

Cryptocurrency Assets Valuation Based on LSTM: Evidence from Bitcoin, Ethereum, and Dogecoin

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Abstract. In recent decades, data analytics has become increasingly involved in people's daily lives. Machine learning, an important part of data analysis, has also been used in the financial sector. Contemporarily, the high volatility feature of cryptocurrencies has attracted lots of investors, which also brings lots of difficulty to predict and analyze. In fact, the price of cryptocurrencies can also be forecasted based on machine learning. This paper uses historical data of Bitcoin, Ethereum and Dogecoin as inputs to predict the future value based on the LSTM. LSTM model can learn the long-term dependencies in data. According to the analysis, mean absolute error calculate the average size of the error in a set of predictions, regardless of its direction. The results produced can roughly predict the future trends of these three cryptocurrencies. This paper combines the fields of machine learning and finance to predict the future value of cryptocurrencies. These results shed light on guiding further exploration of predicting cryptocurrency assets valuation based on LSTM model.

Keywords: LSTM; Cryptocurrency; Bitcoin; Ethereum; Dogecoin.

1. Introduction

The first cryptocurrency appeared in the world in 2009 with the birth of Bitcoin. Until 2022 there are now over 20,000 cryptocurrencies in the market. Underlying blockchain technology and reward mechanism are shared in all cryptocurrencies, but they are basically established on isolated transaction networks [1]. Cryptocurrency is a virtual currency that uses cryptography to secure legitimate and unique transactions [2]. Today, more and more people are getting involved in trading cryptocurrencies. As the most influential cryptocurrency, Bitcoin, has also become a form of payment in everyday life. The creation of Bitcoin perfectly solved the problem of trust model. Bitcoin is an electronic transaction system based on cryptographic proofs rather than trust, allowing any willing party to make a transaction [3]. Bitcoin and Ethereum are the most famous of all cryptocurrencies, and Dogecoin has been the most controversial in the last two years. It has received a lot of attention with its special name and the Twitter from Elon Musk. It is not an alternative deflationary numismatic instrument, but an inflationary leisured exploration of community-building around a cryptocurrency [4].

The value of cryptocurrencies usually fluctuates a lot, sometimes there are booms and sometimes there are busts. From a cryptocurrency trader's point of view, both up and down are predictable by prediction [5]. Investors can gain by buying ahead of cycles where they think they will generally go up even though there may be some volatility during the cycle. In less optimistic periods, they can short these cryptocurrencies through margin trading. Researchers and scholars have worked out various models and methods to predict the future value of cryptocurrencies, including but not limited to dynamic topic modeling, machine learning, data mining and text mining methods [6]. Since there are also commonalities and correlations between different cryptocurrencies, one can use random matrix theory and minimum spanning tree to investigate the cross-correlation between the price changes of various cryptocurrencies [7]. Politicians and businessmen often have different views on cryptocurrencies, ranging from full support to the fact that speculation in certain countries is illegal. This is mainly due to the large fluctuations in the exchange rates of cryptocurrencies and the uncertainty of the legality of cryptocurrencies [8]. It makes this act of investing in cryptocurrencies and on cryptocurrencies only from predictions fraught with risk. This has also led to trading related to cryptocurrencies becoming popular. Many researchers are looking for various ways to conduct research and value predictions on cryptocurrencies. There exists a large literature on computer

languages that provide methods and support for processing, analyzing, and predicting information related to cryptocurrencies [9]. Predicting time series data is an important lesson in economics, business, and finance [10].

Cryptocurrency investments and predictions have long been controversial. The value of cryptocurrencies may change with market expectations or national policies, but when investors know the future direction of the value of this cryptocurrency, it can assist investors in making decisions or give them some reference data when trading. When one has detailed historical data of a cryptocurrency, it becomes the easiest way to predict the value of the cryptocurrency chronologically. This paper focuses on the use of machine learning for predicting the future value of cryptocurrencies in time series model. The model analyzes the historical data of different cryptocurrencies in a chronological order to predict the price direction in the next ten days. The rest part of the paper is organized as follows. The Sec. 2 will introduce the data sources, data information, models, metrics, and the full research process. The Sec. 3 will show the results, tables, giving some correlation analysis and scenarios that can be applied. The Sec. 4 and 5 discuss the drawbacks of study and present an abrief summary, respectively.

