NOVA IMS
Information Management School

BUSINESS CASES FOR DATA SCIENCE

BC5: CRYPTOCURRENCY DATA VISUALIZATION

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DATALIN
Bringing Intelligence

Purpose of the Dashboard

Taking into consideration the previous project developed to meet the needs of *Investments4Some* and improve their business through a reliable predictive model, the subsequent phase is to showcase the results by means of an interactive dashboard. This tool aims to become a support instrument for the financial analysts of the company. *Datalin's* purpose is to build an interactive dash with a layout that follows the standards of highly respectable cryptocurrency dashboards while ensuring that the information is the true and sole focus of possible users.

Design Choices

There are three factors that were considered upon the design development of the dashboard: *Branding*, *Functionality* and *Colours*. It is essential to represent each coin as a brand of its own as this is a current trend in the crypto reality. Using colours that resemble the different coins and displaying the logos ensures that the final user associates the data with the respective currency. Moreover, the dashboard has to be intuitive, easy to use and built to the customer's needs. The final aim of the dashboard requires special attention since the cryptocurrencies traded by the company need to be showcased individually along with a general view of the current market situation. Finally, the usual colour schemes for crypto dashboard refer to dark sci-fi inspired shades, however, a minimalistic white-grey scheme was adopted. Such minimal design choices are growing in popularity since they draw the attention of the user to the data itself and facilitate decision making when compared to more overwhelming style choices.

Cryptocurrency's Predictions & Dashboard Construction

As a consequence of the previous *Business Case (4)*, several predictive algorithms were tested, resulting in the best solution being a *LSTM* – long short-term memory network – model. However, whereas the *BC4* goal was to predict a fixed set of dates also considering a fixed set of training set, the *BC5* goal is to visually display price predictions in real time. Meaning that our model daily extracts new data from the source to be able to automatically display such information on the dashboard, the source being the website *Financial Modelling Prep* for commodities and *Yahoo Finance* for the cryptocurrencies. Consequently, we decided to make the closing price predictions based on a *Linear Regression Model*, which served as the baseline for the *BC4* and presented the second-best results, additionally its major advantage is that it is computationally easier to implement and faster to run in this real-time scenario.

On a different note, to extract relevant information about the prices of the digital coins, we have performed *Feature Engineering* steps applying the same rationale as in the previous *BC*. The indicators are *EMA, ATR, RSI, MOM, STD, STD_Adj, KAMA, OBV, ROC, AROON_down, AROON_up, Avg_Price_Disparity, SMA, KAMA_Disparity.* Except for the disparity indicators, all of them can be accessed for lags of 2, 7 or 20 days.

This dashboard was constructed with the use of *Pycharm* and *Dash*, along with the import of several python libraries. The layout of the application is written in *HTML*, and, in the assets folder, a *CSS* file can be found which describes some of the more general stylings applied. All graphs were built with the *Plotly Express* package, so to guarantee interactivity.

Dashboard Layout & Exploration Route

Datalin's goal was to create a dashboard that allowed the user to freely interact with the visualizations and easily draw its own conclusions about the crypto market. To make the display attractive to explore, a large diversity of graphical visuals was employed, namely bar charts, line plots, scatterplots, bubble plots and others. The dashboard is organized into two distinct pages, the *Overview*, and the *Detailed Analysis* which are then divided into different areas of information. Through this division, the user is led to interpret each one separately without being overwhelmed by information. This also creates an exploration roadmap that guides the users through the dashboard, facilitating the discovery process.

The *Overview* page is the first contact of the user with the display and is divided into three separate parts. It shows general information regarding the coins used by the company and other trading assets. In the first section, world hours regarding Portugal, Switzerland, England, Japan, and USA. are displayed to serve as a reference for the predictions' time and the user's own time zone. Retrieved closing values per coin are shown for the last three days with the prices of the last day being highlighted in either green or red if the price has risen or fallen comparatively to the previous day, respectively. This colour coding is used throughout the dashboard to display rising and falling of coin related values. In the second area are the graphical representations of the average returns per month for the last 3 years and the 10-week cumulative volume of the cryptocurrencies. The third section comprises two graphical displays, the candlestick and the price evolution of gas, oil, wheat, or gold. The first graphic lets the user choose from a *dropdown menu* which asset it wishes to visualize while the second allows for two assets to be viewed at the same time by means of a *multiple dropdown* menu. Finally, there is an option to change the currency in which the data of the full page is displayed in, and the user can choose between Swiss Franc, Euro, Pound, Japanese Yen, and USD Dollar.

