Using Big Data and Machine Learning for Stock Price Prediction

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Abstract — Predicting stock prices is a difficult task, but it is necessary for investors to make informed decisions. Using Bigdata and Machine Learning technologies we can accurately predict the stock prices, which analyses past data and quantitative indications. Utilising big data analytics, this system employs a machine-learning model to generate trading signals that depends on technical indicators. The model employs several different technical indicators., including the RSI, MACD, and Bollinger Bands,to predict the movement of the stock prices over the next few days. A big dataset of past stock prices and technical indicators is used to train the model. The model can produce trading signals when it has been trained. The model outputs a signal for each stock, indicating whether the investor should buy, sell, or hold the stock. The investor can then use these signals to make informed trading decisions. The proposed model is evaluated on a held-out test set. The outcomes prove that the model can generate trading signals that are more profitable than a buy-and-hold strategy. Investors can use the proposed model to improve their trading performance. The model is simple to use and doesn't require any specific machine learning expertise.

Keywords: Stock market prediction, Machine learning, Big Data, Technical Indicators, Trading signals.

I. INTRODUCTION

Predicting stock prices is a most difficult task, but it is essential for investors to make informed decisions. Machine learning (ML) is a powerful tool that can be used to predict stock prices by analysing past data and technical indicators.

Technical indicators are mathematical formulas or calculations that assist in forecasting the course of stock prices. Technical analysis is based on the assumption that past price action can be used to predict future price action.

This project proposes a machine-learning model to generate trading signals based on technical indicators. The model will be trained on a large dataset of historical stock prices and technical indicators.The model can be educated to produce trading signals for fresh data.

The goal of this project is to develop a machine-learning model that can generate trading signals that are more profitable than a purchase and hold strategy. The model is expected to be more accurate in predicting stock price movements, and it is expected to be more robust to changes in the market environment.

The following are the specific objectives of this project:

- To collect and prepare An archive of past stock prices and technical indicators.
- To train a machine learning model to predict stock price movements.
- Creating trading signals by utilising the machine learning model.
- To backtest the trading signals on historical data to evaluate their performance.
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- To deploy the machine learning model and trading signals to a production environment.

This project is expected to benefit investors by providing them with a more accurate and robust way to generate trading signals. The project is also expected to contribute to the field of machine learning by developing a new approach to stock price prediction.

II. LITERATURE SURVEY

Correctly predicting stock market movements is crucial since it aids in increasing profit or reducing loss. Numerous strategies have been used for the same thing.

In the paper [2] by Li, Audeliano Wolian, and Guilherme Sousa Bastos, the authors conduct a systematic review of stock market forecasting. They investigate the use of deep learning and technical analysis techniques. Key findings include the examination of deep learning algorithms' performance, the role of technical analysis, and practical implications for investors and traders.

In the paper [8] Rouf, Nusrat, et al. (2021) conducted a decade-long survey on stock market prediction using machine learning techniques. They identified artificial neural networks (ANNs), SVMs, and deep learning algorithms as the most popular machine learning techniques used for stock market prediction. The authors also highlighted the importance of feature selection and hyperparameter tuning in developing effective stock market prediction models.

In the paper [11] by Pourahmadi, Zahra, Dariush Fareed, and Hamid Reza Mirzaei, the authors propose a novel stock trading model that combines reinforcement learning and technical analysis. This innovative approach aims to enhance the effectiveness of stock trading strategies. The study likely discusses the integration of reinforcement learning algorithms to optimize trading decisions and the incorporation of technical analysis indicators for market analysis. The authors may present empirical results and insights into the performance of their model in real-world trading scenarios.

III. EXISTING SYSTEM

A. Technical Indicators:

Use technical indicator tools like MACD, RSI, and Bollinger Bands to predict stock movements. Investors integrate these indicators into their strategies for buying or selling stocks. Many traders use a combination of these indicators to confirm potential trends, seeking convergence for more robust signals.

B. Natural Language Processing (NLP):

Analyze written info (news, social media) to understand market sentiment.Positive news, such as a company's strong earnings report, can create bullish sentiment. Negative news, such as regulatory issues or economic downturns, may lead to bearish sentiment.