2. Data & Method

2.1 Data

This paper uses three pieces of data from investing.com, which are about Bitcoin, Ethereum and Dogecoin respectively. This data contains historical data from September 26, 2021, to September 26, 2022, for a total of 366 days. This data includes the Date, Price, Open, High, and Low prices. Figs. 1, 2, and 3 show the graphs of volatility of Bitcoin, Ethereum, and Dogecoin from September 26, 2021, to September 26, 2022. They present the trend of Bitcoin, Ethereum, and Dogecoin's Price, Open, Low, and High prices fluctuations over the 366 days in the unit of one day. Bitcoin and Ethereum being the two most widely known of the cryptocurrencies, they are naturally worth a bit more. From September 6, 2021, whichever cryptocurrency is inside these three, regardless of the fluctuations, the overall value shows a decreasing form.

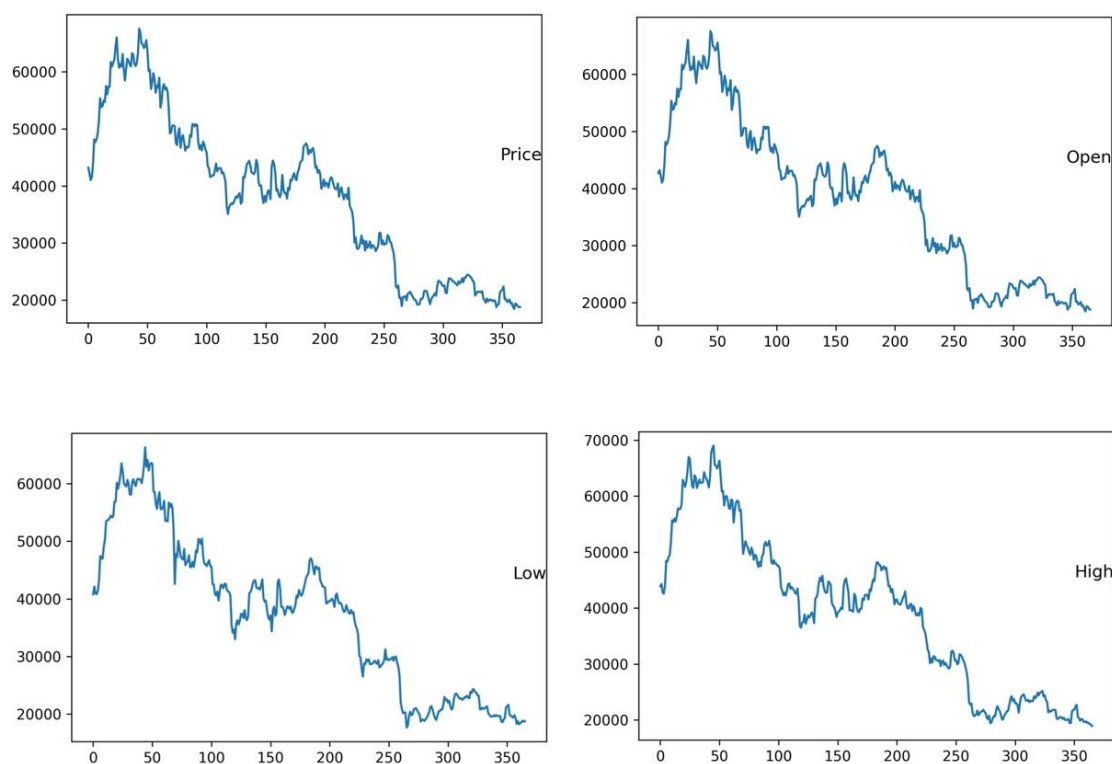


Figure 1. Volatility of Bitcoin

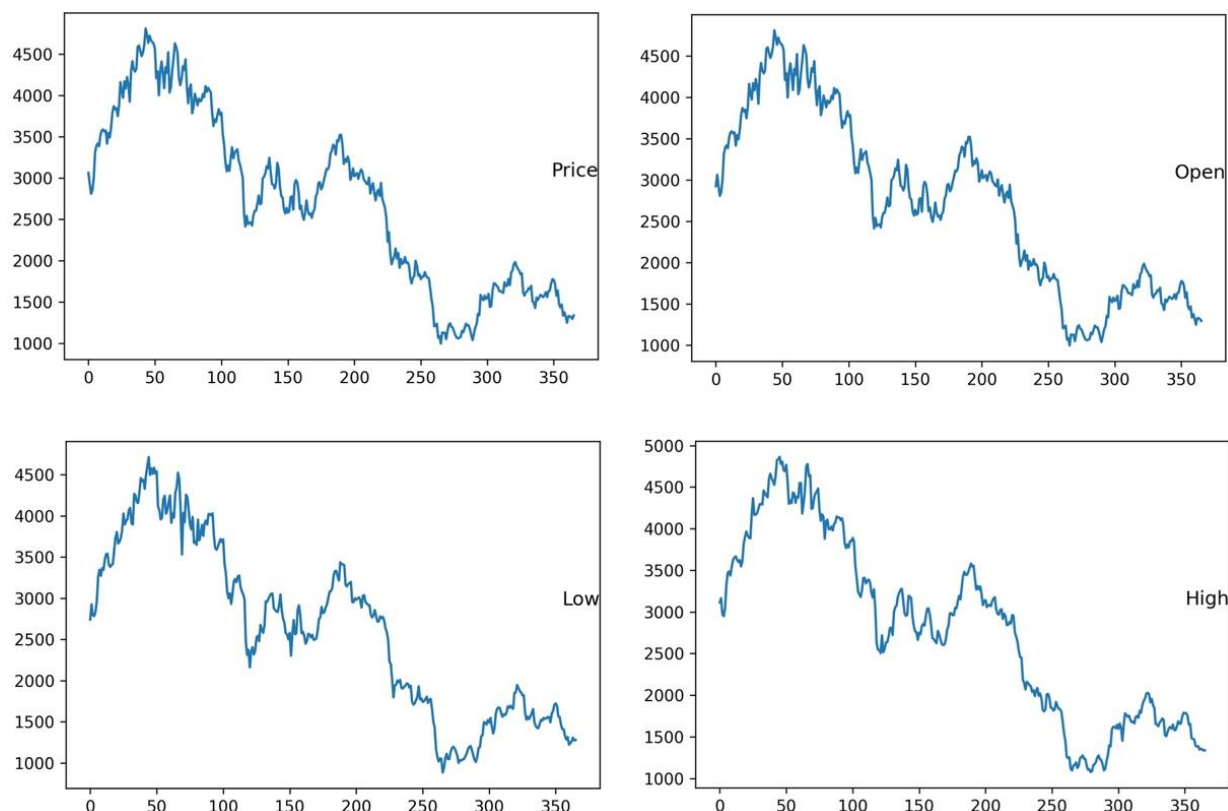


