



Exploratory Data Analysis and Visualization of Real-time Crypto Market data

Data Visualization
Project Review

Lavansh Arora 20BCE1046 Let's dive into it quickly!



- 1 TITLE
- 2 AGENDA

- 3 ABSTRACT
- 4 LITERATURE SURVEY
- 5 OBJECTIVES
- 6 ARCHITECTURE

- 7 MODULES
- 8 CONCLUSION

9 REFERENCES

ABSTRACT

The aim of the project is to develop a web platform to analyze and visualize cryptocurrency data using Python and React. We would be gathering real-time market data on cryptocurrency prices, volumes, and other key metrics through APIs like Coingecko and Yahoo Finance. Also, we can use ANN, ARIMA, and regression with LSTM to forecast Bitcoin's future price. The platform developed would be useful for traders and investors diversify their portfolios, minimize risk, and adjust their strategies. Lastly, it would be analyzing cryptocurrency mining profitability which will help us to identify potential mining opportunities.

This live crypto market analysis will cover the various aspects of the market, including real-time data, trends, risk assessment, portfolio optimization, compliance, and mining.

LITERATURE SURVEY

The study by Fleischer, J. P. et al (2022) [1] highlights the potential of LSTM (Long Short-Term Memory) method for forecasting cryptocurrency prices. The authors suggest that incorporating additional input parameters such as high, low, and volume data of cryptocurrencies and other hyperparameters can further improve the accuracy of the model. This study further indicates that the LSTM method outperforms the ARIMA model in terms of accuracy, although it takes longer to execute. The model's high accuracy is attributed to its low root-mean-squared error and the close proximity of the anticipated value to the actual price. However, the authors acknowledge that the simplistic one-day forecast based on regular time series may not yield highquality results with a prompt response due to the one-day delay in the answer. The study's managerial implications suggest the potential for developing a product for investors to improve upon the model by including other hyperparameters for even more precise forecasts. Future research could consider incorporating sentiment ratings of tweets from Twitter pages or even just the measurement of tweet volume as a hyperparameter to enhance the model. One weakness of the study highlighted by the authors is the lack of thorough investigation into the architecture of introducing hyperparameters. This suggests that further research is needed to explore the potential impact of incorporating additional hyperparameters to the model.

Fleischer, J. P., von Laszewski, G., Theran, C., & Parra Bautista, Y. J. (2022). Time Series Analysis of Cryptocurrency Prices Using Long Short-Term Memory. Algorithms, 15(7), 230.

Giudici, G., Milne, A., & Vinogradov, D. (2020) [2] provide an introduction to the emerging phenomenon of cryptocurrencies and discusses the main trends in academic research related to them. The authors use both neoclassical and behavioral theories to analyze the challenges and concerns for business and industrial economics presented by cryptocurrencies. They highlight the contributions of selected works to the literature, with a particular emphasis on socio-economic, misconduct, and sustainability issues. The authors posit that while cryptocurrencies may perform some useful functions and add economic value, there are reasons to favor regulation of the market as a necessary step to improve social welfare. The article concludes by suggesting that future research should focus on major issues that deserve continued attention from scholars in finance, economics, and related disciplines.

Deshbhratar, P. et al (2023) [3]. React was the primary technology used by the researchers to create the online portal. The CoinGecko API was used to acquire the cryptocurrency data, which included price, volume, market capitalization, and exchange data. The website was deployed using node run time environment. The researchers included various features in their project such as Login authentication, IP address validation, and Session and Hashing. The paper was concluded by saying that more visualizations could be added with time for the traders and investors to better understand the market scenario.

Giudici, G., Milne, A., & Vinogradov, D. (2020). Cryptocurrencies: market analysis and perspectives. Journal of Industrial and Business Economics, 47, 1-18.

Deshbhratar, P., & Jaipurkar, P. REAL TIME PRICE TRACKER WEB APPLICATION FOR CRYPT-CURRENCY.

