Cryptocurrency Price Prediction using LSTM & MLP in Machine Learning

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ABSTRACT- Considering the growing interest, in cryptocurrency, Bitcoin and the need to manage risks in market conditions a research study has been conducted to predict Bitcoin prices. The study uses Long Short Term Memory (LSTM) and Multilayer Perceptron (MLP) type of networks, which are well-known for their capacity to recognize patterns in data over extended periods of time, to address the intricacies of cryptocurrency markets.The research leverages Bitcoin stock queries along with price and trading data integrating them with Yahoo Finances dataset. This integration likely includes indicators, market sentiment analysis or relevant data that enhance the LSTM models understanding of what influences Bitcoin prices. By exposing the LSTM model to sequences of data during training it can discern patterns and relationships necessary for accurate predictions. The goal is to provide investors with insights into Bitcoin prices through these assessments and assist in decision making while minimizing financial risks. The study acknowledges that predicting cryptocurrency prices is challenging due to market volatility but emphasizes that leveraging network architectures like LSTM and comprehensive financial data from platforms such as Yahoo Finance can lead to more informed analyses and forecasts, in this dynamic landscape of cryptocurrency investments.

KEYWORDS: Cryptocurrency, LSTM, Bitcoin Stock Market Prediction, Bitcoin Confirmation, MLP

I. INTRODUCTION

The name of the first and most prominent cryptocurrency is Bitcoin. It is a peer-to-peer ledger program based on encryption, blockchain, and distributed ledger technology. In the field of financial technology, several mathematical models exist to determine the price of bitcoin in the future. These models will describe the results for quantitative investors. Just like the prices of stocks and products fluctuate through time, bitcoin prices are a steady series of predictions. However, one critical distinction between stocks and bitcoin is that equities only exchange during business hours from Monday to Friday. Unlike other goods, cryptocurrency trading hours exist on weekdays. With a market that never sleeps, there will always be surprise changes in bitcoin prices, Ye[1].

Recent studies have utilized techniques such, as analyzing time series data employing machine learning algorithms and utilizing natural language processing to identify trends in the fluctuations of cryptocurrency prices[2]. Unlike currencies cryptocurrencies were created for transactions[3]. Are built on decentralized control principles. Many countries have acknowledged cryptocurrencies, as forms of payment. Researchers studied the effectiveness of network models such, as CNN feedforward neural networks and gated recurrent units. Among these models the CNN model displayed a percentage error of 0.08. Consistently achieved the highest explained variance score of 0.96. In a research study long short term memory (LSTM) and gated recurrent units (GRU) were employed to predict cryptocurrency price movements[5].

An action recommendation algorithm was developed based on sentiment analysis on Twitter to advise investors on the best course of action for optimizing profits. The suggestions were "sell," "buy," and "wait." The investigation's findings showed that the recommended strategy performed better than the conventional ways and was backed by statistical evidence [6]. This has generated a lot of interest from academics looking to forecast bitcoin values. By utilizing particular indices, interpreters are able to evaluate price changes and obtain professional opinions. Robotic systems have the potential to forecast bitcoin prices in a manner akin to that of predicting popular stock searches. In every LSTM module, RNNs are integrated. Hoch Reiter and Schimidhuber developed and improved upon LSTM in 1997. Similar to RNNs, LSTM modules have different thicknesses. An analytical method with several dimensions is provided by the application of LSTM modules in predicting the behaviour of cryptocurrencies. Especially, LSTM modules have an adaptable architecture that enables the addition of different thicknesses, just like RNN modules. This natural flexibility allows for more in-depth analysis of the underlying trends and patterns by enabling detailed assessments of the dynamics of the bitcoin market. Furthermore, the capability of LSTM can identify long-term dependencies in sequential data sequences gives analysts the ability to recognize minute changes and predict future movements in the market more accurately.

II. LITERATURE SURVEY

A. DIGITAL MONEY AND BITCOIN

Zhang et al.[8] he innovative approach to cryptography confused the by stopping signers from figuring out the technology involved, academics from both academia and industry can be involved. B-Plutocrat encouraged the expansion of virtual currencies. Plutocrat is a decentralized, anonymous digital payment system that was developed by Wei Dai . This device works with protocols based on an untraceable community, where all interactions are color-coded from sender to recipient and senders and recipients are connected together like public keys.