Figure 2. Volatility of Ethereum

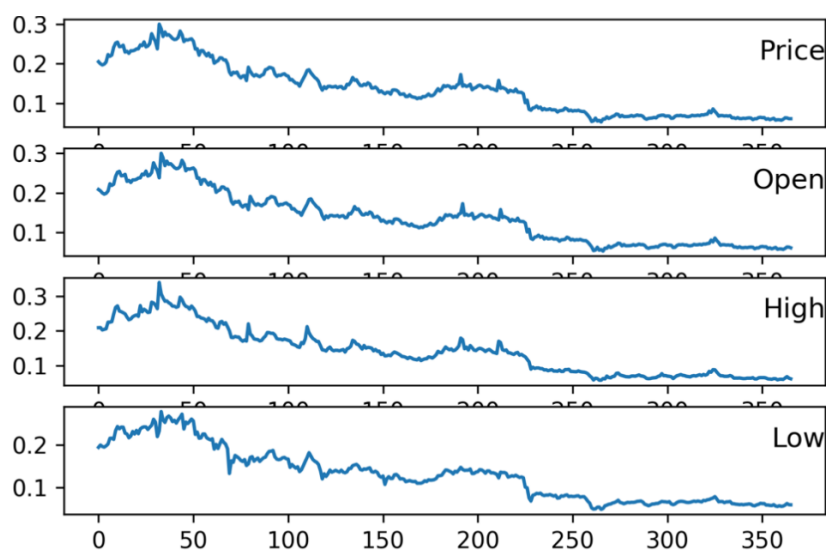


Figure 3. Volatility of Dogecoin

2.2 Model & Metrics

The model used in this paper is time series forecasting using sequence to sequence and the model requires a historical dataset. It is a deep learning model which need a sequence of data and generate another sequence of results. It can be used on a broad class of problem, including finance, economics, and neuroscience area. There are two essential keys in this model, repeat vector layer and time distributed layer. The repeat vector will repeat the context vectors from encoder and pass it to the decoder as an input. Stacking additional layers on the encoder and decoder part of the sequence-to-sequence model. By stacking LSTMs, one can improve the ability of the model. This paper calculates the mean absolute value of all the observations to check the error. It measures the absolute value of the observation errors.