Nicolas H et al (2019) [4] gave a review of visualizations of Bitcoin cryptocurrency. The researchers used Google to collect and gather Bitcoin visualization tools and found 46 online tools. The paper even contained geographical information derived from Bitcoin transactions and network nodes on maps both in 2D and 3D. The researchers were creative enough to come up with unique plots such as a comparative view of market capitalization as a treemap, multiple crypto-economics factors in a spider chart, and cryptocurrency trading flows as Sankey diagrams. They also represented money flows of transactions were represented as node-link diagrams, an adjacency matrix, and a Gantt chart. The paper concluded by saying that for visual analytics tools that help experts detect different groups of Bitcoin users and connect the activities of different groups together.

Tovanich, N. et al (2019)[5] presented a review of visual analytics tools used for the analysis of blockchains-related data. The researchers have made use of 76 analytics tools in order to visualize blockchain and cryptocurrency networks. They also proposed a classification scheme to group those visualizations based on target blockchains, blockchain data, target audiences, task domains, and visualization types. The authors systematically and quantitatively assessed each of the 76 tools used and identified the areas that deserve more investigation in the future. They came up with various graphs such as a tile map, a 3D scatter plot etc. Moreover, BitConduite and BlockchainVis were used to analyze entity groups for Bitcoin and for creating transaction networks and analyzing the connectivity of transaction exchanges in Bitcoin respectively.

Berger, A., Košťák, M., & Ježek, B. (2021). Online Application for Bitcoin Price Visualization. In Mobile Web and Intelligent Information **Systems:** 17th International Conference, MobiWIS 2021, Virtual Event, August 23–25, 2021, **Proceedings** 17 (pp. 74-81). Springer **International** Publishing.

Tovanich, N., Heulot, N., Fekete, J. D., & Isenberg, P. (2019). A systematic review of online bitcoin visualizations. In Posters of the European Conference on Visualization (EuroVis).

Bhardwaj S, et al (2022) [6] conducted a research on CRYPTO CURRENCIES PERFORMANCE TRACKER. They described the regulatory as well as technological changes of cryptocurrency. The paper discussed the advantages of using a digital currency price tracker and also said that a good tracker enables consumers to compare the prices with historical data provided by many of these websites. Further, the researchers also added that the accuracy of the cryptocurrency price tracker an investor chooses can significantly impact their investment decisions, timing, and success. It is crucial to select a price tracker that uses reliable data and is consistently updated. Other factors to consider when choosing a cryptocurrency price tracker include ease of use, the number of digital currencies and tokens covered, and the suite of additional tools and information offered. The authors also suggested that companies should consider the effects of placing cryptocurrencies on their balance sheet and the potential impact on company valuation.

According to Yue, X et al. (2018) [7], the lack of effective instruments has restricted the task of multiple exchanges exploration and comparisons. The researchers highlighted some of the earlier techniques for visualizing Bitcoin data and discovered that they had mostly focused on monitoring records of questionable transactions. However, using current tools and techniques to analyze transactions and their connections is laborious. In order to investigate the evolutionary transaction patterns of Bitcoin exchanges from two perspectives, namely exchange vs exchange and exchange versus client, the authors devised an interactive visual analytics system. Furthermore, they have incorporated three case studies in the research in order to demonstrate the effectiveness and usefulness of the method used.

Bhardwaj, S., Basu, S., & Pal, M. A RESEARCH ON CRYPTO CURRENCIES PERFORMANCE TRACKER AND DATA VISUALIZATION APP.