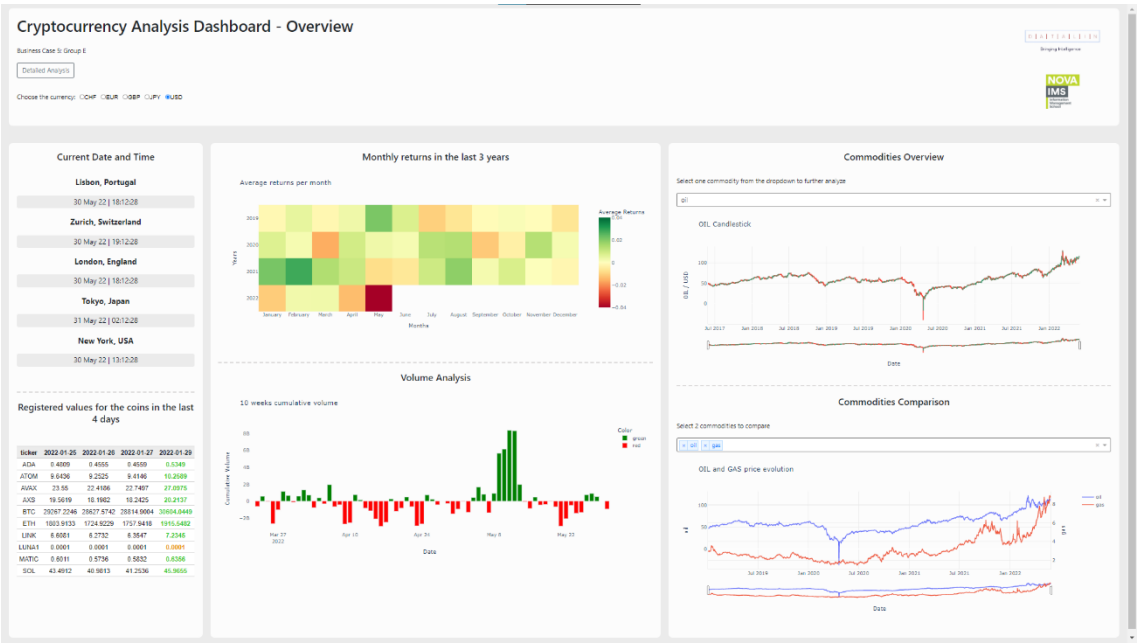
After analysing the general reality of the trading market, the user can choose to enter the *Detailed Analysis* page and further investigate each of the ten cryptocurrencies individually, namely *Cardano, Cosmos, Avalanche, Axie Infinity, Bitcoin, Ethereum, Chainlink, Terra, Polygon* and *Solana*. The display is divided into three distinct areas and from the beginning the crypto coin to be viewed can be chosen from a *dropdown* menu as well as the currency in which the data is displayed, by means of a *radio items group*. In the first part a small introduction to the history of the coin is showcased, along with its logo and important financial information that deserves to be highlighted, such as the current value of the coin and percentual changes over time. In the second part the historical price data is displayed and the user has the option to choose any time period it wishes to visualize. Next, the predictions by day and hour are displayed in two separate graphics and the number of days and hours to be predicted can be selected freely by the viewer, along with what area of the visualization to be seen. Finally, financial indicators are shown through various visual representations according to their categories: *Momentum, Overlap*, and *Volatility*.

Interpretation of the Visualizations

1. *Overview Page*

The first part of our dashboard has the goal of giving the viewer the opportunity to assess the market's current state and evolution with a glance of an eye. The *Monthly Returns heatmap* shows us how lucrative the market has been over the last 4 years. It's possible to observe that 3 major movements occurred since 2020, including the hit of the pandemic, that really affected the markets in March 2020, the recovery of the pandemic that was very visible one year later in February 2021, and the crash that's occurring now which started in mid-April and got worse with the crash of *LUNA* and all its 'brother' coins. The spike in cumulative volume that occurred in May can be justified by investors losing trust in the crypto market, therefore performing major sell-outs which may lead to higher drops in price. The crypto market clearly went from a long period of a bull state of almost 2 years to a bear state. On the right side of this age, we can analyse how different commodities evolved over time and how they might be correlated with the performance of the crypto market.