B. METHODS FOR PREDICTING THE PRICE OF BTC

Research on cryptocurrency forecasts is rather popular. Sattarov Otabek et al. [9] chart analysis of bitcoin prices using with SVM and logistic regression's assistance. Huisu Jang et al. analysis on bitcoin data used Bayesian Neural Networks to forecast and customize bitcoin prices. Researchers have also used ensemble neural networks to predict bitcoin values. The Synthetic Neural Community and Arief Radityo et al. have tried to forecast the price of bitcoin. Practical indicators and indications for the market are incorporated, but the outcomes fall short of average performance. A device learning technique as a way to automatically anticipate bitcoin values. A prediction system based on LSTM was created by Chih-Hung et al.

C. THE CHARGE PREDICTION APPROACH FOR CRYPTOCURRENCY

Balcilar [10] focused on predicting the cryptocurrency stock market is comparable to predicting the traditional stock market. When we try sentiment analysis, we can fail or receive unexpected findings. The distributed nature of bitcoin sets it apart from fiat money and the stock market. The same collection of indications may be used to anticipate the bitcoin process using a variety of algorithms, including SVM, Naive Bayes, and regression approaches, to enhance outcomes.

When making forecasts it's important to use cryptocurrency in the way it was meant to be used. For example we can use techniques, like short term memory (LSTM) to gauge the value of today or tomorrows prices or we can make quality predictions by analyzing signals or pricing trends. Accuracy and outcomes increase when any prediction method or approach is used with the prediction set of pointers.

This study presents several approaches and discusses earlier research on a few publications. Market-sensible analysis uses media charts to assess price changes. Accuracy and outcomes increase when any prediction method or approach is used with the prediction set of pointers. This study presents several approaches and discusses earlier research on a few publications. The information gathered can be used to forecast future pricing. Models called Autoregressive Integrated Moving Averages (ARIMA) are used to predict values over a given threshold. It seldom functions when data is fluctuating in real-time, which makes it risky.

III. METHODOLOGY

Dataset Analysis

The Yahoo website's finance area [4] is where the historical values of Bitcoin can be discovered. CSV datasets are used for price forecasting on bitcoin. Our selection process involves a 3290-day timeframe, beginning on January 1, 2015, and ending on January 3, 2024, for the historical bitcoin values.

	Date	Open	High	Low	Close	Adj Close	Volume
0	2015-01-01	320.434998	320.434998	314.002991	314.248993	314.248993	8036550.0
1	2015-01-02	314.079010	315.838989	313.565002	315.032013	315.032013	7860650.0
2	2015-01-03	314.846008	315.149994	281.082001	281.082001	281.082001	33054400.0
3	2015-01-04	281.145996	287.230011	257.612000	264.195007	264.195007	55629100.0
4	2015-01-05	265.084015	278.341003	265.084015	274.473999	274.473999	43962800.0

Figure 1. Dataset of BTC

Data Visualization

The data is analysed by plotting graphs with the stock open, close, high, and low prices on a monthly basis. The analysis chart is presented for each year as well as for all the years combined.

Figure 2. Monthwise comparision between stock open and close price

In all of the months shown in Figure 2, the beginning price of the stock was greater than the closing price. Every month, there are two bars: the "Stock Open Price" bar represents the opening price, and the "Stock Close Price" bar represents the closing price.

Figure 3. Monthwise comparision between stock high and low price

A bar graph depicting the average monthly high and low closing prices of a stock over a full year is shown in Figure 3. Every month, there are two bars: one labelled "Stock High Price" and the other "Stock Low Price," which indicate the average high and low prices, respectively.

