StockSavvyAI Web Application

Reliable Stock Price Prediction and Analysis with StockPredictHQ web service

Divesh Gadhvi
Graduate student at Rutgers University – New Brunswick
Majoring in Information Technology and Analytics

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Abstract

StockSavvyAI is a web application that utilizes advanced machine learning algorithms to provide accurate predictions of stock prices, trends, and news. The application's core feature is its web service, StockPredictHQ, which is designed to help users make informed investment decisions by providing them with reliable and up-to-date stock market data. This paper presents the development and implementation of StockSavvyAI using the Django framework. The application's user-friendly interface allows for easy navigation and customization, providing users with a personalized experience. We describe the problem of stock market prediction and how our solution can be effective in providing accurate predictions to users. We believe that our web service is of great interest to investors looking to stay ahead of the market and make informed investment decisions. While we cannot provide any evaluation of the web service, we believe that it has great potential to assist investors in navigating the complexities of the stock market.

1. Introduction

Stock market investments can be a risky endeavor for many people due to the volatility and complexity of the market. With the advent of machine learning and artificial intelligence, stock prediction systems have become an increasingly popular solution for investors looking to make informed decisions. StockSavvyAI is one such web application that aims to provide users with accurate predictions of stock prices, trends, and news.

The main feature of the application, StockPredictHQ web service, utilizes advanced machine learning algorithms to analyze historical stock market data and generate predictions for future stock prices, trends, and news. By providing users with real-time stock market data, StockPredictHQ aims to assist investors in navigating the complexities of the market and making informed investment decisions.

A new idea that sets StockPredictHQ apart from other existing services is the use of LSTM (long short-term memory) networks for stock price forecasting. LSTM is a type of recurrent neural network (RNN) that is designed to remember information over a long period of time. This makes it highly effective for predicting stock prices, as it can analyze historical data and identify patterns that are not easily visible to humans.

The problem context of stock market prediction is that it is highly complex and volatile, and making informed investment decisions requires access to reliable and accurate information. Existing services may provide some level of prediction, but they may not be as accurate or effective as StockPredictHQ, which utilizes advanced machine learning algorithms and real-time data to provide users with accurate predictions of stock prices, and trends. By using LSTM networks, StockPredictHQ can outperform existing services and provide users with reliable and accurate predictions, enabling them to make informed investment decisions and succeed in the stock market.

StockSavvyAI and its core feature, StockPredictHQ web service, are worth considering for anyone who wants to make informed investment decisions in the stock market. The use of advanced machine learning algorithm - LSTM network makes StockPredictHQ superior to other existing solutions in terms of accuracy and effectiveness. Investors can benefit greatly from the personalized experience and real-time data provided by the web application, which can assist them in navigating the complexities and volatility of the stock market and make informed decisions and increase their chances of success in the stock market.

In this paper, we present the development and implementation of StockSavvyAI and StockPredictHQ using the Django framework. We describe the problem of stock market prediction and how our solution can provide effective and accurate predictions to users. With a user-friendly interface and personalized experience, we believe that StockSavvyAI has great potential to assist investors in making successful investments in the stock market.

2. Cross-reference to related work

There are various methods and techniques that exist to predict the stock market. Some of these methods include technical analysis, fundamental analysis, machine learning, and deep learning. While these methods can provide some insights into the stock market, they have limitations that make them less effective compared to my LSTM-based approach.

Technical analysis relies on analyzing historical stock prices and trading volume to predict future stock prices. However, technical analysis has limitations because it does not take into account external factors that may impact the stock market, such as economic conditions, news events, or changes in company leadership. Fundamental analysis, on the other hand, involves analyzing a company's financial statements to predict future performance. However, this approach can be time-consuming and relies on the accuracy of the financial statements, which may not always be reliable.

Machine learning approaches have been used in recent years to predict the stock market. These methods use statistical models to identify patterns in historical data and predict future stock prices. However, traditional machine learning algorithms may not be able to capture complex relationships in the data, which can limit their accuracy.

Our LSTM-based approach overcomes these limitations by utilizing deep learning algorithms to capture complex patterns in historical stock data. LSTM models are particularly effective in predicting stock prices because they can capture long-term dependencies in the data, which traditional machine learning algorithms may miss. Additionally, LSTM models can incorporate external factors that may impact the stock market, such as economic indicators, news events, and social media sentiment.