Yue, X., Shu, X., Zhu, X., Du, X., Yu, Z., Papadopoulos, D., & Liu, S. (2018). Bitextract: Interactive visualization for extracting bitcoin exchange intelligence. IEEE transactions on visualization and computer graphics, 25(1),

Rathore, et al. [8], addressed cryptocurrency's unique challenges, exploring algorithms like LSTM and ARIMA for price prediction but highlighting their drawbacks. To overcome limitations, a novel Fbprophet model was proposed, excelling in handling seasonality and volatility, enhancing prediction accuracy for Bitcoin prices. The introduction contextualized cryptocurrencies as decentralized digital assets, influenced by blockchain and cryptographic security, while also acknowledging their speculative nature. The study emphasized the need for a model capable of interpreting dynamic trends, leading to the development of the Fbprophet model through comprehensive data analysis and pre-processing, ultimately achieving accurate predictions for real-world applications.

Rathore, R. K., Mishra, D., Mehra, P. S., Pal, O., Hashim, A. S., Shapi'i, A., ... & Shutaywi, M. (2022). Real-world model for bitcoin price prediction. Information Processing & Management, 59(4), 102968.

In the paper, **Fang, F., et al. [9]** ,presented a comprehensive survey on cryptocurrency trading, exploring its growing integration into financial portfolios. It addressed the distinct nature of cryptocurrencies as digital assets and their evolving behavior in trading. The survey covered 146 research papers, examining diverse aspects of cryptocurrency trading, including software systems, systematic trading, emerging technologies, portfolio construction, market conditions, and miscellaneous topics. Notably, a surge in research activity was observed from 2018 onwards, indicating the rising importance of cryptocurrency trading. The study aimed to gauge the maturity of research in this field by analyzing relevant indicators and trends up until June 2021.

Fang, F., Ventre, C., Basios, M., Kanthan, L., Martinez-Rego, D., Wu, F., & Li, L. (2022). Cryptocurrency trading: a comprehensive survey. Financial Innovation, 8(1), 1-59.

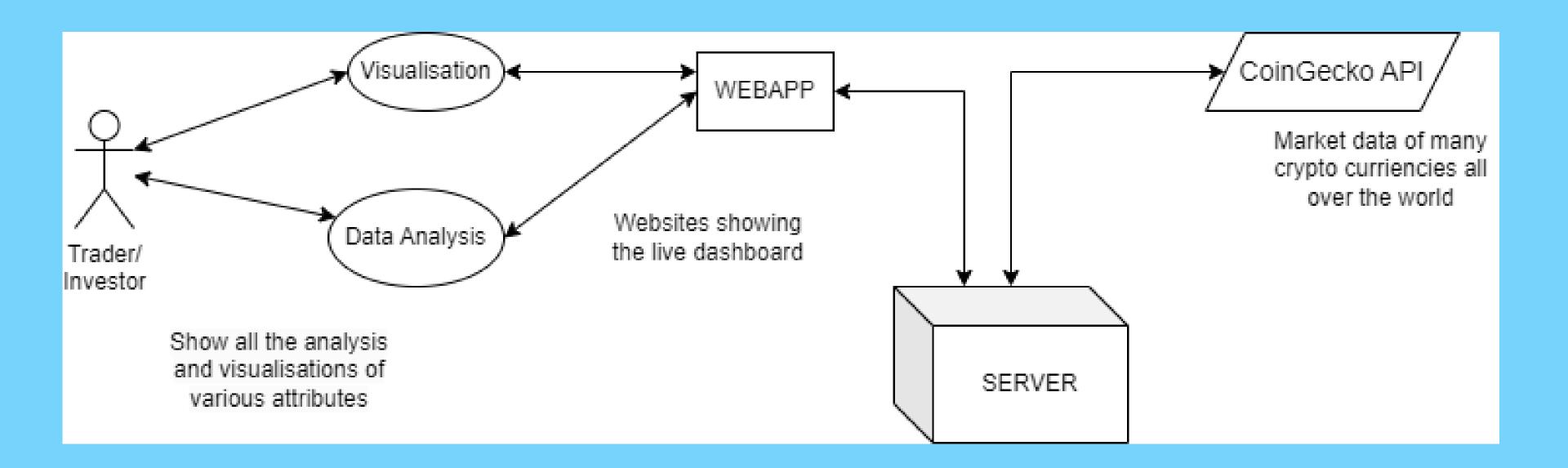
Yang, et al.[10], in the paper introduced a web platform for comprehensive cryptocurrency data aggregation, which utilized multi-modal data fusion, AI, and visual representation. The platform encompassed real-time trading data, both on- and off-chain, and offered visual analysis of market data. A full-stack framework was proposed, which comprised a front-end for user interaction and visualization, and a back-end server for data collection, preprocessing, and analysis. The model integrated deep learning with market trends, utilizing high-frequency vocabulary from social media, sentiment analysis, historical price trends, and hash rates. The paper emphasized the aim of bridging the gap between numerical and intuitive insights into the cryptocurrency market through a user-friendly interface. The platform facilitated investor decision-making and explored market sentiment.