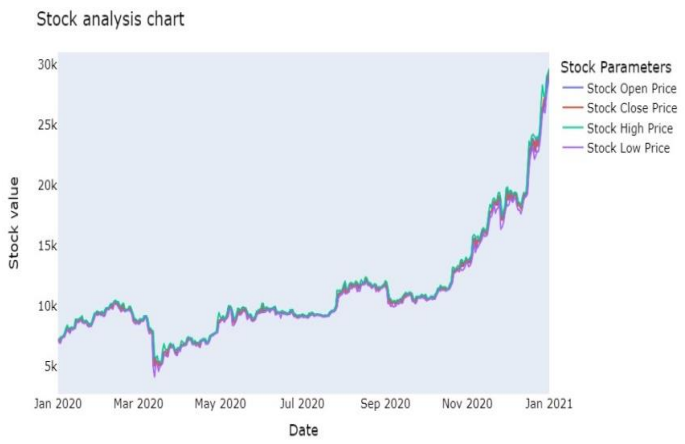


Figure 4. Stock analysis chart of year 2020

Line graphs depicting the historical pricing over time are shown in Figures 4 and 5. On the y-axis, the stock price is displayed, and on the x-axis, the date.

Based on the above graph we can analyse the following:

- **Trend:** Is the price of bitcoin going up, down, or sideways? Look at the overall direction of the line on the chart. If it's generally sloping upwards, the trend is up. If it's sloping downwards, the trend is down. If it's moving up and down without a clear direction, it might be sideways.
- **Volatility:** How much does the price fluctuate in the year? Look at how much the line on the chart zigzags up and down. The more it zigzags, the more volatile the price is.
- **Trading Range:** What is the highest and lowest price that the bitcoin has traded at in a given period? The highest price will be the highest point on the line within that time frame, and the lowest price will be the lowest point.

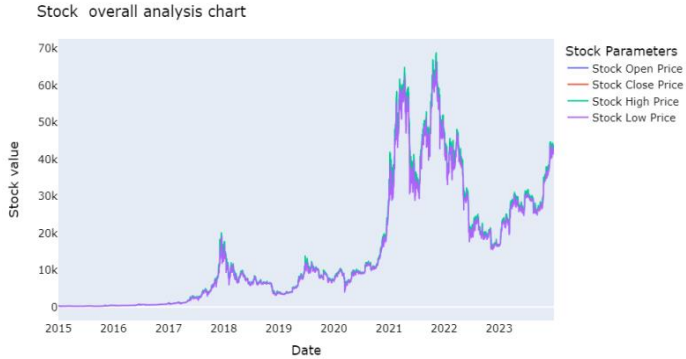


Figure 5. Stock overall analysis chart

Pre Processing Techniques

Before we could use the data, we had to clean it up by getting rid of any missing information and unusual values. This makes the data ready for training and testing our models.

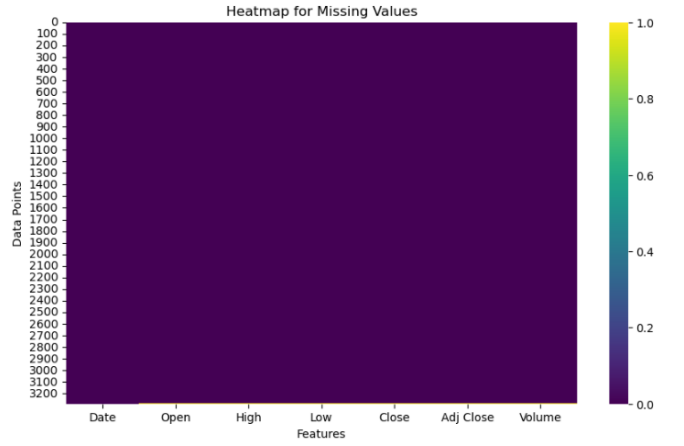


Figure 6. Heatmap for missing values

The heatmap for missing values in a dataset is shown in Figure6. Each row in heatmap represents an observation, and each column represents a dataset variable. The variables, for instance, have names like "Date," "Open," "High," and so forth, while the observations are integers with values between 0 and 3200.

