Data Visualization on Cryptocurrencies

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ABSTRACT

The problem which this project sets to address is data visualization with crypto-currencies. With this project, we focus on two perspectives of cryptos: correlations and investments. With correlations part, we provide a visualization for users who would like to know which cryptocurrency correlates the most with spikes and/or drops in the price of bitcoin. After comparing the correlation of 4 cryptocurrencies and Bitcoin, we found that Litecoin and Ethereum have a high correlation, when the price of Bitcoin changes, there is an 80% probability that the price of Litecoin and Ethereum will also change accordingly. In addition to that, to better serve crypto investor, we also create graphs for users who are interested in investing in cryptocurrencies with data visualization to have users figure out which cryptocurrencies are more volatile and which are more stable, so that they can invest according to their needs. In order to analyze the price changes of cryptocurrencies, we looked at the standard deviations of various cryptocurrencies, and based on the results, we created an interactive data visualization scatter plot (users can click to view the standard deviation and volume of cryptocurrencies). And as an extension of the first part(correlation), we compared the price stability of Litecoin and Ethereum, and found that the price of Ethereum is more stable than Litecoin. After all of the works, we put all the data visualization plots into a web page for users to view.

Keywords: Cryptocurrency, Correlations, Bitcoin, Crypto Investment, Interactive Data Visualization, Price Change, Stand Deviation

1 INTRODUCTION

In recent years, the topic of Cryptocurrency has seen a dramatic rise in popularity. With over 7550 cryptocurrencies in circulation, cryptocurrencies are currently being traded at "a volume of $120 billion dollars daily on average" with "43% of Americans aged between 18 and 29 saying that they have traded or used cryptocurrency" [3]. Despite its popularity however, crypto investing is notorious for being frustrating and intricate due to the extremely volatile nature of cryptocurrency prices. Prices have the potential to surge and dip dramatically within days or weeks, making predicting these changes paramount for investors trying to make a profit. In this paper, we attempt to provide comprehensive data visualizations that attempt to assist with these predictions. After summarizing existing work related to our topic, we provide a visualization for users who would like to know which cryptocurrency correlates the most with spikes and/or drops in the price of bitcoin - the current most popular crypto. In doing so, users would be able to make more informed decisions on buying/selling in order to maximize returns. In addition to that, we provide users with a visualization that showcases the level of volatility of different cryptos so that users can invest according to their needs. We will discuss the design elements of our visualizations and finally, discuss our findings from our work.

2 RELATED WORK

2.1 Correlation with Bitcoin

Data Selection and Prepossessing

In order to figure out cryptos correlations, we selected some of the top-ranked cryptocurrencies: Ethereum, Litecoin, Avalanche, and Tezo to study the correlation between these cryptocurrencies and Bitcoin. The reason we chose these cryptocurrencies is that in general popular cryptocurrencies. In addition to that, Litecoin founder Charlie Lee sees Litecoin as "silver to Bitcoin's gold." and positions Litecoin for small transactions with lower fees [4] (Bitcoin is often used for large transactions) . Therefore, the price of Litecoin is likely to be affected by the price of Bitcoin.

To analyze the correlation of these data, we collected hourly opening and closing price comparisons for Bitcoin, Litecoin, Ethereum, Avalanche and Tezo throughout 2021.

Because the original data contains some parts that we are "not interested in", such as market volume, number of trades, etc. (we only focus on the opening and closing prices of cryptocurrencies), so we did some data preprocessing, which dropped"useless" Data " columns. After that we compare the closing price of the current time with the closing price of the previous hour. and plotted data visualizations representing cryptocurrency correlations(as shown in Figure 1).

Correlation Results

According to Kenny's article, when comparing correlations, anything above 0.7 would be considered a strong positive correlation between the two cryptocurrencies [2], and in our research, we found that both Litecoin and Ethereum and Bitcoin have over 75 percent Correlation. This corroborates Kenny's research in 2018 [2](0.95 correlation rate for Litecoin

and 0.91 correlation rate for Ethereum in 2008). At the same time, the correlation values of Avax and Tezo do not show a high correlation with Bitcoin (Tezo's correlation is about 60%, and Avalanche's correlation is 55%).