Zhu, N., Yang, F., Zhu, M., Sun, X., & Cheng, I. (Year). DATA-ENABLED CRYPTOCURRENCY MARKET ANALYSIS AND VISUALIZATION PLATFORM. In Proceedings of the International Conferences Computer Graphics, Visualization, Computer Vision and Image Processing 2021; Connected Smart Cities 2021

OBJECTIVES

- To obtain real-time market data: One of the primary objectives of using an API for live crypto market data analysis is to obtain real-time market data on cryptocurrency prices, volumes, and other key metrics, which can then be used to monitor market conditions, identify trends, and make informed trading decisions.
- To automate data collection and analysis: APIs can be used to automate the collection and analysis of live crypto market data, allowing traders and investors to efficiently monitor market conditions and respond to changes in real-time. This can help to increase efficiency and reduce the risk of human error.
- To help traders develop trading algorithms: By using live crypto market data obtained through an API, traders and investors can develop trading algorithms that can be used to automate trading decisions based on specific market conditions and trends. This can help to reduce the risk of emotional trading decisions and improve overall trading performance.
- To help investors stay up-to-date with the latest market developments: Finally, live crypto market data analysis using API can be used to stay up-to-date with the latest market developments and emerging trends. This can help traders and investors stay ahead of the curve and identify new opportunities for profit in the cryptocurrency market.

ARCHITECTURE DIAGRAM



MODULES

Module 1: Data Collection CoinGecko is a popular cryptocurrency data aggregator platform that provides an API (Application Programming Interface) for developers to access a wide range of cryptocurrency market data. The CoinGecko API provides real-time and historical data on various cryptocurrency metrics, including prices, volumes, market capitalization, exchange rates, trading pairs, and more. We have collected the data of over 4000+ cryptocurrencies from coingecko API, out of which ten were used to design our web portal.

CoinGecko API link: https://www.coingecko.com/en/api/documentation

Yahoo Finance link: https://finance.yahoo.com/quote/BTC-USD/history?
https://finance.yahoo.com/quote/BTC-USD/history?
https://finance.yahoo.com/quote/BTC-USD/history?
https://finance.yahoo.com/quote/BTC-USD/history?
period1=1546300800&period2=1680739200&interval=1d&filter=history&frequency=1d&includeAdjustedClose=true

Module 2: Data Analysis

Detailed analysis will be done about the following:

- Market Capitalization (24 hours): It is a measure of the total value of a company's outstanding shares of stock, usually represented as a percentage. It is calculated by multiplying the price of a stock by its total number of outstanding shares.
- All time high (ATH): It refers to the highest price at which a cryptocurrency or stock has ever traded
- All time low(ATL): It refers to the lowest price at which a cryptocurrency or stock has ever traded
- Positive sentiments: It refers to the percentage of people who have a positive attitude towards investing in a particular cryptocurrency
- **High (24 hours):** It refers to the highest price that a particular cryptocurrency has reached within the past 24 hours.
- Low (24 hours): It refers to the lowest price that a particular cryptocurrency has reached within the past 24 hours.
- Current price: It refers to the current market price of a cryptocurrency.
- Market volume: It refers to the total number of shares or contracts traded in a particular market during a specific period of time

Regression with LSTM

This model involves analyzing the historical behavior of a particular cryptocurrency over time to identify trends, seasonality, and other patterns that can be used to make predictions about future market behavior.