2.3 Procedure

Finding data and writing code is a fundamental and indispensable part of this paper, and this paper utilizes one-year data for machine learning. All the numbers in this data regarding price, open, low, and high were converted into float type in python language. Based on this data, this paper uses matplotlib, a plotting library, to plot the price trends of the three cryptocurrencies over the course of the year for the different price categories. The inputs for this time series model are two days' data and using the input to forecast future ten days regarding price, open, low, and high. Using MinMaxScaler to scale features between -1 and 1 and making a function to monitor the learning algorithms. Converting train and test data in the split_series function. This paper creates two model to predict the future prices. The first model, E1D1, is a sequence-to-sequence model with one encoder layer and decoder layer and the second model, E2D2, is a sequence-to-sequence model with two encoder layer and decoder layer.

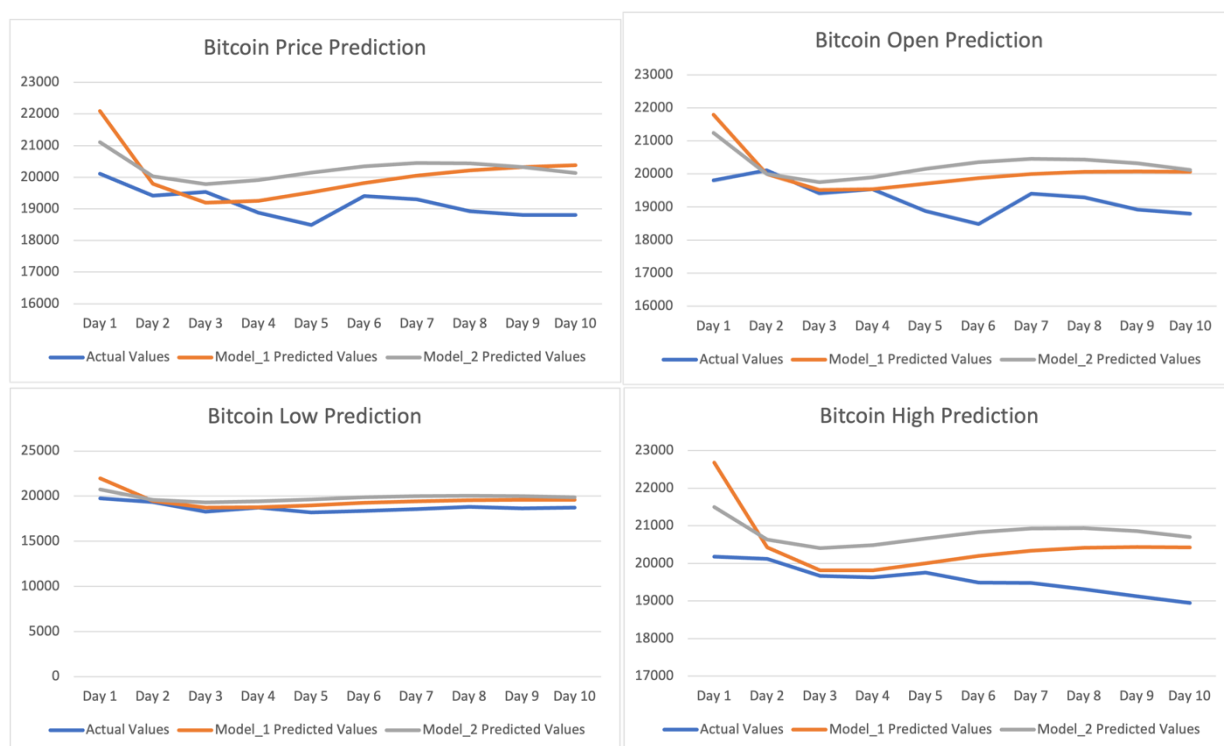


Figure 4. Bitcoin Prediction

3. Results & Discussion

Figs. 4, 5, and 6 are the prediction results for Bitcoin, Ethereum, and Dogecoin respectively. These forecasts include the price, open, low, and high for the next ten days. The predictions are made using two days of data. The ten-day forecast uses September 15, 2022, and September 16, 2022, as the input data. The day one of the forecast corresponds to September 17, 2022, and so on, and the tenth day of the forecast corresponds to September 26, 2022. The output contains the predicted value of E1D1, the actual value of that day, and the mean absolute value of E1D1. Similarly, the predicted value of E2D2, the actual value, and the mean absolute value are also included. From the outputs of prediction of two models, it can be observed that E1D1 model perform better than the E2D2 model in all three cryptocurrency predictions. For these results the blue line in the chart is the actual data, the orange line represents the price predicted by Model 1, and the gray line represents the price predicted by the model. The more closely the orange and gray lines fit the blue line, the more accurate the prediction.