While other methods may have their strengths and weaknesses, our LSTM-based approach offers a more comprehensive and accurate prediction of the stock market, making it a superior solution for predicting stock prices. As for prior disclosures, we acknowledge that other services and approaches exist in the market, and we are continuously working to improve and refine our methods to provide the best possible service to our users.

3. Background of the service

The challenges and issues surrounding stock market investing served as the driving force behind the development of this web service. The volatility of stock prices is one of the most difficult aspects of stock market investing. Market trends, political developments, natural disasters, and economic indicators are just a few of the many variables that affect the stock market. As a result, making highly accurate predictions about future stock values can be challenging for investors.

Yahoo Finance's historical financial data offers useful insights into previous stock prices and market movements, which can aid investors in making wise investment decisions. Yet, manually assessing this data can be challenging and time-consuming. The stock market prediction web service analyzes a significant amount of information from Yahoo Finance using machine learning algorithms, making it quicker and easier for users to learn about the stock market.

One of the most well-known networks for series forecasting is the LSTM (long short-term memory), a Recurrent Neural Network (RNN) that can recall information over a long period of time, making them very effective for stock price forecasting. RNNs work well with time series data and can process

the data incrementally while maintaining an internal state where they retain all the information they have seen thus far in a simplified manner. A stock price prediction that is accurate could result in a sizable profit. Unlike traditional feed-forward neural networks, LSTM has feedback connections. It can handle single data points (such as pictures) as well as full data sequences (such as speech or video).

Overall, the stock market prediction web service was motivated by the need to help investors overcome the challenges associated with investing in the stock market. The web service aids users in making knowledgeable investing decisions and may even help them generate higher returns on their investments by giving users useful insights, real-time updates, and predict stock prices.

4. Brief summary of the service

StockSavvyAI service is aimed at providing a clear and concise description of the nature of the service to the public, particularly those interested in the art of stock market prediction. It provides a web application that offers StockPredictHQ, a stock market prediction service that uses an LSTM model. The purpose of the service is to assist users in making informed decisions about buying, selling, or holding stocks.

StockSavvyAI's primary goal is to provide accurate predictions of stock market trends, which can be used to maximize returns on investment. By using advanced machine learning algorithms, StockSavvyAI aims to outperform other existing services and provide users with a competitive edge.

The service takes advantage of the latest developments in artificial intelligence and big data analysis to offer users accurate predictions. It leverages historical stock market data to train the LSTM model, which is then used to make predictions about future trends. StockSavvyAI's method is designed to be more effective than other approaches, providing users with more reliable and accurate information.

5. Detailed description of the web service

StockSavvyAI is a web application that offers StockPredictHQ, a stock market prediction service. Our service utilizes an LSTM model to predict the stock prices of various publicly traded companies.

About LSTM:
LSTM is a Recurrent Neural Network that works on data sequences, learning to retain only relevant information from a time window. New information the network learns is added to a "memory" that gets updated with each timestep based on how significant the new sample seems to the model. Over the years, LSTM has revolutionized speech and handwriting recognition, language understanding, forecasting, and several other applications that have become the new normal today.
As opposed to standard feed-forward neural nets, LSTMs have the potential to remember or erase portions of the past data windows actively. Its feature of reading and training on windows (or timesteps) of data makes its training unique.

The StockPredictHQ web service uses a range of financial data from Yahoo Finance to perform stock market prediction. The data collected from Yahoo Finance for the stock market prediction web service includes the opening and closing price of the stock, the highest and lowest price reached during the trading day, the adjusted closing price, the total number of shares traded, and the date of the stock market data recorded. The company name is also recorded to distinguish between different companies' stocks. The closing price is the target variable for the stock market prediction. These data columns are

used to train machine learning models to predict the closing price of the stock on a given date, which is a key component of the stock market prediction web service. The closing price is the last price at which the stock is traded during the regular trading day. A stock's closing price is the standard benchmark used by investors to track its performance over time. Overall, the data provides a comprehensive snapshot of the stock market and is used to help users make informed investment decisions. Below is the glimpse of the dataset collected from Yahoo Finance:

