project users can easily understand and analyze the stock data with user-friendly interface and dynamic visualization. This project's ultimate objective is to democratize access to stock forecasting tools for all traders and they get better experience levels can confidently make an gameplay with financial market trends.

Key Words – Stock Forecasting, Web Application, Machine Learning, LSTM Algorithm, Python, Django, HTML, CSS, JavaScript, yfinance, SQLite, TensorFlow, scikit-learn, Matplotlib, Plotly, Financial APIs.

1. Introduction

Making wise investment decisions in today's volatile financial markets requires accurate stock price forecasting. We present a web-based application that uses real-time data visualisation and machine learning techniques to address this need for stock forecasting.To give users accurate forecasts of future stock prices, our platform combines SARIMA, Random Forest, Prophet, and LSTM (Long Short-Term Memory) networks. To guarantee access to current market data, these models are trained on historical stock data obtained from yfinance and other financial APIs.Powered by HTML, CSS, and JavaScript (Angular), our application's user-friendly interface makes it simple for traders and investors to access and analyse stock market data. The Candlestick charts provide users with a real-time visual representation of market trends, and the Streamlit web application link allows users to forecast future stock prices with a variety of forecasting models.Our platform works to enable traders and investors of all skill levels to confidently navigate the intricacies of the stock market by democratising access to stock forecasting tools and furnishing users with actionable insights. Our platform is a useful tool for people who want to make sense of the competitive market environment of today by combining cutting-edge machine learning techniques with an easy-to-use interface.

2. Literature Review

1.1 Stock Market Prediction Web Service Using Deep Learning by LSTM

In 2021, an innovative technique to stock market prediction using Long Short-Term Memory (LSTM) neural networks is presented by Mohammad Mahabubul Hasan, Pritom Roy, Sabbir Sarkar, and Mohammad Monirujjaman Khan. Through the use of the TensorFlow library and historical stock closing prices from the Dhaka

Stock Exchange (DSE), the authors train the LSTM model to estimate future prices with a noteworthy 70% accuracy. Notably, the system's live web service implementation through the use of Django and Android applications is a real-world use case for deep learning methods in financial forecasting. Even though the study shows that machine learning is effective in stock prediction, there are still concerns to be addressed, including overfitting, poor data quality, and the requirement for ongoing model improvement.However, the results show the promise of LSTM networks in financial forecasting and point to directions for future study to overcome the limitations noted.

1.2 Stock Market Price Prediction Using Machine Learning

In May 2023, a study titled "Stock Market Price Prediction Using Machine Learning" was written by Saranya K, Vijayashaarathi S, Sasirekha N, Koushikrajaa M, and Lohith Raksha. It discusses the growing interest in stock market prediction. Using Yahoo Finance datasets, the authors investigate the use of Long Short-Term Memory (LSTM) and Linear Regression algorithms for long-term stock price forecasting. The research notes drawbacks including overfitting and sensitivity to data quality and quantity, but also demonstrates how well LSTM models handle time series data and capture long-term interdependence. Notwithstanding these difficulties, LSTM algorithms provide insightful information that can help investors make wise choices. To assure their efficacy, though, a thorough assessment against other models and benchmarks is essential.Therefore, even though LSTM models have potential for stock market prediction, further study is required to improve predictive models and solve issues in order to achieve more precise forecasting.

1.3 Analysis and forecasting of Time-Series data using SARIMA, CNN and LSTM

The 2021 paper "Analysis and forecasting of Time-Series data using SARIMA, CNN and LSTM" by Subhash Arun Dwivedi, Amit Attry, Darshan Parekh, and Kanika Singla explores the complexities of stock market prediction. The study forecasts trends in the Nifty-500 indexes using SARIMA, CNN, and LSTM models in an effort to reduce the risks involved in trend prediction. The study acknowledges the importance of SARIMA in the machine learning paradigm in addition to demonstrating the effectiveness of deep learning models. The dynamic and chaotic character of stock market data presents difficulties, and there are restrictions like overfitting and sensitivity to the quantity and quality of the data In spite of these obstacles, deep learning models—LSTM in particular—perform better at extracting and learning time series data features, opening up new research directions. On the other hand, thorough assessment and investigation of substitute techniques, including generative adversarial networks (GANs), are necessary to improve stock market prediction abilities.