2.2 Crypto Volatility

In searching for previous work on visualizing cryptocurrency volatility, we had trouble finding any academic work related to this topic. Closely related however, we did find an article, "A Systematic Review of Online Bitcoin Visualizations" by Tovanich et. al., which analyzed and categorized online visualization tools related to Bitcoin. In this article, five tool categories were deduced: Financial Transaction tools which expose statistics on individual transactions and users, Transaction Network tools which create (directed) graphs to visualize a networks of transactions, Peer to Peer Network Activity tools which concern "aggregated statistics that give an overview of activities in the peer-to-peer (P2P) network, such as mining, transaction rates, or transaction volume", Cryptocurrency Exchange tools which present market statistics such as exchange rate and volume, and finally enjoyment/casual use tools which attempt to attract public audiences towards blockchain technology [5]. Our work closely resembles the creation of a Cryptocurrency Exchange tool since we're using market statistics; in contrast however, we're looking at multiple cryptos rather than just bitcoin.

In terms of investigating crypto volatility itself, we still only found work investigating volatility in relation to other financial assets (e.g. SP 500, Gold) [1] but none comparing the volatility between different cryptos. We hope to bridge that gap.

3 Visualization Descriptions

Figure 1 is a line plot plotting average correlation of various cryptos with Bitcoin against the rolling window length. The decision to plot this as a line chart was heavily related to how we wanted the user to visualize the data in relation to time. We also used a categorical encoding in order to differentiate between different currencies.

Figure 2 is an interactive time series line plot showing the High-Low % change of the most correlated cryptos with Bitcoin from Figure 1 (Bitcoin and Litecoin). The plot is zoom-able so that users can choose their desired time granularity, and there is a hover-able tooltip displaying the y-axis value so that users can visualize the exact data point with ease. The color scheme is categorical for the same reason as figure 1.

Figure 3 is an interactive scatter plot that plots High-Low % Change Standard Deviation against Volume for each crypto. A tooltip appears when hovering over data points which displays Standard Deviation and Volume values. A scatter plot was chosen here to allow for easy interpretation