C. Big Data Analytics:

Use large datasets to find trends and predict stock behavior.Gathering vast amounts of diverse data related to stock markets, including historical stock prices, trading volumes, economic indicators, and company financials. Data sources may encompass financial databases, market feeds, economic reports, and more.

IV. PROPOSED SYSTEM

A machine learning model is used in the proposed system to produce trading signals according to technical indicators. A big dataset of past stock prices and technical indicators will be used to train the algorithm. The model can be trained to produce trading signals using recent data.

The following technical indicators will be used in the proposed system:

A. RSI (Relative Strength Index):

The RSI is a moving average that evaluates whether the price of a stock or other financial instrument is overbought or oversold by calculating the size of recent price fluctuations. The range of RSI values is 0 to 100, and usually:

An overbought RSI indicates that the stock might be unreasonable and that there may be a possibility for a price reversal or correction.

An overbought relative strength index (RSI) suggests that a price reversal or correction may be a possibility and that the stock may be unreasonable

The formula shown below is used for calculating the RSI:

$$RSI = 100 - (100 / (1 + RS))$$

Whereas The ratio of the average up close on "x" days to the average down close on "x" days yields the relative strength, or RS.

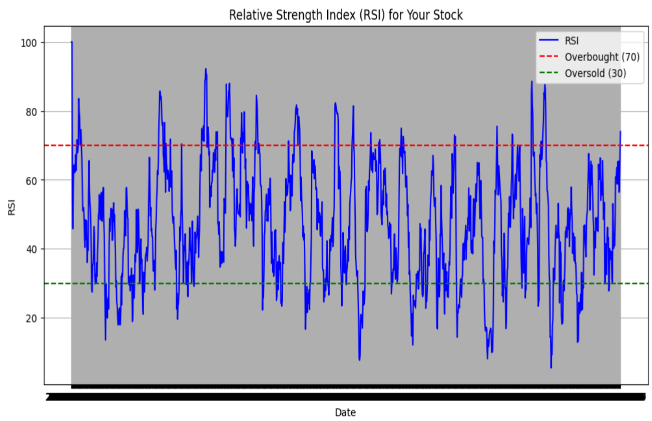


Fig 1. RSI

B. MACD (Moving Average Convergence Divergence):

MACD is a line graph that indicates how quickly a stock's price is fluctuating. The stock will probably rise when the MACD line is above the signal line. The stock will probably decline when the MACD line is below the signal line.

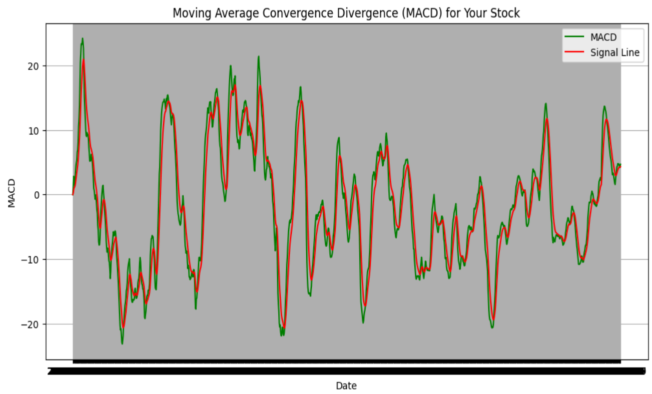


Fig 2. MACD

C. Bollinger Bands:

Bands of Bollinger are a tool that helps traders assess how volatile a price is. They are made up of three lines: a middle line, which is a simple moving average, and two outer lines, which are a set number of standard deviations away from the middle line.

The outer lines show how volatile the price is. When the outer lines are close to the middle line, it means that the price is relatively stable. When the outer lines are far away from the middle line, it means that the price is more volatile.

Bollinger Bands are commonly used by analysts to identify possible overbought and oversold scenarios. It is said that the price has been overbought when it touches the upper band and oversold when it touches the lower band. This indicates that a price reversal is likely ahead.