1.4 Prediction of TCS Stock Prices Using Deep Learning Models

A 2021 study titled "Prediction of TCS Stock Prices Using Deep Learning Models" by Srilakshmi.K and Sai Sruthi.Ch explores the use of deep learning and statistical techniques for stock price prediction. Five deep learning models are compared in the study: CNN LSTM, Convolutional LSTM, Bidirectional LSTM, Three-Layer LSTM, and Single-Layer LSTM. SARIMA is the middle model. Even if deep learning models perform better, issues like optimising hyperparameters and adding outside influences like news articles still arise. Deep learning models, among which ConvLSTM and Bidirectional LSTM are especially good, nevertheless, provide robustness and versatility. Evaluation indicators such as R2-Score, RMAE, MAE, and RMSE verify the effectiveness of the suggested models. Additionally, the research proposes possible improvements by adjusting hyperparameters and combining models.This study highlights the potential of deep learning for stock price prediction across different industries and provides insightful information about its implementation.

1.5 Stock Price Prediction Using Machine Learning

The July 2023 study titled "Stock Price Prediction Using Machine Learning" by Md Humayun Kabir, Abdus Sobur, and Md Ruhul Amin explores the uses of machine learning algorithms in stockmarket price forecasting. The objective of this study is to investigate the efficacy of different machine learning models and features while highlighting the intricacy of the stock market environment. The study highlights the promise of machine learning in the financial sector, but it also points out drawbacks, including the volatility of the market and outside events. In spite of this, the study highlights how crucial feature engineering and selection are to raising prediction accuracy. In conclusion, even though machine learning has great potential for predicting stock prices, further research is needed to solve issues and improve the accuracy of predictions using cutting-edge methods and feature engineering strategies.

1.6 Comparative Study of Stock Price Prediction using Machine Learning

The 2021 paper titled "Comparative Study of Stock Price Prediction using Machine Learning" by Parag P. Kadu and Dr.R. Bamnote delves into the complexities involved in stock market prediction. The study emphasises how crucial

reliable and precise forecasts are in the ever-changing stock market environment. Among the features investigated is the use of machine learning methods for technical and fundamental analysis-based stock selection. On the other hand, there are substantial obstacles, such as the effect of outside causes like the COVID-19 epidemic on the stock market. Even if machine learning shows promise in resolving these issues, the intricacy of stock market prediction is still a difficult undertaking because of a number of contributing elements. Despite these difficulties, good stock forecasting models can offer insightful information about how the market behaves, making it possible to spot trends and patterns. Even with stock market dynamics' inherent volatility, improving prediction accuracy and reliability requires ongoing study and investigation of cutting- edge machine learning techniques.

2.7 Stock Market Prediction Using Machine Learning Techniques

The 2022 paper "Stock Market Prediction Using Machine Learning Techniques" by Jagruti Hota, Sujata Chakravarty, Bijay K. Paikaray, and Harshvardhan Bhoyar explores the field of stock market forecasting. The research highlights the significance of precise forecasting in optimising investment yields and its function in fostering economic expansion, specifically in developing nations such as India. The use of machine learning algorithms for stockmarket price prediction, such as Random Forest, Decision Tree, Support Vector Regressor, and Artificial Neural Network, is one of the features that have been investigated. The inherent unpredictability of market dynamics and reliance on stockbrokers for financial advice are difficulties that machine learning holds promise for addressing. Subsequent investigations will try to increase forecast accuracy by using sophisticated methods such as genetic algorithm optimisation.Not withstanding these obstacles, the study highlights how machine learning has the ability to revolutionise stock market prediction and provide insightful information to both stockbrokers and investors.

3. Real Time Stock Market Data Visualized by Candlestick Chart

The project's site features an interactive interface with a candlestick chart that allows users to see real-time market data visualisation. A JavaScript package called CanvasJS is used to create the chart. It allows for dynamic and eye-catching data visualisation. Users are presented with the headline "Mini Project" and a form to fill out when the homepage loads, asking them to enter the name of the stock and choose the time period they would want to see data visualised. To meet different analytical demands, a range of time intervals, from 1 minute to monthly data, are provided. The chart dynamically changes to show the related stock price data when users input the stock name and select the time window of interest.

