Cryptocurrency Price Prediction using Linear Regression & High Performance Computing Techniques

Naomi Rodriguez[1], Marissa Murphy[1], Aaron Morgado[2], Mason Gawler[3], Min Sun Kim[4], Khem N. Poudel[1]

Department of Mathematics[1], Department of Electrical, Computer Software and System Engineering[2], Department of Aerospace Engineering[3], Embry-Riddle Aeronautical University; Department of Mathematics and Computer Science, East Central University[4]

Introduction

New forms of currency have been constantly evolving over the past few years, namely cryptocurrency. Virtual forms of currency have open new doors within the software industry in finance, data storage and data collection. Cryptocurrency (Crypto) in is very volatile in terms of market value, which carries a host of unknowns that make it difficult to predict and analyze the future prices of crypto. However, cryptocurrency behaves similarly to stocks, which allows for the use of linear regression models to make predictions about price levels.

Two types of linear regression models, least squares and auto regression, as well as predictors such as social media and economic data to calculate the volatility of a given cryptocurrency and its prices. Using high performance computing techniques will allow regression models to predict relatively accurate crypto prices and past available cryptocurrency price data will be used to verify our results.
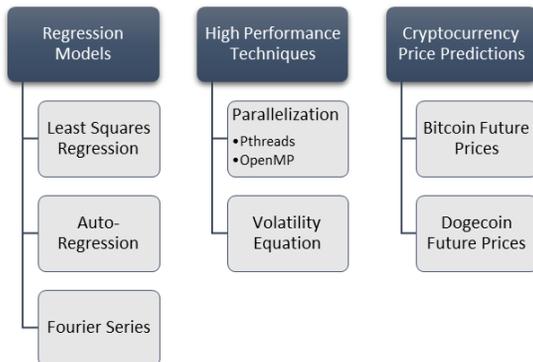
Methods

Figure 1. Methods—The diagram shows what regression models will be used and types of High Performance Computing Techniques that will be used to execute the future price predictions of Bitcoin and Dogecoin
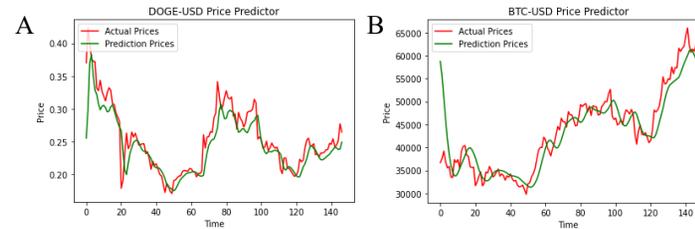
Results

Figure 2. Linear regression using Least Squares without Volatility equation incorporated to check data for best fit curve within the data set. **A)** The number of days this model predicts is 7 days into the future for Dogecoin **B)** The number of days this model predicts is 7 days into the future for Bitcoin and this model does not fit all data points preventing over plotting of the regression
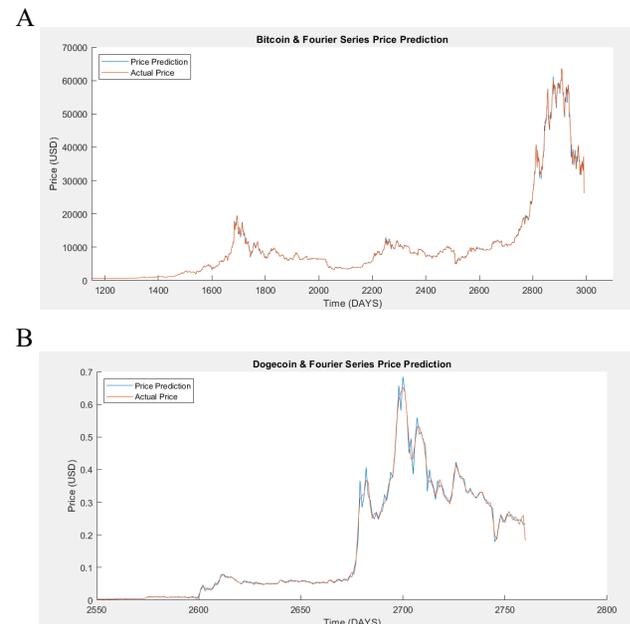

Figure 3. Fourier Series Model without Volatility equations incorporated to check data for best fit curve within data set. The Fourier Series where k = 200, k represents the number of terms within the series to make the curve more precise without over plotting. As the k value increases the more precise the fitting and prediction becomes. However, there is a limited to how accurate the prediction will be before over fitting the data, skewing the results. **A)** Graph A depicts the actual prices of Bitcoin (USD) in red and the Fourier Series best fit curve in blue over the span of 3000 days. **B)** Graph B depicts the actual prices of Dogecoin (USD) in red and the Fourier Series best fit curve in blue over the span of 2780 days.

Preliminary Results

- Ordinary Least Squares Regression model plotted without Volatility plots relatively accurate best fit curve to both Bitcoin and Dogecoin
- Non-linear regression may be able to provide more precise price prediction but would not provide context in the process of the price prediction
- Fourier Series model can yield higher precision due to the number of iterations that can be added to the series
- Models such as Auto-regression still need to be implemented in additional to the volatility equation being implemented back into Least Squares regression and Fourier Series Model

Next Steps

- Determine other parameters that contribute the volatility of these 2 cryptocurrencies
- Continue to train the model to become more precise and accurate with price predictions
- Apply model to other cryptocurrency giants such as Ethereum, Litecoin and Cardano
- View other types of models and algorithms such as neural networks and non-linear regression for more precise price predictions

References

1. "Cryptocurrency." Wikipedia, Wikimedia Foundation, 13 Sept. 2021, en.wikipedia.org/wiki/Cryptocurrency.
2. Frankenfield, Jake. "What Is Dogecoin?" Investopedia, Investopedia, 13 Sept. 2021, www.investopedia.com/terms/d/dogecoin.asp.
3. Ganti, Akhilesh. "How Implied Volatility (Iv) Helps You to Buy Low and Sell High." Investopedia, Investopedia, 27 Sept. 2021, https://www.investopedia.com/terms/i/iv.asp.
4. Hayes, Adam. "Volatility." Investopedia, Investopedia, 28 Sept. 2021, https://www.investopedia.com/terms/v/volatility.asp.
5. "Metaheuristic." Wikipedia, Wikimedia Foundation, 28 Sept. 2021, en.wikipedia.org/wiki/Metaheuristic
6. Patel, Mohil Maheshkumar, et al. "A Deep Learning-Based Cryptocurrency Price Prediction Scheme for Financial Institutions." Journal of Information Security and Applications, Elsevier, 26 Aug. 2020, www.sciencedirect.com/science/article/abs/pii/S2214212620307535.
7. Pagnottoni, Paolo. "Neural Network Models for Bitcoin Option Pricing." Frontiers in Artificial Intelligence, Frontiers Media S.A., 3 July 2019, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7861292/
8. Sagar, Abhinav. "Cryptocurrency Price Prediction Using Deep Learning." Medium, Towards Data Science, 3 Dec. 2019, https://towardsdatascience.com/cryptocurrency-price-prediction-using-deep-learning-70cfca50dd3a.
9. "Stock Price Prediction Using Artificial Neural Network." IJIRSET, International Journal of Innovative Research in Science, Engineering, and Technology, 28 Sept. 2021, citeserx.ist.psu.edu/viewdoc/download?doi=10.1.1.1066.9415&5