Module 3: Models (3 models)

Time series Forecasting

We will be using the ARIMA model to forecast the future price of bitcoin by taking into consideration past few prices (depending upon the best chosen lag).

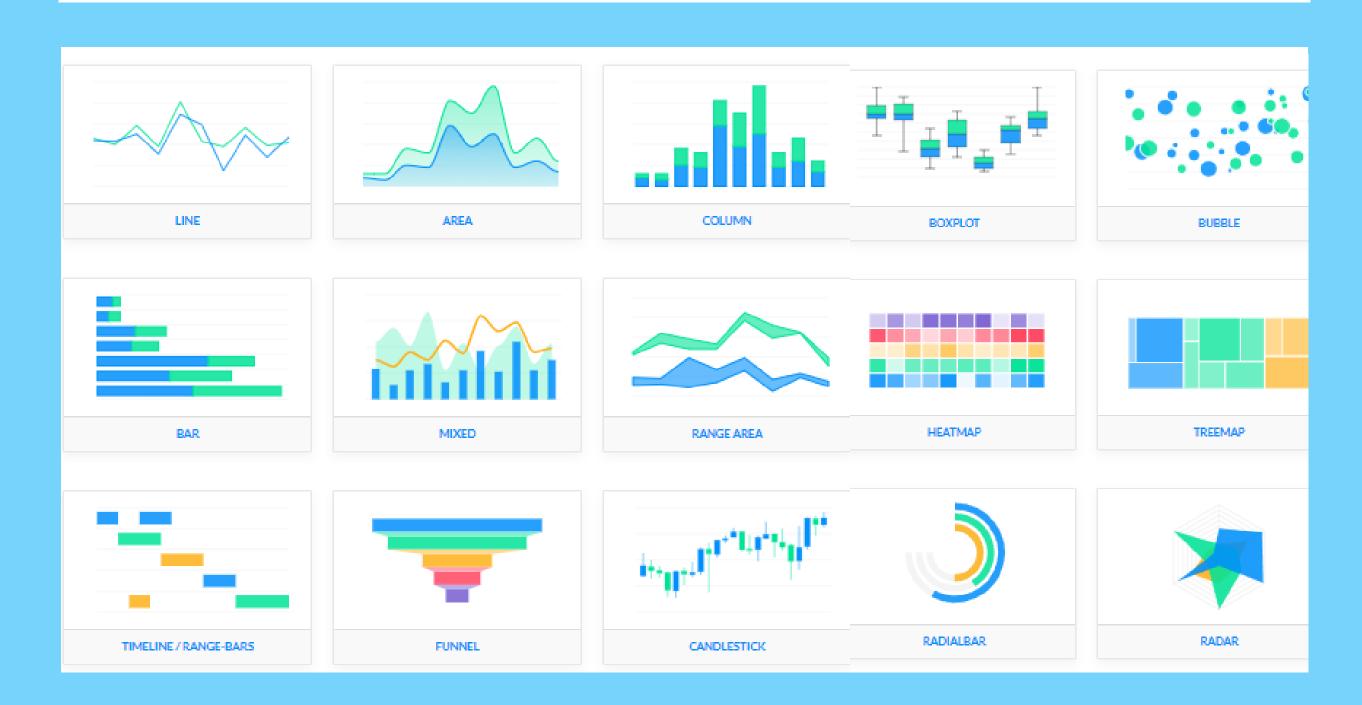
Neural Network

ANNs (Artificial Neural network) are a type of machine learning algorithm that can learn from historical data and make predictions on future data. It consists of input, hidden, and output layers with connected neurons (nodes) that process information. The nodes receive input signals, process them, and then pass the output signals to other nodes in the network.