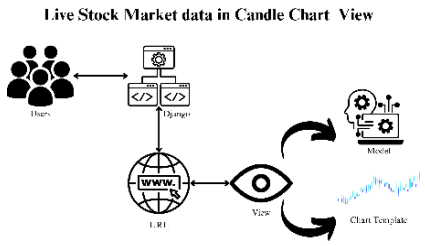

Fig 1 Live Stock Market Data in Candle Chart View

Fig 2 Home Web Real-Time Live Stock Data visualization

The candlestick chart itself is the focal point of the homepage, occupying a prominent position within the webpage layout. It features a title indicating the selected stock name and time frame, providing users with context for the displayed data. This chart is designed to display the open, high, low, and close prices of the selected stock over the chosen time frame. The candlestick represents a specific time- interval, with colors indicating whether the stock market price increased (green) or decreased (red) during that period. This visual representation allows users to quickly grasp trends and patterns in the stock price movements, aiding in decision- making and analysis. All things considered, the homepage provides a simple and easy-to-use interface for obtaining and evaluating real-time stock data. Users can confidently make well-informed investment decisions by utilising dynamic visualisation techniques and interactive elements to obtain valuable insights into stock market trends.

4. System Method

Whatever the algorithm selected, there are usually a few essential steps involved in developing a stock market forecasting model. The initial step is to gather the pertinent stock data, which typically consists of historical price and volume data. In order to handle missing values, normalise features, and possibly include additional data sources for increased accuracy, this data is then preprocessed. The model, be it a Prophet, Random Forest, LSTM, or SARIMA model, is then created. Choosing the proper hyperparameters, defining the architecture, and configuring the training procedure are all part of this. Following model creation, the preprocessed data is used to train the model, enabling it to identify patterns and relationships in the data.Measuring accuracy with testing data after training, the model's performance is assessed; metrics like mean squared error or root mean square error are commonly used for this purpose. Now that the model is operational, traders and investors can use it to forecast previously unseen data, giving them important new information.

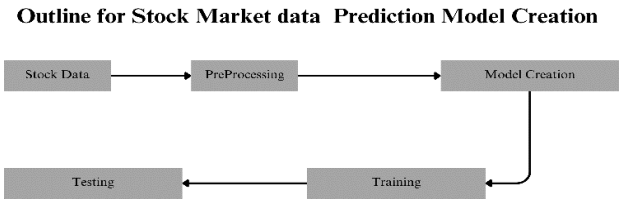

Fig 3 Outline for Stock market data Prediction Model Creation

5. System Process

Experimental evaluation of DoseGuard system is presented in this section and their efficiency in medication dispensing, prescription authentication and real time adherence monitoring was highlighted. The system features that are novel include medical inventory management and keeping track of prescription history both of which enhance healthcare safety and efficiency.

5.1 Streamlined Forecasting Pipeline: From Data Retrieval to Model Deployment :

With the stock market forecasting web application Streamlit, users can easily predict future stock prices by following a structured journey. To begin, they set up a timeline, choose a start and end date, and identify the company whose stock data they want to examine. The application quickly retrieves historical stock data based on the user's preferences by utilising the yfinance library. After that, the data is carefully preprocessed to make sure it is suitable for analysis. This includes cleaning and organising the data. After that, users are given the option to select one of four different forecasting models: Random Forest, LSTM, Prophet, or SARIMA. Every model has distinct capabilities that are suited to various data attributes and forecasting needs.The application starts the training process as soon as a model is chosen, enabling the model to absorb knowledge from the prepared data. Ultimately, the web application incorporates the trained model seamlessly, enabling users to predict future stock prices based on the selected model and input parameters. With the help of this iterative process, users can confidently explore a variety of forecasting techniques and obtain insightful knowledge about future market trends.

5.2 Data Selection:

Users must first specify the start and end dates for the historical stock price data they want to analyse in order to use the stock market forecasting application. The scope of the analysis and the precision of the forecasts are determined by the choice of data period, which makes it essential. Users' interests may lie in long-term patterns or short-term trends, and the date range they selected corresponds to their analytical goals. Users may choose a longer period of time if they want to comprehend historical trends, but they may choose a shorter period if they want to evaluate current market dynamics.