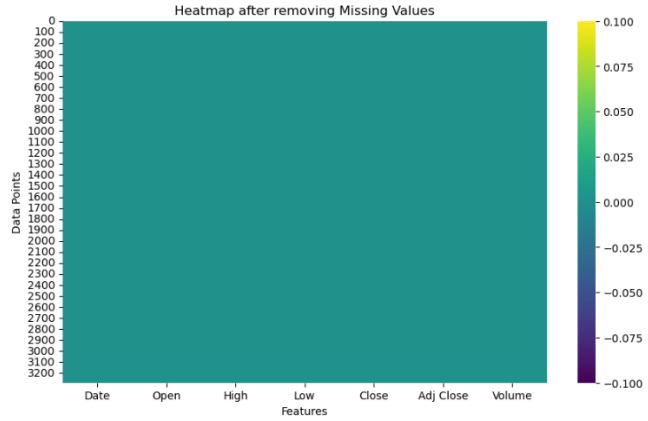


Figure 7. Heatmap after removing missing values

After missing values in a dataset are eliminated, the heatmap is shown in Figure 7. Every cell in the heatmap corresponds to a dataset variable (column) and an observation(row).

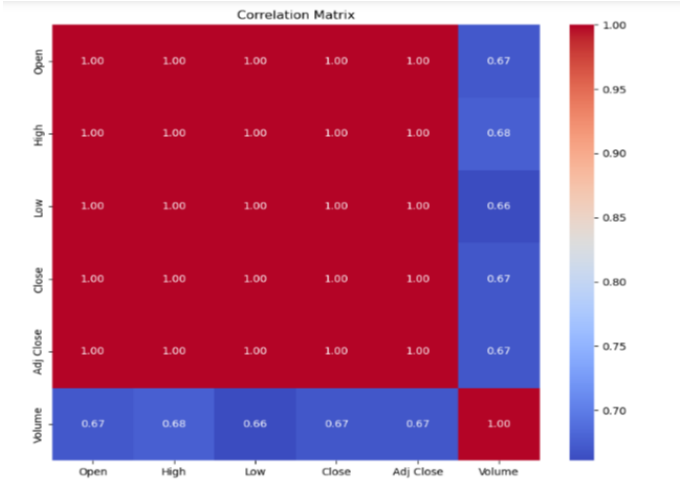


Figure 8. Correlation of the Data

Figure 8 displays a data correlation matrix. A correlation value of 1 indicates a strong association, 0 a neutral relationship, and -1 a weak relationship between the variables in the matrix, which is a table.

Data Splitting: We separated the data into two sets: 60% of the first set was used to train our models, and 40% of the second set was used to evaluate the effectiveness of the models.

Model Evaluation

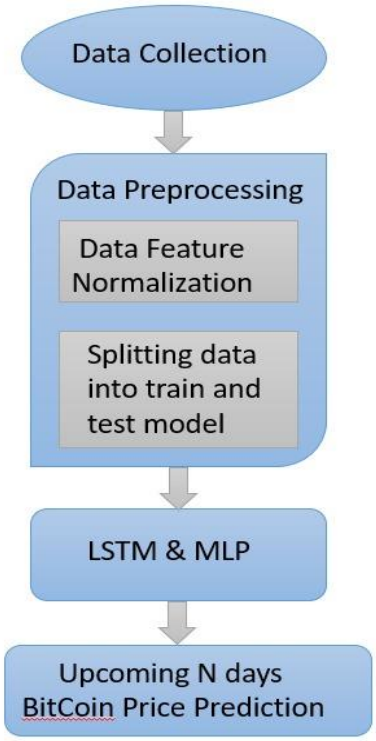


Figure 9. Proposed Method

Similar to RNN modules, LSTM modules possess recurrent consistency. An enhanced RNN model with several previously unidentified layers is called LSTM. RNN and LSTM have geometrical characteristics, however LSTM contains a hidden layer.
A special kind of RNN called LSTM (Long Short Term Memory) and MLP (Multilayer Perceptron) has been employed in the suggested strategy. Compared to RNN, this technique's primary benefit is its ability to enable long-term dependencies and produce accurate predictions.