ApexChart.js

ApexCharts.js is a JavaScript library that provides a wide range of interactive and customizable chart visualizations for web applications. It can be easily integrated into React applications to create various types of charts and graphs.

Module 4:
Data
Visualization



CONCLUSION

In conclusion, the analysis of live cryptocurrency market data using regression models, including Long Short-Term Memory (LSTM), Autoregressive Integrated Moving Average (ARIMA), and Artificial Neural Networks (ANN), will prove to be effective for predicting cryptocurrency prices in the future.

The regression analysis using LSTM will be particularly effective in capturing long-term dependencies in the data, surpassing the forecasting capabilities of the ARIMA model. Meanwhile, the ANN model will prove its utility in capturing nonlinear relationships between variables, making it a valuable tool for predicting trends in cryptocurrency prices over time.

Overall, the use of regression models in cryptocurrency market data analysis will hold significant potential for predicting future trends in cryptocurrency prices. These models will provide crucial insights for investors and traders, enabling them to make well-informed decisions. Subsequent research in this field will be necessary to explore alternative hyperparameters and input parameters, aiming to enhance the models' accuracy. While these models will offer valuable insights into the cryptocurrency market, they should be employed in conjunction with other analytical methods and should not be the sole basis for making investment decisions.

REFERENCES

- 1. Fleischer, J. P., von Laszewski, G., Theran, C., & Parra Bautista, Y. J. (2022). Time Series Analysis of Cryptocurrency Prices Using Long Short-Term Memory. Algorithms, 15(7), 230.
- 2. Giudici, G., Milne, A., & Vinogradov, D. (2020). Cryptocurrencies: market analysis and perspectives. Journal of Industrial and Business Economics, 47, 1-18.
- 3. Deshbhratar, P., & Jaipurkar, P. REAL TIME PRICE TRACKER WEB APPLICATION FOR CRYPT-CURRENCY.
- 4. Berger, A., Košťák, M., & Ježek, B. (2021). Online Application for Bitcoin Price Visualization. In Mobile Web and Intelligent Information Systems: 17th International Conference, MobiWIS 2021, Virtual Event, August 23–25, 2021, Proceedings 17 (pp. 74-81). Springer International Publishing. (download)
- 5. Tovanich, N., Heulot, N., Fekete, J. D., & Isenberg, P. (2019). A systematic review of online bitcoin visualizations. In Posters of the European Conference on Visualization (EuroVis).
- 6. Bhardwaj, S., Basu, S., & Pal, M. A RESEARCH ON CRYPTO CURRENCIES PERFORMANCE TRACKER AND DATA VISUALIZATION APP.

- 7. Yue, X., Shu, X., Zhu, X., Du, X., Yu, Z., Papadopoulos, D., & Liu, S. (2018). Bitextract: Interactive visualization for extracting bitcoin exchange intelligence. IEEE transactions on visualization and computer graphics, 25(1),
- 8. Rathore, R. K., Mishra, D., Mehra, P. S., Pal, O., Hashim, A. S., Shapi'i, A., ... & Shutaywi, M. (2022). Real-world model for bitcoin price prediction. Information Processing & Management, 59(4), 102968.
- 9. Fang, F., Ventre, C., Basios, M., Kanthan, L., Martinez-Rego, D., Wu, F., & Li, L. (2022). Cryptocurrency trading: a comprehensive survey. Financial Innovation, 8(1), 1-59.
- 10. Zhu, N., Yang, F., Zhu, M., Sun, X., & Cheng, I. (Year). DATA-ENABLED CRYPTOCURRENCY MARKET ANALYSIS AND VISUALIZATION PLATFORM. In Proceedings of the International Conferences Computer Graphics, Visualization, Computer Vision and Image Processing 2021; Connected Smart Cities 2021



THANK YOU!