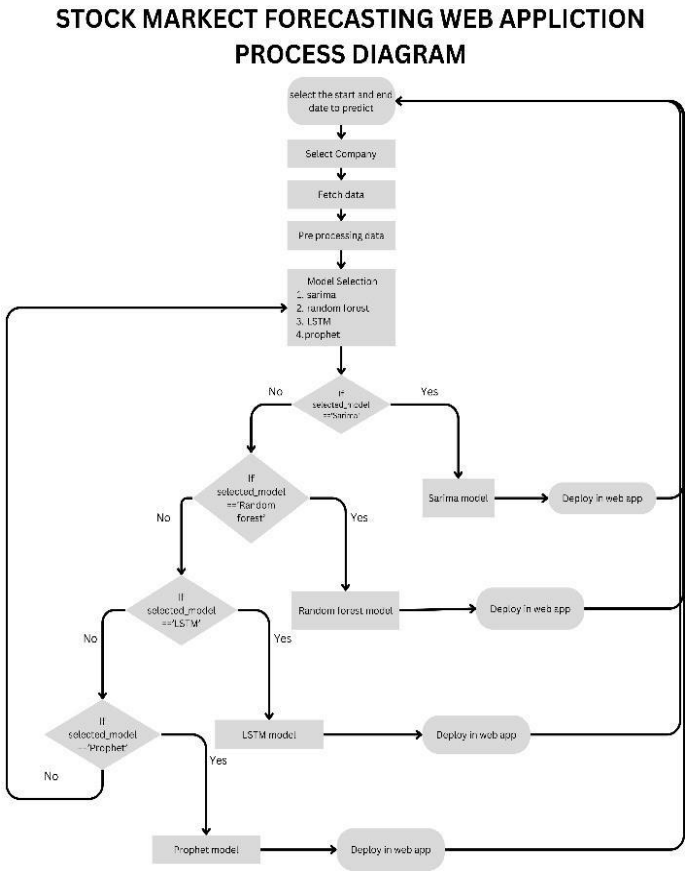

Fig 4 Overall Process Flow Chart

Data from 2020-01-01 to 2024-03-11

	Date	Open	High	Low	Close	Adj Close	Volume
0	2020-01-02 00:00:00	67.0775	68.407	67.0775	68.3685	68.3685	28,132,000
1	2020-01-03 00:00:00	67.393	68.625	67.2772	68.033	68.033	23,728,000
2	2020-01-06 00:00:00	67.5	69.825	67.5	69.7105	69.7105	34,646,000
3	2020-01-07 00:00:00	69.897	70.1495	69.519	69.667	69.667	30,054,000
4	2020-01-08 00:00:00	69.604	70.579	69.542	70.216	70.216	30,560,000
5	2020-01-09 00:00:00	71.0285	71.3665	70.5135	70.9915	70.9915	30,018,000
6	2020-01-10 00:00:00	71.378	71.7465	70.9175	71.4865	71.4865	36,414,000
7	2020-01-13 00:00:00	71.8065	72.026	71.301	71.9615	71.9615	33,046,000
8	2020-01-14 00:00:00	71.9505	72.09	71.4185	71.544	71.544	31,178,000
9	2020-01-15 00:00:00	71.5105	72.0697	71.5105	71.96	71.96	25,654,000

Fig. 5 Data Selection from 2020-01-01 to 2024-03-11

5.3 Company Selection:

After specifying the duration, users choose the particular company whose stock market data they want to examine. Users of the application are given access to a list of companies that are available, most of which are well-known brands like Apple, Microsoft, Google, Tesla, and so on. Through this step, users can narrow down their analysis to a specific industry, sector, or company of interest. Various factors, including personal investment portfolios, market interests, or research objectives, frequently influence the choices made by users on this platform.

5.4 Data Fetching::

The application retrieves historical stock price data for the selected company within the given date range after the user selects the desired company. Using libraries like yfinance, which offer access to enormous repositories of historical stock market data, this process entails fetching data from financial APIs. Essential information like the opening and closing prices, highest and lowest prices, trading volume, and timestamp for each trading day during the designated period are usually included in the fetched data.

5.5 Data Preprocessing:

After being retrieved, the historical stock price data is preprocessed to make sure it is accurate and suitable for analysis. Preprocessing includes a number of steps, including handling missing values, eliminating outliers, normalising data, and creating features. In order to guarantee the precision and dependability of ensuing analyses and projections, data cleaning is essential. Depending on the unique properties of the dataset and the demands of the selected forecasting model, different preprocessing methods may be used.

5.6 Model Selection:

Once the preprocessed data is ready, users can choose between SARIMA, Random Forest, LSTM, or Prophet as their forecasting model. Every model has its own advantages and can be used for various data types and forecasting goals. The intricacy of the data, the required degree of accuracy, and the results' interpretability can all influence the model that users choose. Users can customise their analysis in this step to fit their unique requirements and tastes.

