CryptoGram

Visualization and in-depth analysis of cryptocurrencies

COM480: Data Visualization

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Introduction

Digitised assets and innovative financial channels are emerging in recent years. The tendency of the number of financial institutions to include cryptocurrencies in their portfolios has accelerated. Although many traders and scholars want to know more in this area, the websites online only contain the information of the price, there lacks an in-dept analysis. **Cryptogram** aims to bridge this gap by including related news information. Through this project, we hope an intuitive visualization together with updated new could give a better guidance to novices in this field.
Cryptogram visualizes:

- Informative news related to certain cryptocurrency
- Meaningful Keywords from news of different kinds of coins
- Useful price information about cryptocurrency
- Display related news for price fluctuations
- Comparison of different kinds of cryptocurrencies

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Data Set

In the project, we use the data source cryptocompare, which provides various information related to crypto currency and several free APIs to access the data. The main reason of using this data source is its high quality: most numeric data are cleaned and there is no need to preprocess the dataset for data like price. They also provide daily news data which our text analysis are based on.

The detail of our source data is as follows:

- **Price data** contains the daily price data for 30 different cryptocurrencies traded in 6 different currencies, including the highest price, the lowest price, opening price, closing price, trading volume from, trading volume to, for major crypto currencies from 2010 to 2022.
- **News data** contains the up-to-date news article information, including date, title, body, and image, from 2013 to 2022. Every article has multiple categories, which also contains different types of cryptocurrencies. We aggregate the articles by time and by coin.

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Design

Our website is clearly divided into 4 parts and it overall follows the same theme and style. We utilized various ways to visualize different aspects of the cryptocurrency.

3.1.Selection of Coins and Date

When user tab the left menu bar in header, coin and date selection tab appears. Considering the cognitive load of users who browse the website, we limited the maximum selection of coins to 4. This way, the information can be properly presented and users can comprehend without too much effort. Instead of providing the whole information of coins, we filtered the information by month. User can select specific month, year and our website shows aggregated visualization for each month. After the selection, the selected coin and date is shown in the header, so that user can easily recognize their selection.

3.2.Coin News Summary

3.2.1. Monthly Coin News

To attract visitors' attention, we provide the monthly news summary on the top of our website. We filtered the news by the month and cryptocurrency that the user selected.

User can easily go to the link of news by clicking the news card. When the user clicks the refresh button, they can always get a new piece of news.

3.2.2. News Keyword Word Cloud

To show the overall summary of news information, we extracted the keywords on title of news and show as a word cloud. Referring to Rad Cloud[1], user can easily compare

[1]Michael Burch. RadCloud: Visualizing Multiple Texts with Merged Word Clouds

the frequency of keywords for different cryptocurrencies.

The position of keyword is computed by the sum of weighted vector:

$$position(word_i) := \sum_{c=1}^{|C|}(V_c \times w_i^{''c})$$

. The intended placement for each word is then obtained using:

$$w_i^{''c} := \frac{w_i^{'c}}{\sum_{k=1}^{|C|} w_i^{'k}}$$

3.3.Price and Sentiment Analysis

The price and sentiment analysis is one of our key components, which supports four functionalities: **overview** of selected coins' prices, **monthly detail** of the selected coin, **daily detail** of the selected coin, and **moving** to the previous or the next date.

Initially, we have prices for all selected coins, users can clearly see the relatively price change among the month. Here, each point shows the *open price* of the coin of a day. The reason of using relative price is because the scale of each coin varies significantly, from 45000 USD (BTC) to 1 USD (XRP). Moreover, showing the relative price trend can better visualize the **correlation** between coins, which is more useful.

Once we hover the mouse on the curve, the y-axis and the daily **open, close, max, and min** are shown, while the information of other coins are hidden. The change of the display of coins is animated and smooth. Moreover, on the top right we show the corresponding color of price increase, unchanged, and decrease. Typically, we assign a color family to each coin and use light color for price increase and dark color for price decrease.