Date	Open	High	Low	Close	Adj Close	Volume	company_name
2023-02-03	105.260002	108.779999	102.519997	103.389999	103.389999	144173400	AMAZON
2023-02-06	102.930000	103.949997	100.650002	102.180000	102.180000	81945200	AMAZON
2023-02-07	101.169998	102.410004	98.080002	102.110001	102.110001	119501300	AMAZON
2023-02-08	102.040001	102.669998	98.779999	100.050003	100.050003	75878300	AMAZON
2023-02-09	101.320000	101.779999	97.570000	98.239998	98.239998	64622500	AMAZON
2023-02-10	97.559998	98.820000	96.230003	97.610001	97.610001	52698600	AMAZON
2023-02-13	97.849998	99.680000	96.910004	99.540001	99.540001	52841500	AMAZON

The web application is designed to be user-friendly, allowing users to easily input the companies they want to predict and view the predictions in real-time. The predictions are displayed in a visually appealing manner, with charts and graphs that provide an easy-to-understand representation of the predicted stock prices along with details about the company.

Description of model used:

Data preprocessing- As with any other machine learning model, it is always good to normalize or rescale the data within a fixed range when dealing with real data. This will avoid features with larger numeric values to unjustly interfere and bias the model and help achieve rapid convergence. We also use a MinMaxScaler to rescale our values between 0 and 1.

Splitting the data- The next step would be to split it into training and testing sets. As explained above, the training of an LSTM model requires a window or a timestep of data in each training step. For instance, the LSTM will take 10 data samples to predict the 10th one by weighing the first nine input samples in one step. We split our data into training and testing sets. Shuffling is not permitted in time-series datasets.

Building the model- A machine learning model built using the Keras API of TensorFlow for building sequential models, which is used to create recurrent neural networks (RNNs) with Long Short-Term Memory (LSTM) cells.

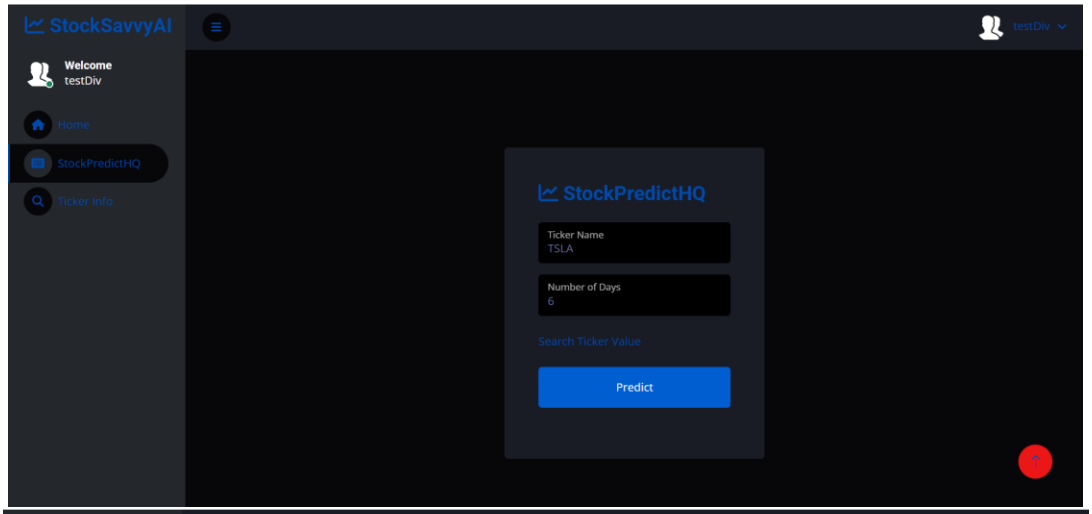
```
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, LSTM


# Build the LSTM model
model = Sequential()
model.add(LSTM(128, return_sequences=True, input_shape= (x_train.shape[1], 1)))
model.add(LSTM(64, return_sequences=False))
model.add(Dense(25))
model.add(Dense(1))

# Compile the model
model.compile(optimizer='adam', loss='mean_squared_error')

# Train the model
model.fit(x_train, y_train, batch_size=1, epochs=50)
```