5.6.1 SARIMA Model:

The Seasonal Autoregressive Integrated Moving Average (SARIMA) model is a useful tool for time series forecasting when working with seasonal patterns in stock market data. SARIMA adds trend, stochastic fluctuations, and seasonal variations to the ARIMA model.The moving average (MA), the differencing (I) component, the autoregressive (AR) component, and an extra seasonal component make up its three main components. These components allow SARIMA to forecast and capture the intricate dynamics of seasonal data. In numerous fields, including finance, economics, and climate science, it is extensively employed to forecast future values by utilising past observations.

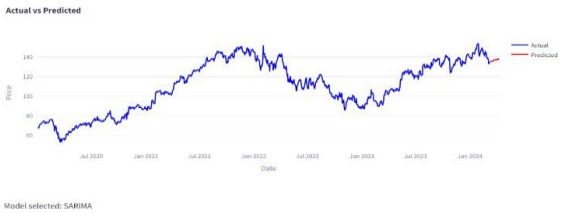

Fig 6 SARIMA MODEL Next 30 days Future Stock Price Prediction

5.6.2 Random Forest Model:

Based on decision trees, the Random Forest model is an ensemble learning technique that can handle tasks involving both regression and classification. During the training phase, it builds multiple decision trees and outputs the mean prediction (regression) or the mode of the classes (classification) of each tree. By averaging the predictions of several trees, Random Forest reduces overfitting and remains reliable and accurate even when dealing with noisy or imperfect data. This model is appropriate for stock market forecasting applications where data volume and complexity pose significant challenges because it is highly scalable and capable of handling large datasets with efficiency.

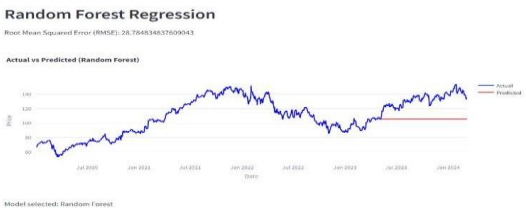

Fig 7 Random Forest Regression MODEL Next 30 days Future Stock Price Prediction

5.6.3 LSTM Model:

Recurrent neural networks (RNNs) with long-range dependencies can process and predict data sequences using the Long Short-Term Memory (LSTM) model. LSTM networks are perfect for time series forecasting tasks because, in contrast to traditional feedforward neural networks, they have recurrent connections that allow them to retain information over extended time intervals. Because LSTMs learn from previous observations and dynamically modify their internal state, they are particularly good at capturing complex temporal patterns in sequential data, like stock prices. They perform better than conventional forecasting models in many situations, and they are especially useful when working with non-linear and non-stationary data.

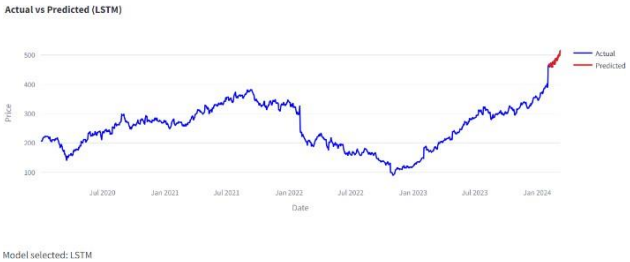

Fig 8 LSTM MODEL Next 30 days Future Stock Price Prediction

5.6.4 Prophet Model:

Prophet is an open-source forecasting tool. That was developed by the Facebook Core Data Science team to facilitate time series forecasting for business and research applications. This model is useful for to predict the Future Stock Price. The time series model it employs is divided into three primary components are trend, seasonality, and holidays. Prophet is capable of automatically detecting and incorporating seasonal patterns from multiple sources, including daily, weekly, and yearly seasonality as well as holiday effects. Its user-friendly parameter tuning features and graceful handling of outliers and missing data make it appropriate even for users with limited time series forecasting experience. Because of its versatility and ease of use, Prophet is favoured by analysts and researchers from a wide range of fields for producing accurate and comprehensible forecasts.