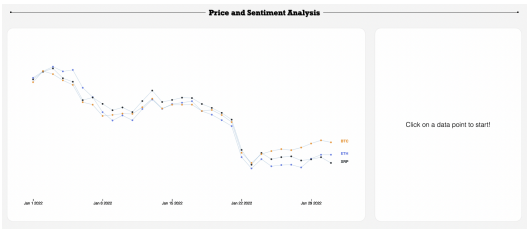

Figure 3.1: Price and Sentiment Analysis: Un-selected

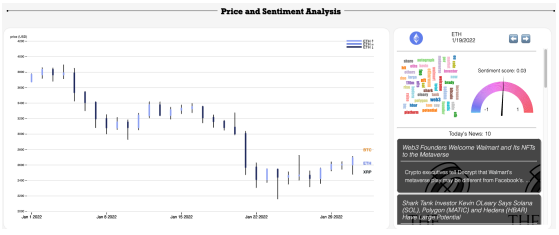

Figure 3.2: Price and Sentiment Analysis: After selecting a block

When the user clicks on a specific block, he could view the detail of the coin of the specific day on the right. As shown in Figure 3.2, we show the coin icon, name, the chosen date, the coin's daily word cloud, the coin's daily sentiment score, and all the news related to the coin in that day. We use **2-level flex** to organize all information

together.

The word cloud shows the coin's daily keywords, which helps to visualize people's daily attention on the coin. The sentiment score ranges from -1 to 1, showing an aggregated daily attitude of the coin based on the news texts. At the bottom, we display all the related news, on which users can click to further read the detail of it. For example, on 19 January 2022, there were some focuses on the Metaverse, one of the hot topic of ETH. By presenting above facts and graphs, our visualization helps the users who are interested in crypto currency have some elementary analysis.

Furthermore, we provide forward and backward arrows so that visitors can easily switch to the previous and the next date and browse related news article.

3.4.Coin Information for Comparison

In this part, we examine the trading details and provide the following information:

- timeline to show the release date of all the 8 coins (Figure 3.3).
- circles sizes are proportional to the quantity of transaction volume. This is quite an intuitive way to show the quantity of popularity of the cryptocurrencies (Figure 3.4).
- table to compare detailed information about the selected coins, the user can also sort it by clicking on the header of a certain column.
- arcs to show the percentage of volumes of the coins.

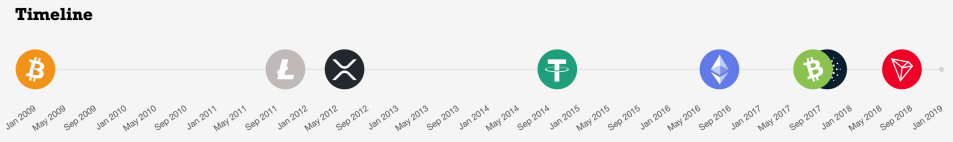

Figure 3.3: Cryptocurrency release date timeline

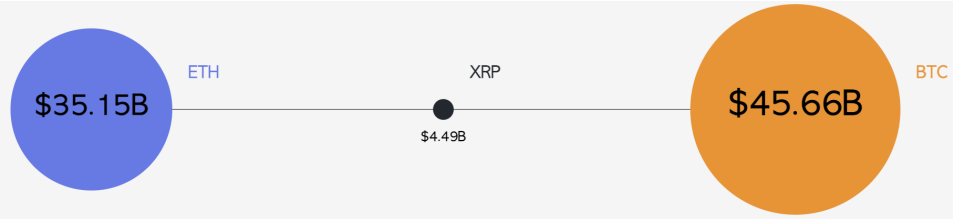

Figure 3.4: Transaction quantity circles

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Challenges

4.1.Coin News Summary

Figure 4.1: First sketch

Figure 4.2: Second sketch

Figure 4.1 shows our first sketch for coin news summary that shows only one news headline with bigger image. However, we changed the design that shows one news per cryptocurrency so that user can find out news article for all of the cryptocurrency at a glance. Figure 4.2 is the second sketch, thatsrhows the news for every selected coin at a glance, but we thought it would be better to visualize the word cloud by aggregating them in one visualization.