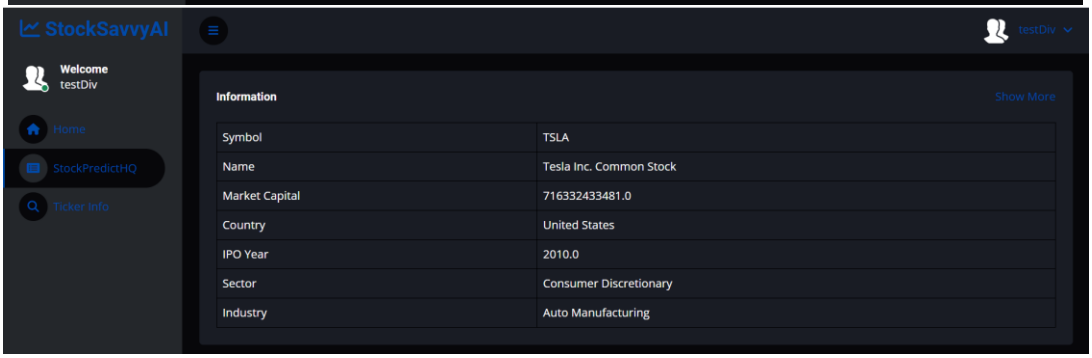
The model architecture has two LSTM layers with 128 and 64 LSTM cells, respectively. The input shape of the first layer is defined as (x_train.shape[1], 1), where x_train is the input data for the training set. The return_sequences argument of the first layer is set to True, which means the output of the layer will be a sequence of outputs for each input time step, rather than just a single output. The second LSTM layer has return_sequences set to False, which means it only outputs a single output value for the whole input sequence.

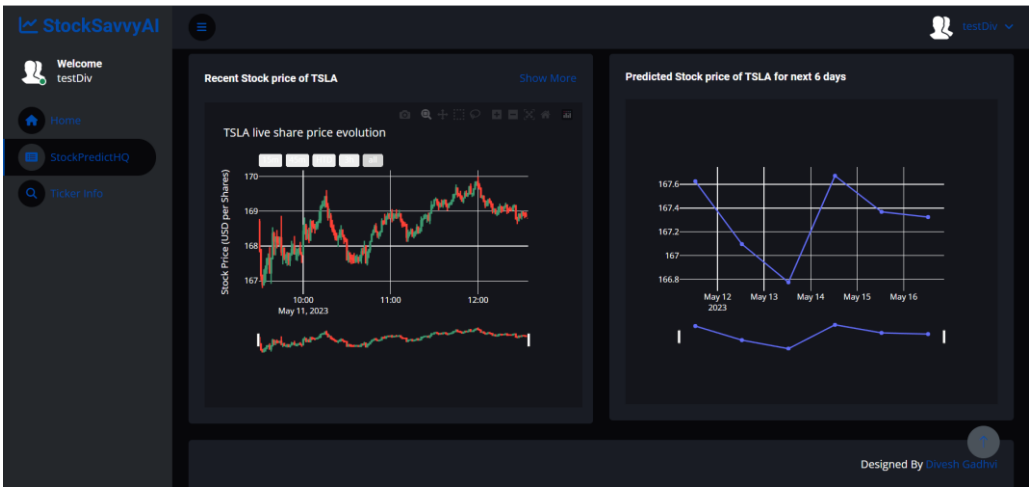
After the LSTM layers, there are two fully connected Dense layers. The first has 25 units, and the second has 1 unit, which is the output of the model. The final output is a single value representing the predicted output for the given input sequence. The loss function used for training the model is mean squared error, and the optimizer used is Adam, which is an adaptive learning rate optimization algorithm that is well-suited for deep learning applications. The model is trained using a batch size of 1 and for 50 epochs, which means that the training data is split into batches of one sample each and the model is trained for 50 iterations over the entire training set.

Overall, this model is designed to take in a sequence of input data, such as a time series, and output a single prediction value.