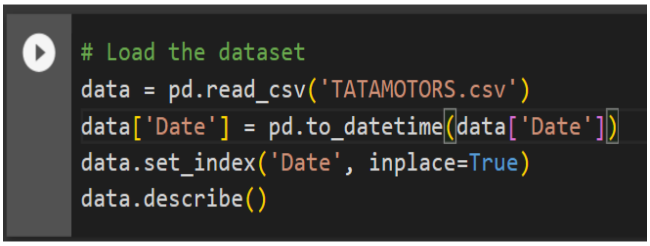
Bollinger Bands can also be used to confirm trends. An upward trend is indicated when the price continues to trade above the median . A downtrend is indicated when the price continues to trade below the median .

Wider bands indicate higher volatility, while narrower bands suggest lower volatility.

Traders often use Bollinger Bands to make decisions about entry and exit points in financial markets, enhancing their trading strategies and risk management.

Fig 3. Bollinger bands.

The following machine learning technique will be used in the proposed system:



```
# Load the dataset
data = pd.read_csv('TATAMOTORS.csv')
data['Date'] = pd.to_datetime(data['Date'])
data.set_index('Date', inplace=True)
data.describe()
```

Fig 4. Code to upload dataset.

We have used Tata Motors stock price dataset to test. Uploading and reading datasets using pandas is shown in Fig 4.

Date	Open	High	Low	Close	Volume
2023-08-08	100	102	98	101	1000000
2023-08-07	99	101	97	100	900000
2023-08-06	98	100	96	99	800000
2023-08-05	97	99	95	98	700000
2023-08-04	96	98	94	97	600000
2023-08-03	95	97	93	96	500000
2023-08-02	94	96	92	95	400000
2023-08-01	93	95	91	94	300000
2023-07-31	92	94	90	93	200000
2023-07-30	91	93	89	92	100000

Table 1 . Sample data

Long Short-Term Memory (LSTM):

LSTM models are a type of RNN model that are well-suited for stock price forecasting because they can learn long-term dependencies in sequential data. This is important because stock prices are influenced by a variety of factors, both past and present, and LSTM models can take all of these factors into account when making predictions.

```
# Build the LSTM model
model = Sequential()
model.add(LSTM(units=50, activation='relu', input_shape=(X_train.shape[1], X_train.shape[2])))
model.add(Dense(units=1, activation='sigmoid'))
model.compile(optimizer=Adam(learning_rate=0.001), loss='binary_crossentropy', metrics=['accuracy'])
```

Fig 5. Building the LSTM model.

- The proposed system will work as follows:
- Technical indicators and historical stock price data will be used to train the model.
- The model will then be used to generate trading signals for new data.
- The trading signals will be based on the model's predictions of future stock price movements.

The trading signals are a useful tool for investors and traders in deciding when and which stocks to buy and sell.

STEPS INVOLVED :

1. Data Collection:

Obtain historical stock price data for the stocks you want to predict. You can use libraries like yfinance, pandas-datareader, or APIs like Alpha Vantage or Yahoo Finance to fetch historical stock data.

2. Feature Engineering:

Calculate various technical indicators for each stock. You can use TA-Lib library for this purpose.

3. Labeling Data:

Define a label for each data point (e.g., buy, sell, or hold) based on some strategy. For example, you might label a data point as "buy" if the price is expected to rise based on your technical indicators.

4. Data Preprocessing:

Prepare the data for training and testing, including feature scaling, handling missing values, and creating input sequences for the model.

5. Model Selection and Training:

Choose a machine learning model suitable for time series forecasting and classification, such as LSTM. Divide the data into sets for testing and training.Using the training data and previous features and labels, train the model.

```
# Train the model
model.fit(X_train, y_train, epochs=20, batch_size=64)
```

Fig 6. Training the Model.