After searching various kinds of text visualization, we found Word Cloud is the best choice to show keywords from different coins. At first, we followed the ellipse shape of Word Cloud. But the space is quite limited, so we changed by dividing the rectangle space filling the background with representative color of coins.

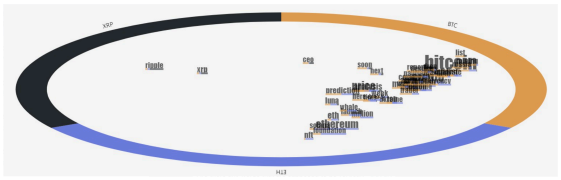

Figure 4.3: Ellipse word cloud

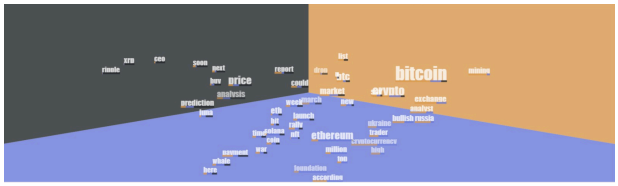

Figure 4.4: Divided space

Since the position is computed by weighted vector, we needed to correct position so that there is no overlapping among different texts. We referred to Spiral Generator algorithm [1], which can be written as :

Algorithm 1 Correcting position to prevent overlapping

```
Place the word computed by sum of weighted vector
while word intersects any of the previously placed words do
    Move it one step along an ever-increasing spiral
end while
```

The algorithm terminates within 5 seconds for most of the cases, but sometimes the while loop does not end for a long time, which makes users exhausting. Therefore, we forced to terminate the while loop after 5 seconds.

4.2.Price and Sentiment Analysis

The implementation of price and sentiment analysis has great complexity. Figure 4.5 shows the initial sketch of our design, while Figure 3.2 is our final implementation.

The first challenge is to display coin prices with different scales, from 45000 USD (Bitcoin) to 1 USD (XRP) for example. If we use a fixed y-axis, the figure will be dominated by coins with the biggest scale (e.g. BTC). However, the relative changing trend of different coins is more useful. Therefore, in our final solution, the y-axis is shown on demand and we normalized all coins with the max and min prices on a monthly basis. The result turns out to be quite neat and we can clearly see the correlation between coins.

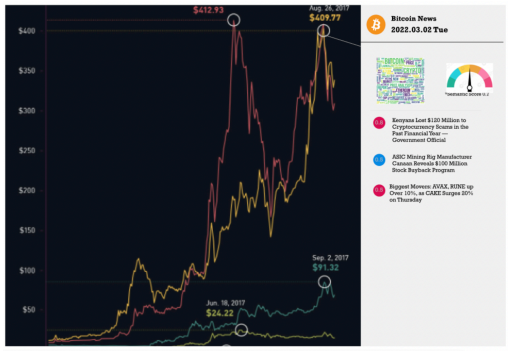

Figure 4.5: Initial design of price and sentiment analysis

The second challenge is the calculation of width for svg figures. Unlike HTML elements that we can easily use the relative width, svg requires us to specify the width when creating. We make significant efforts to trail and test. Eventually, we come up with the final solution to convert relative width with padding into the absolute width.

[1] https://github.com/Syzygy2048/RadCloud/

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Conclusion

5.1.Peer assessment

All the team members are involved in the important design decisions and the work was divided after consent with an aim to achieve the best visualization of the website. The contributions of each member are as follows:

- **Jisu Yim:** Crawling coin news from the website and did visualization of news and key word cloud.
- **Guochao Xie:** Obtaining coin price online and finished the price and sentiment analysis part.
- **Xiaotian Su:** Preprocessing price data and envisaged coin information and comparison part.

5.2.Conclusion

The work on this project turned out quite interesting, we are all happy with the informative and user-friendly website. And we learnt a lot about visual design and javascript along the way.