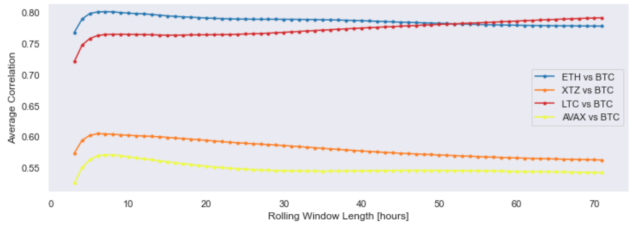

Figure 1: Ethereum, Litecoin, Avalanche and Tezo Correlation with Bitcoin

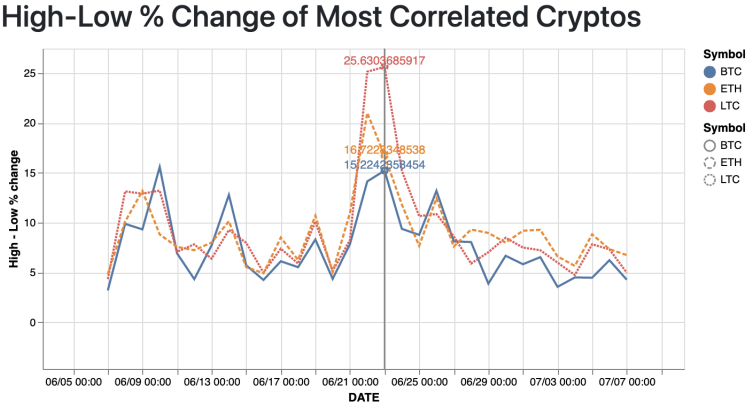

Figure 2: High-Low % Change of Correlated Cryptos

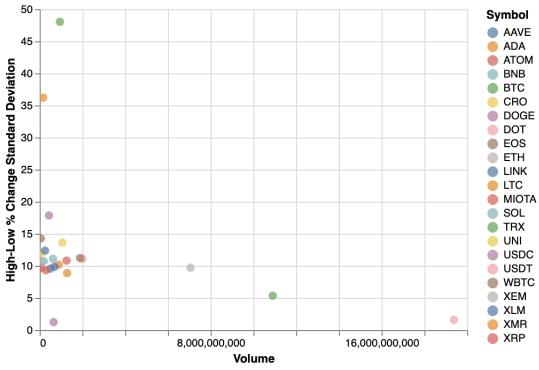

Figure 3: High-Low % Change Standard Deviation

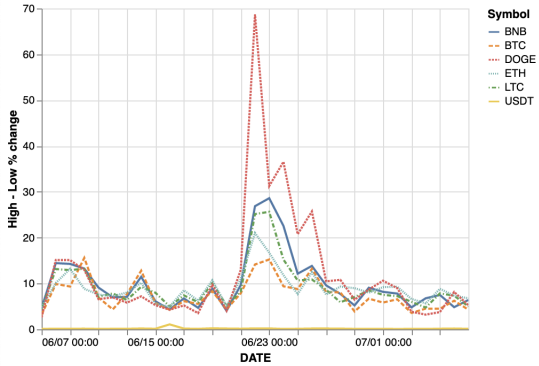

Figure 4: High-Low % Change of All Cryptos

of the data; we wanted users to be able to easily determine which crypto is the most stable and has the highest market strength, and that could be deduced by seeing the data points closest to the bottom right corner.

Figure 4 is another interactive time series plot showing the High-Low % change of some popular cryptos. The plot is zoom-able similar to Figure 2 with the main purpose of providing users change over time at a granularity of their choice. A line plot was chosen due to how easy it is to visualize spikes and drops over time.

4 Discussion

Correlation with Bitcoin

	Open	Close
Litecoin vs Bitcoin	0.72	0.78
Ethereum vs Bitcoin	0.76	0.75
Avalanche vs Bitcoin	0.52	0.55
Tezos vs Bitcoin	0.57	0.56

According to the correlation visualization, we found that Litecoin and Ethereum have the highest correlation with Bitcoin (78% and 75% respectively at the close), which means that when Bitcoin price changes (up or fall), there is a more than 75 percent chance that the price of Litecoin and Ethereum will also change. Also, we found that Avalanche and tezos have a low correlation with Bitcoin - around 0.55 and 0.56, which means that it is difficult to get Avalanche and Tezos price trends from Bitcoin price movements (and vice versa) In addition to that, we found over time, Litecoin and Avalanche's correlation with Bitcoin has trended upwards (Litecoin from 72% to 78%, Avalanche from 52% to 55%), while Ethereum and Tezos shows a downward trend in correlation with Bitcoin (Ethereum from 76% to 75%, Tezo from 57% to 56%)

Crypto Volatility

From figure 2, out of the two most correlated cryptos to Bitcoin, it can be argued that Ethereum is slightly more stable than Litecoin. Spikes in High-Low % change seem to be less dramatic for Ethereum in comparison; thus, if an investor is looking to choose a stable crypto that is closely correlated to bitcoin, Ethereum should be their choice.

From figure 3, it can be seen that Tether, Bitcoin, and Ethereum are all stable cryptos that hold high market strengths. All three have relatively low standard deviations when compared to the rest of the data points and are positive outliers when it comes to volume. It can also be seen that USD Coin is the most stable coin in terms of High-Low % change standard deviation; however, it does not hold a very high volume. Thus, under the assumption that an investor is looking for a stable, high volume coin to invest in, Tether, Bitcoin, or Ethereum should be the choice that the investor makes.

Figure 4 seems to confirm many of the conclusions mentioned above along with other insights from figure 3. The height of spikes for example for Ethereum, Bitcoin, and Tether all seem to be less dramatic when compared to other cryptos which confirms their stability shown in figure 3. Similarly, figure 3 deems Dogecoin as relatively volatile (as it has the third highest High-Low % Standard Deviation) which is confirmed in figure 4 by the height of the spike on June 22nd.

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