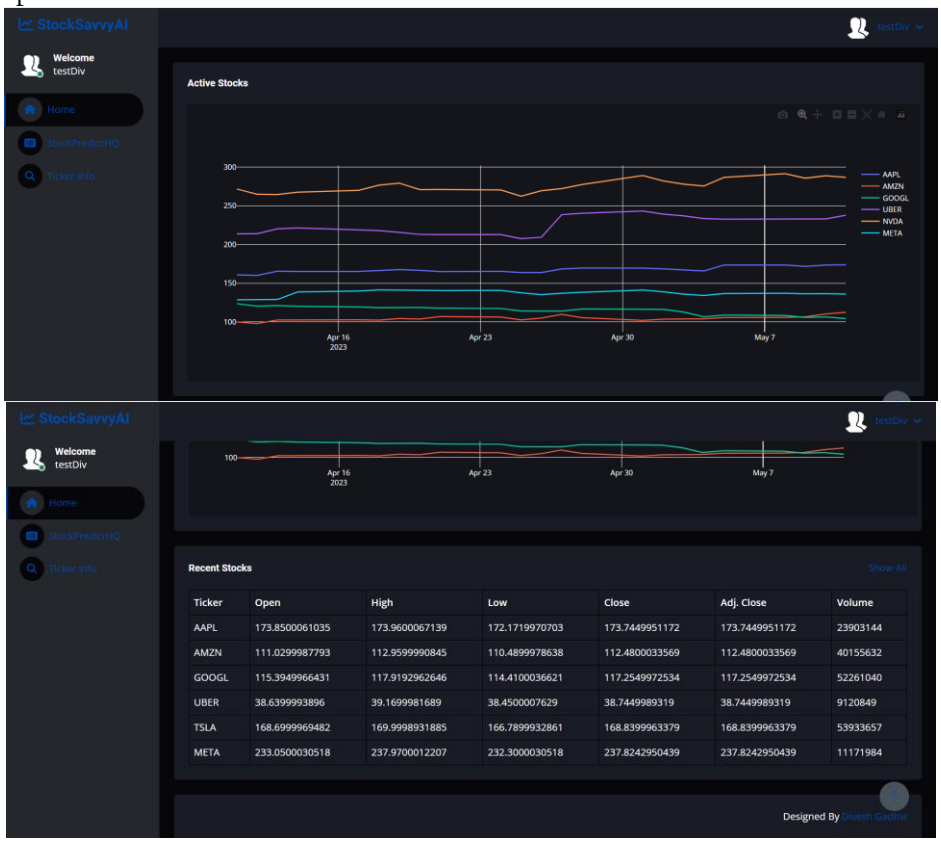
The above trained model is used to predict the stock price for the specified number of days, based on the most recent historical data available. The predicted stock prices are displayed to the user in the web application using a charting library such as Plotly and Matplotlib. The user can interact with the application service by specifying the stock and number of days for which they wish to predict the stock price.







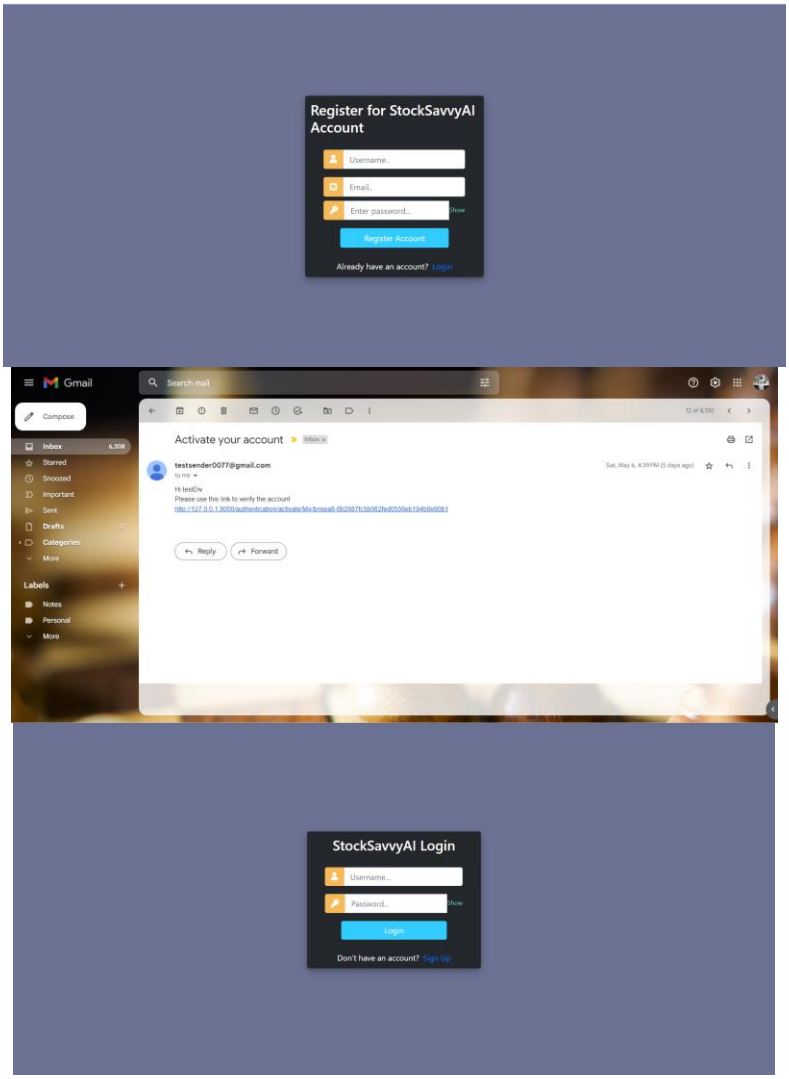
The user is also provided with a dashboard wherein they can see a visual representation of the top 6 stocks in the market. A line chart for six stocks (AAPL, AMZN, QCOM, META, NVDA, JPM) with their adjusted close prices plotted against date. This chart is displayed in the "Active Stocks" section of the dashboard. This chart is helpful in providing the user with a quick glance of the performance of these stocks over a period of time. Also, a table of recent stock data for six stocks that shows the open, high, low, close, adjusted close, and volume data for each stock is displayed on the dashboard. This table is displayed in the "Recent Stocks" section of the dashboard. This table is useful in providing the user with a more detailed view of the performance of these stocks over a specific period of time. The combination of the line chart and the table provides the user with a comprehensive understanding of the recent performance of these six stocks in the market.