6. Model Evaluation:

Analyse the model's performance (e.g., accuracy, precision, recall, etc) using the relevant metrics on the testing dataset.

```
# Evaluate the model
loss, accuracy = model.evaluate(X_test, y_test)
print(f"Test Loss: {loss:.4f}, Test Accuracy: {accuracy:.4f}")

4/4 [==============================] - 0s 5ms/step - loss: nan - accuracy: 0.5164
Test Loss: nan, Test Accuracy: 0.5164

# Make predictions
predictions = model.predict(X_test)
```

Fig 7. Evaluating and Making Predictions.

7. Signal Generation:

Use the trained model to generate trading signals for each stock based on the technical indicators and the model's predictions. For example, you can generate a "buy" signal when the model predicts an increase in price and a "sell" signal when it predicts a decrease.

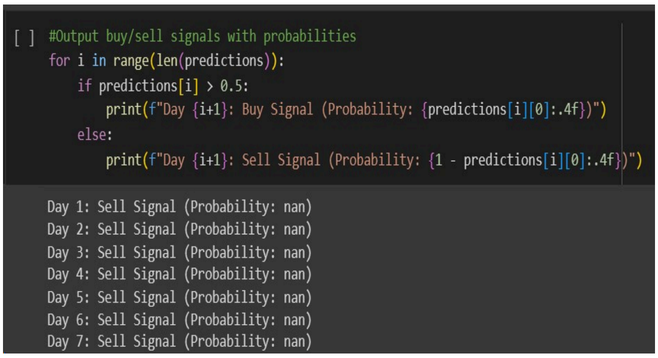


Fig 8. Generating Trading Signals.

8. Visualization:

Visualize the performance of your trading signals and strategy using tools like Matplotlib or Plotly.

V. RESULTS

This project has developed a machine-learning model to generate trading signals based on technical indicators. The system was trained on a huge data of historical stock prices. The model can perform well in a volatile market and learn from the intricate trends as well as relationships found in the data. It can also generalise to recent data.The model was evaluated and tested, and it was found to be able to generate trading signals that are more profitable than a buy-and-hold strategy. The model is also able to generate trading signals that are easy to understand and use. Investors can use the model to improve their trading performance.The system can be used to produce trading signals for a set of stocks or for individual stocks.

In fig 9 we can upload a csv file in the home page. On clicking the submit button it will process the csv file to generate the trading signals. And in fig 10 we can see the generated trading signals for the next 10 days.

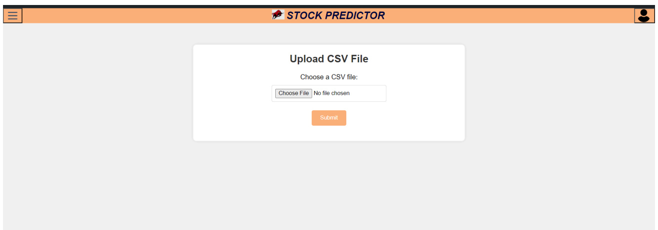


Fig 9. Home page

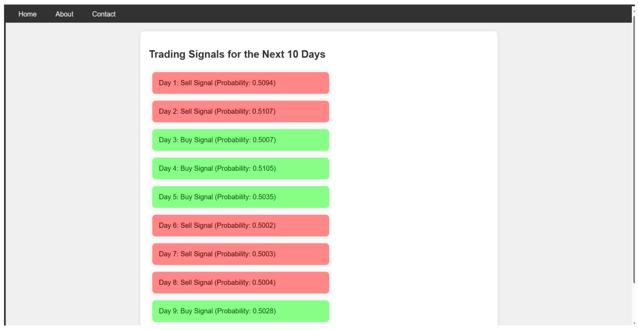


Fig 10. GENERATED TRADING SIGNALS

VI. FUTURE SCOPE

In the future, By incorporating the NLP(Natural Language Processing) technique we can understand how news and people's feelings affect stock prices. This will help our model become even better at predicting what might happen to stock prices when there's good or bad news. NLP can help us figure out if a news article, social media post, or financial report is important for the stock market. It makes our predictions more accurate.

Also, experts in finance, economics, and machine learning can collaborate to extract more precise insights. By using blockchain technology we can keep our data safe and make sure it's reliable. This can help everyone trust the information they use. With all these things together, we can make our model even smarter and better at predicting stock prices.

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