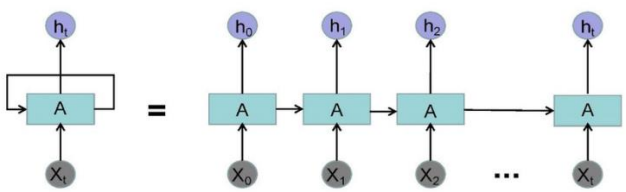


Figure 10. RNN's Expanded Structure

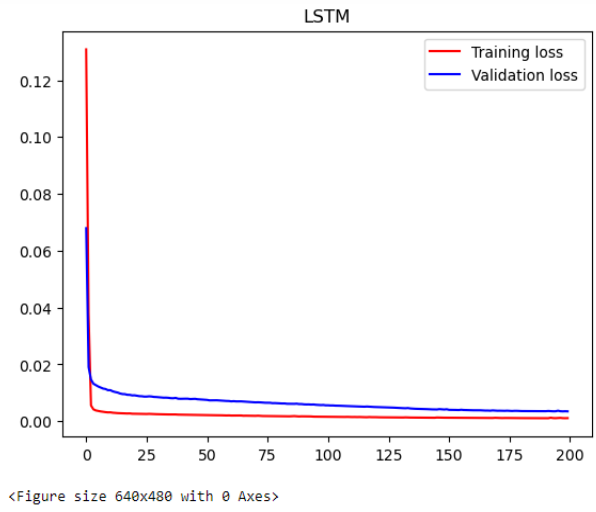
Figure 10 shows RNN flaws that can be identified in the early stages LSTM, in contrast to RNN, has the ability to use memory cells and gate devices to store memory at each entry.

```
In [78]: import matplotlib.pyplot as plt

         loss = history.history['loss']
         val_loss = history.history['val_loss']

         epochs = range(len(loss))

         plt.plot(epochs, loss, 'r', label='Training loss')
         plt.plot(epochs, val_loss, 'b', label='Validation loss')
         plt.title('LSTM')
         plt.legend(loc=0)
         plt.figure()
         plt.show()
```

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```

Figure 11. LSTM graph

This is the suggested model graph, which was created using the neural network mat plot package for LSTM (LONG SHORT TERM MEMORY).

```
In [81]: plt.plot(epochs, history.history['loss'], 'r', label='Training loss')
         plt.plot(epochs, history.history['val_loss'], 'b', label='Validation loss')
         plt.title('MLP')
         plt.legend()
         plt.show()
```

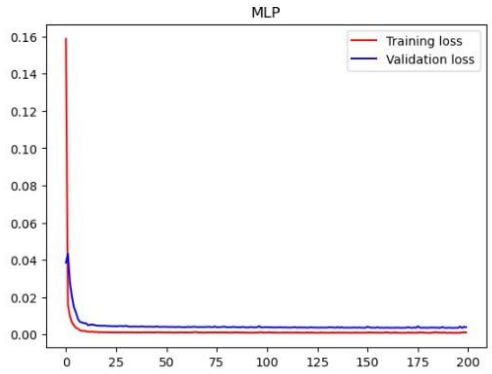

Figure 12. MLP graph

This is the suggested model graph created using the neural network mat plot package for MLP (Multi Layer Perceptron). When it came to forecasting future bitcoin prices, the MLP and LSTM models performed somewhat better than the current model.

Lastly, we evaluate the predictive power of the trained models using widely used metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE).

IV. RESULTS

We evaluate the correctness of models trained on historical and contemporary data, as well as look at different kinds of errors that were made, in the results section. We will also provide the expected outcomes of our online application and contrast our results with the latest research in the sector.