The StockSavvyAI web application also provides a user login feature that involves three main steps: user registration, account activation, and user login.

1. User registration: In order to register, a user needs to input their desired username, email id, and password. The application will validate all inputs to ensure that the username is not already taken and that a valid email id is entered. If any of the inputs are invalid, the user will be prompted to correct them before proceeding. Once all inputs are validated, the user can click on the "Register" button to complete the registration process.
2. Account activation: After successful registration, the user will receive an activation link on the email id used during registration. This link is used to activate the account and the user will not be able to login without completing this step. Once the user clicks on the activation link, the account will be activated, and the user will be redirected to the login page.
3. User login: Once the user's account is activated, they can login using the username and password used during registration. Upon successful login, the user will have access to the features and functionalities provided by the StockSavvyAI application.

Overall, the user login feature in StockSavvyAI provides a secure and convenient way for users to access the application's functionalities while ensuring that only authorized users can access the system.



6. Evaluation

Stock price prediction being a fundamental regression problem, we can use RMSE (Root Mean Squared Error) or MAPE (Mean Absolute Percentage Error) to measure how close or far off our price predictions are from the real world.
Looking closely at the formula of RMSE, we can see how we will be able to consider the difference (or error) between the actual (At) and predicted (Ft) price values for all N timestamps and get an absolute measure of error.

$$RMSE = \sqrt{\frac{1}{N} * \sum_{t=1}^{N} (At - Ft)^2}$$

```
# Get the root mean squared error (RMSE)
rmse = np.sqrt(np.mean(((predictions - y_test) ** 2)))
rmse
```

```
5/5 [==============================] - 1s 11ms/step
```

```
7.437895134106755
```

We note that LSTM was able to achieve decent RMSE values despite the data complexity. Further, we note that creating even deeper networks did not help improve the test performance.

7. Claims

In conclusion, investors who want to make wise investing decisions might benefit from using the StockSavvyAI web application, which was created using Django and Yahoo Finance data. The web application can effectively forecast future stock values and offer users real-time updates on stock quotations by using machine learning algorithms and historical financial data.

The web application's data processing algorithm is crucial because it enables the analysis and transformation of historical financial data from Yahoo Finance into a format that machine learning models can easily use. As a result, predictions are more accurate, and users receive more insightful information about market trends. The performance of an LSTM model used for the prediction can be evaluated using a variety of metrics, including Mean Squared Error (MSE) and Root Mean Squared Error (RMSE). A lower RMSE indicated better performance.

Overall, the stock market prediction web application is a valuable tool for anyone interested in applying machine learning to make wise investing decisions. This webservice can assist investors in making more well-informed and effective investing decisions by properly forecasting future stock prices and providing real-time updates on stock quotes.

References

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