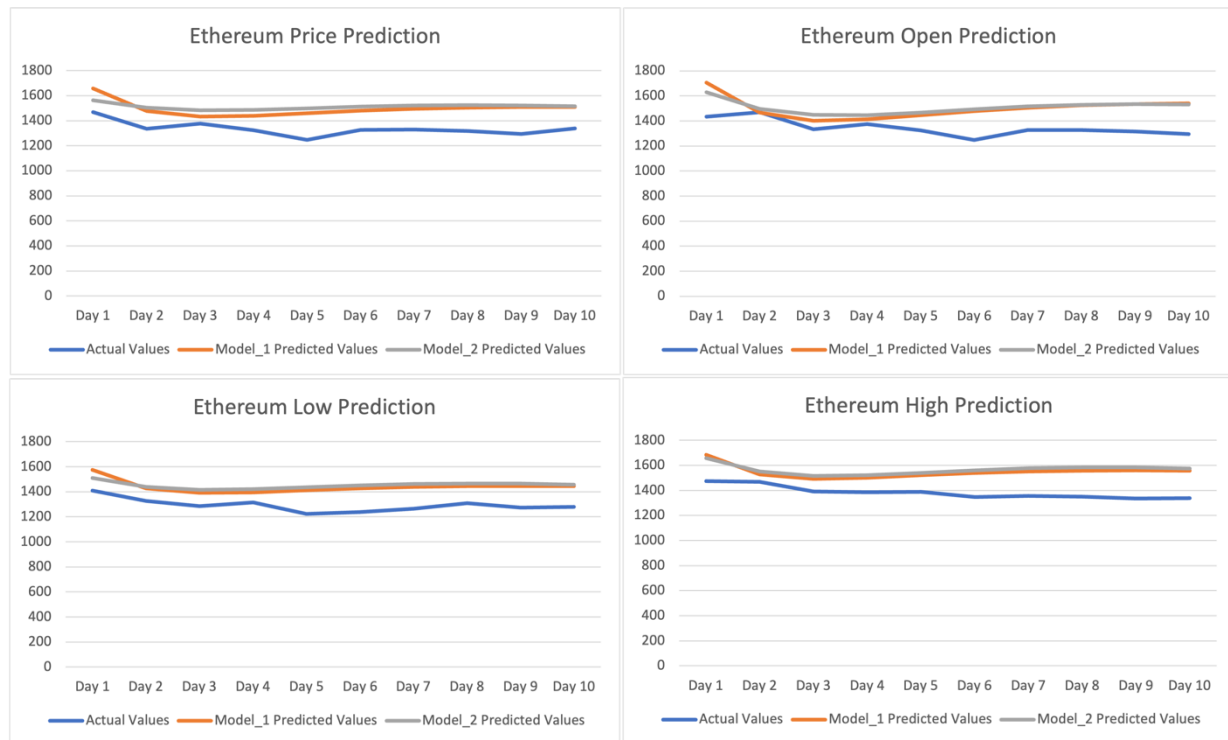


Figure 5. Ethereum Prediction

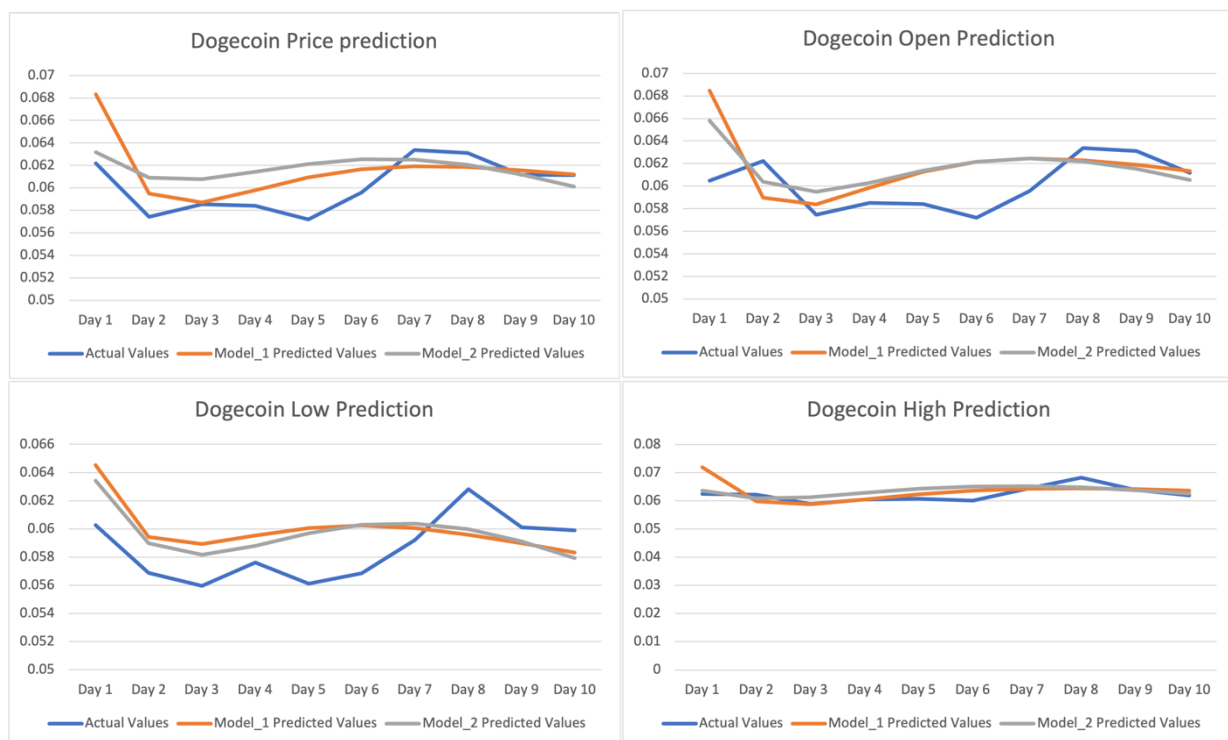


Figure 6. Dogecoin Prediction

Figs. 7, 8, and 9 are the mean absolute error of the prediction price and actual value of two models for Bitcoin, Ethereum, and Dogecoin respectively. Here, the yellow line is the mean absolute value of model 1, while the blue line represents the mean absolute value of model 2. The closer the yellow and blue lines are to zero, the smaller the prediction error is. From the results, it is obvious that the predicted price, opening price, high price and low price are not the same as the actual results, but can give a trend and a general range of up or down. Machine learning can help investors to have a general expectation or as a reference data to assist investors to make decisions. Machine learning is not a

random prediction, but rather a learning process that uses historical data to predict what will happen in the future.