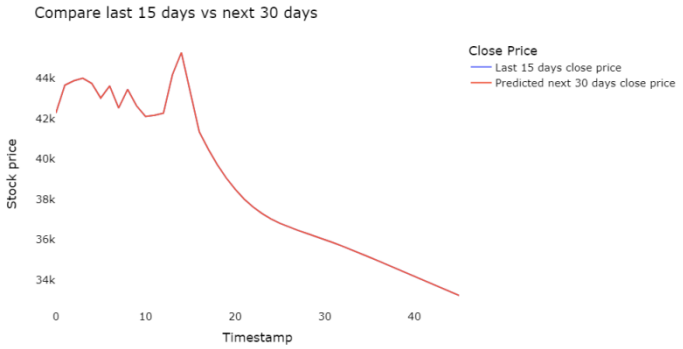

Figure 13. Graph plotted for 30-day prediction

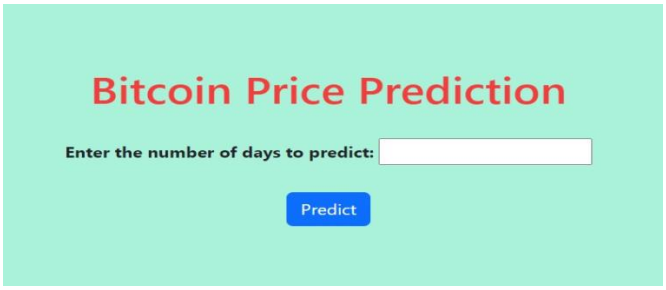

Figure 14. Price prediction form

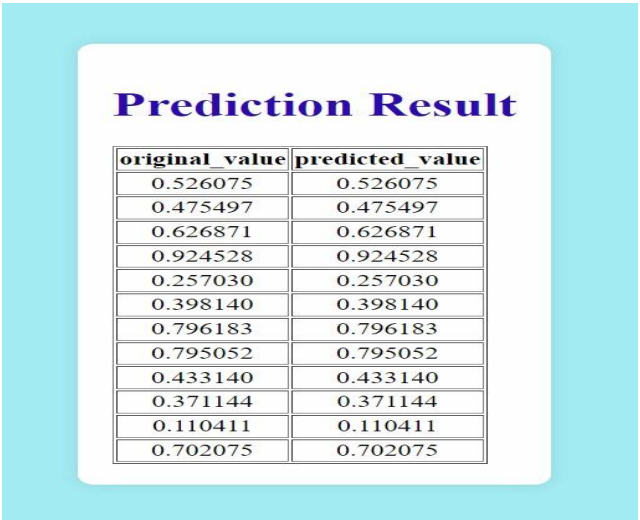

Figure 15. Prediction Result

The performance measures for several regression models are comprehensively compared in the table below. These were employed to evaluate the correctness of every model. These metrics are crucial indicators of the models' expected accuracy, applicability to fresh data, and predictability.

An improved fit between the model and the observed data is shown by an R2 score that is closer to 1, which sheds light on the model's fit. The mean absolute error, or MAE, provides a clear indication of prediction accuracy by measuring the average amount of errors between predicted and actual values.

Table 1: Model performance of regression models

Algorithm	**MAE**	**MSE**	**RMSE**
Linear Regression	8.36	127.96	11.31
Random Forest Regressor	1.78	8. 31	2.88
XGB Regressor	8.36	127.96	11.31
Decision Tree Regressor	1.43	4.32	2.07
LSTM	9.70	210	14.49

ACCURACY

Our suggested machine learning model forecasts Bitcoin values with 98% accuracy, which is a considerable improvement over current systems and demonstrates the model's effectiveness in predicting trends in the cryptocurrency market. With a high degree of accuracy, our model 98% of the time accurately forecasts the prices of Bitcoin in the test dataset, providing a trustworthy tool for traders and investors to make wise judgments. Our model outperforms existing methods and shows a superior capacity to use given data effectively, which might improve risk management and possibly lead to better financial outcomes.

This accomplishment raises doubts about the accuracy of our forecasts while also pointing to a significant influence on the decision-making processes involved in bitcoin trading.

Table 2: Accuracy for different algorithms

ALGORITHM	ACCURACY
Logistic Regression	88.7%
RandomForest Regressor	88.4%
XGB Regressor	88.6%
Decision Tree Regressor	87.7%
LSTM	98%
LSTM[20]	95%

V. CONCLUSION AND FUTURE SCOPE

The recommended version is compatible with the bitcoin inventory request from Yahoo Finance. The time series trail model and fine-tuning may be required to improve the accuracy and robustness of the predictions. The RMSE has a poor level of accuracy. Compared to the RMSE, it may be hundreds of points lower. As mentioned before, some discussion points correspond to stock needs. Consequently, investing in Bitcoin is not warranted by the LSTM Bitcoin value rate. Here, the model has been effectively applied to investigate how Bitcoin values fluctuate and provide insightful forecasts.

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