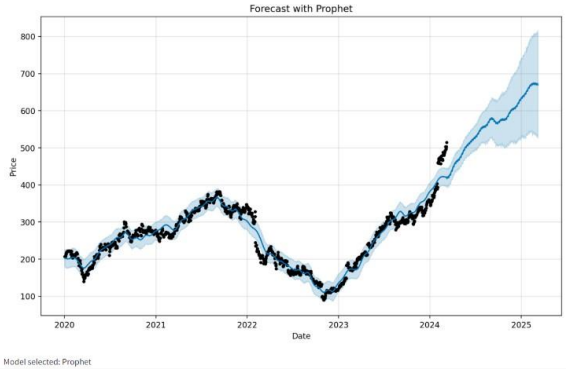

Fig 9 Prophet MODEL Next 30 days Future Stock Price Prediction

6. Requirements Tools And Software

This project is completed successfully, a complete set of specifications, instruments, and software are needed. First and foremost, it is imperative to have access to real-time stockmarket data, which is made possible by financial APIs such as Alpha Vantage and yfinance Library. Python is the main programming language that we used to create machine learning models and web applications. Forecasting algorithms are derived from libraries like scikit-learn, TensorFlow, and Prophet. Frameworks like Django are used in web development, and frontend technologies like HTML, CSS, JavaScript are used for user interface design. Matplotlib, Plotly are a few examples of data visualisation libraries that improve stock data presentation and facilitate user comprehension. To make the model accessible on multiple platforms, Streamlit is used to deploy it as a web application. When taken as a whole, these specifications, instruments, and programmes make it possible to create a reliable and approachable stock assessment tool.

6.1 Exploring challenges, pros, and cons in stock market prediction: a machine learning approach

6.1.1 Challenges

Data Quality and Reliability: The accuracy of forecasting models may be impacted by errors or missing values in historical stock market data obtained from online sources.

Model Selection: Selecting the best forecasting model (SARIMA, Random Forest, LSTM, Prophet) for a given dataset can be difficult and necessitates testing and analysis.

Deployment and Scalability: Scalability, performance, and resource management must be carefully considered when implementing machine learning models in a web application, especially when handling massive data volumes and simultaneous user requests.

6.1.2 Pros

Accessibility: Users can easily access forecasting tools for the stock market through this web application, which enables them to analyse and interpret data without the need for specialised software or technical knowledge.

Interactivity: By interacting with the application in real- time, users can improve their comprehension of stock market trends and patterns by changing parameters and dynamically visualising results.

Integration: Integration with widely used libraries and APIs, such as Plotly, Prophet, and yfinance, streamlines the workflow by making data retrieval, visualisation, and model development easier.

Educational Value: Users with an interest in financial markets, machine learning, or data analysis can use the application as a learning tool as it gives them practical experience with real-world datasets and methodologies.

6.1.3 Cons

Resource Requirements: It may be difficult for some users to obtain the substantial computational power and knowledge needed for the training and implementation of machine learning models, particularly deep learning models like LSTM.
Over fitting: When trained on sparse or noisy data, complex models like Random Forest and LSTM are particularly vulnerable to over fitting, which can result in subpar generalisation performance on new data.
Maintenance: Forecasting models must be regularly updated, monitored, and adjusted to user feedback and shifting market conditions in order to maintain their accuracy and dependability. These tasks can be time and resource consuming. Accuracy: The reliability of forecasts is limited by the errors and uncertainties present in financial markets, even with the use of sophisticated forecasting models, particularly when extending out over longer time horizons.

7. Conclusion

In conclusion, this project is a major advancement in the application of machine learning techniques to stock market prediction. Investors are able to access robust forecasting tools through the integration of multiple models, including SARIMA, Random Forest, LSTM, and Prophet, into an intuitive web application. The benefit is that it democratises access to precise stock price forecasts, empowering traders of all experience levels to make well-informed investment choices. The user experience is improved, allowing for quicker analysis and decision-making, by the real-time data visualisation, model selection flexibility, and ease of use. It could be better in certain areas, though. In order to improve forecasting models' accuracy and dependability, one important factor is that they must be continuously optimised and refined. To achieve this, one could try varying the hyperparameters, investigate different feature engineering methods, or add outside variables that might affect stock values. As the user base expands, it is imperative to prioritise the web application's scalability and resilience. In the ever-changing stock market environment, the application must receive regular updates and maintenance to account for modifications to data sources or market conditions. Only then will it remain relevant and functional. All things considered, this project creates a strong basis for future developments in stock market forecasting and expands the field's potential for study and research.

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