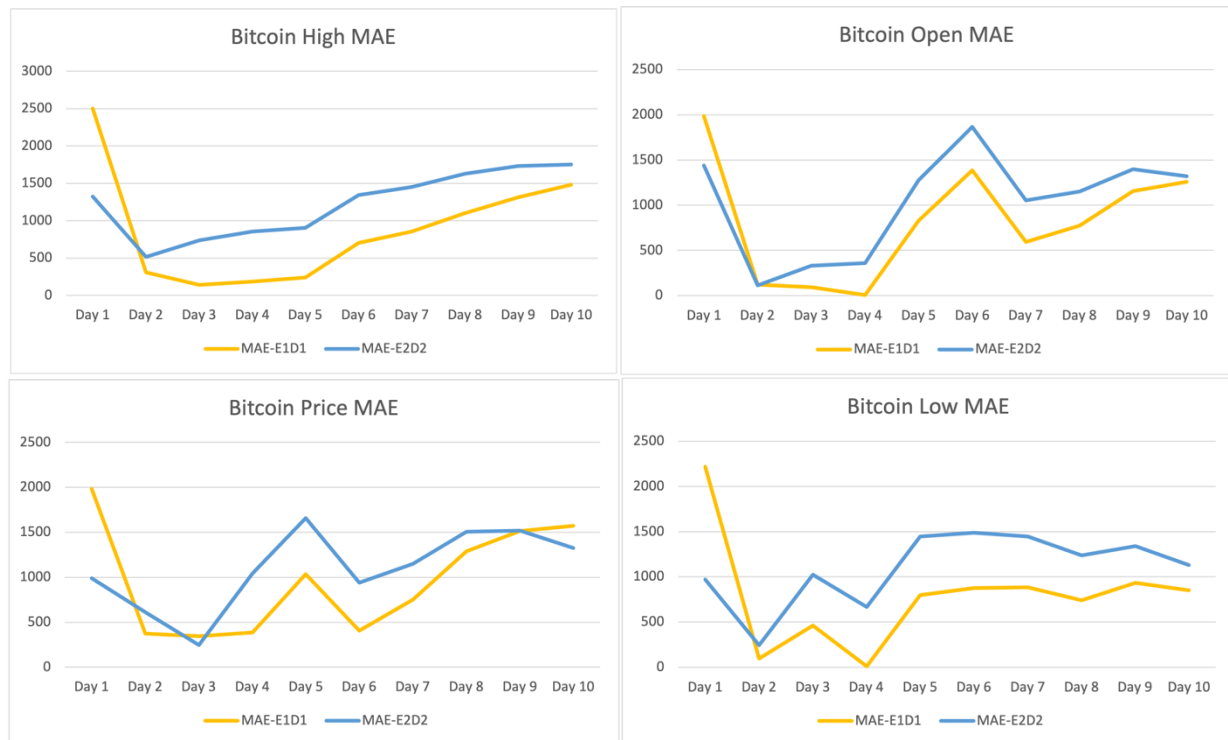


Figure 7. Bitcoin MAE

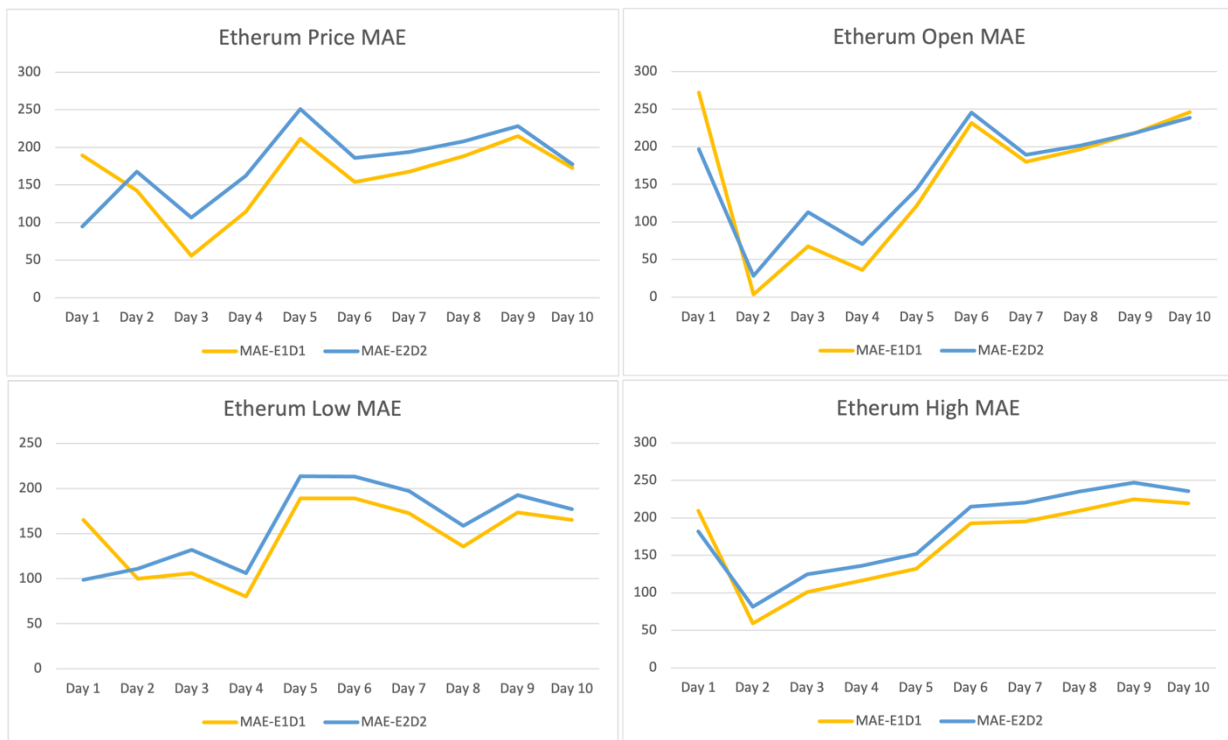


Figure 8. Ethereum MAE

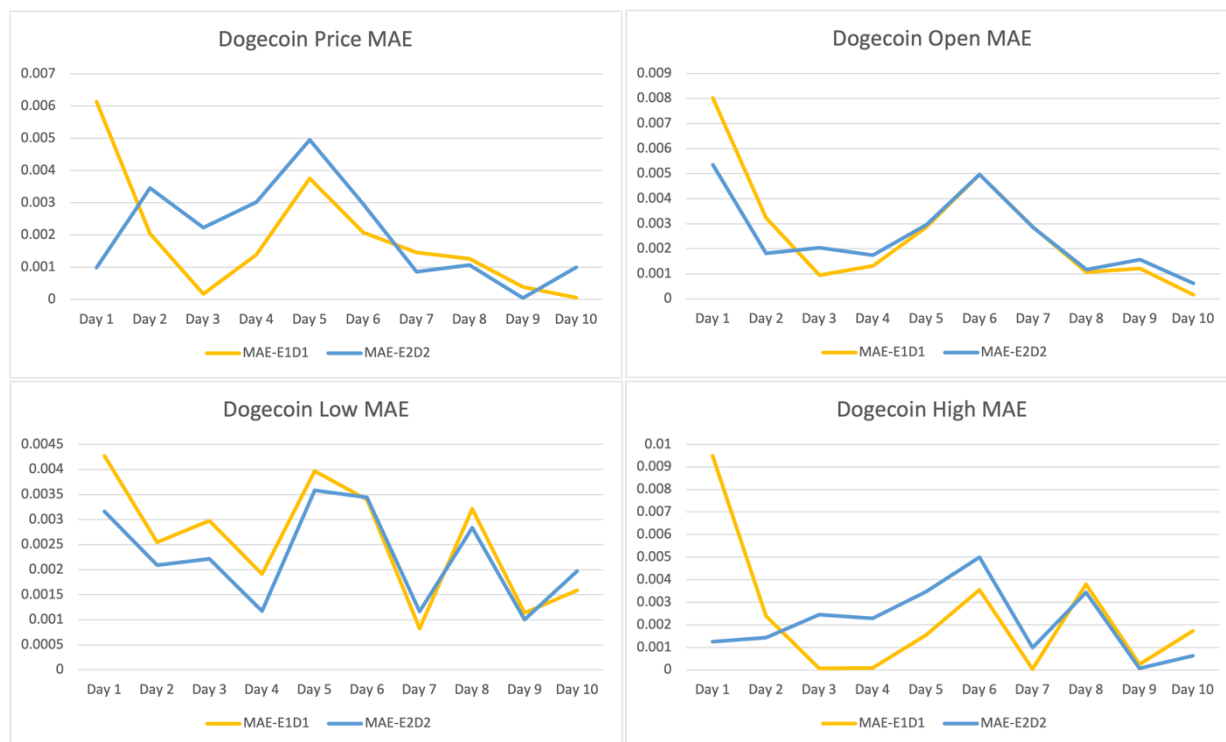


Figure 9. Dogecoin MAE

4. Limitations & Future Outlooks

The model in this study uses a LSTM model to predict the future based on past historical data. According to the analysis, the predicted results are not the same as the actual results. The prediction results can only be used as a general direction and range, and do not constitute investment advice. The cryptocurrency market is very complex and difficult to analyze and can be influenced by market sentiment, the words of influential people, and national policies. Leverage and high volatility are common in the cryptocurrency market, which can affect the mindset and decisions of investors, which can lead to the legitimacy of cryptocurrencies in many countries. Often the value impact of national laws cannot be predicted by machine learning. The machine learning in this study only uses past data to determine the general direction of cryptocurrency values in the absence of special events that typically occur.

The emergence of machine learning is great as a tool for data analysis to help train computers to process data that is difficult or impossible for people to process. There are also various models in machine learning to target different situations. The combination of computer languages and finance is also something that has happened only in recent decades. This clever combination has also given rise to a new genre of investing. Investors in this genre train computers to perform machine learning to help them make decisions and predict the future in the financial markets. Different from humans who are influenced by emotions or mindsets to make decisions, computers can always process data and analyze it in a structured way. In the future, it is likely that by constantly generating new models and more refined training, predictions can become more and more accurate.

5. Conclusion

In summary, this paper uses machine learning scenarios to predict the future value of Bitcoin, Ethereum, and Dogecoin. Predictions include price, open price, low price, and high price. The time series model predicts roughly the same direction as the actual value and has a small margin of error. Among the three cryptocurrencies, Bitcoin's prediction results are more accurate than Ethereum and Dogecoin. However, the predicted results cannot include all the special cases and cannot be the same

as the actual results. In the future, as the field of computers and machine learning continues to advance, better models will emerge for the high volatility cryptocurrencies, so that the prediction of value will be more accurate. This study demonstrates the relevance of machine learning to the cryptocurrency market and the ability of computers to predict the future value of cryptocurrencies through machine learning. Overall, these results offer a guideline for predicting cryptocurrencies assets value by using LSTM model.

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