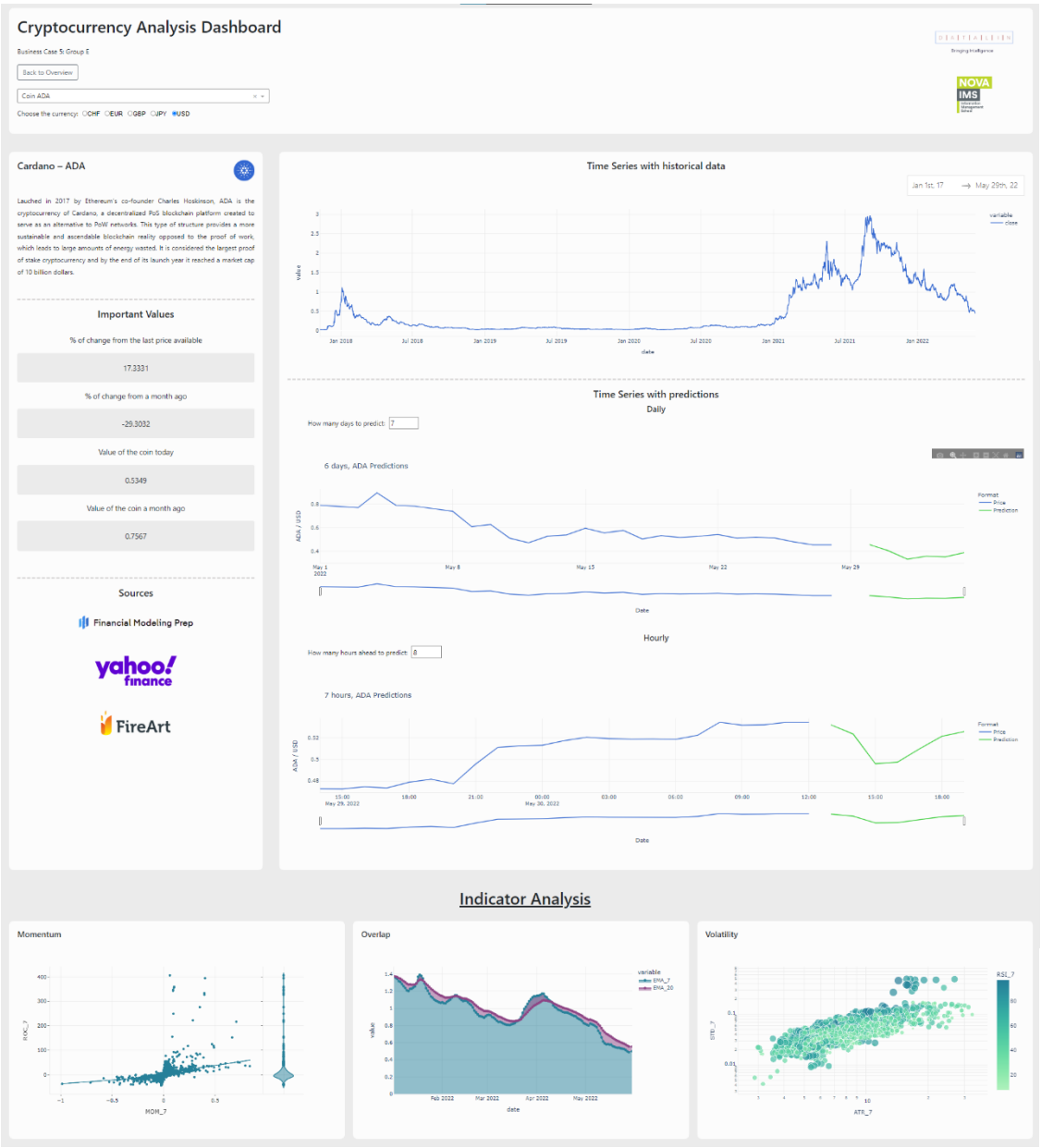
When looking at the evolution of the wheat and gas prices we can see that they present a high correlation and had a spike in prices that started in February. This spike in prices is highly influenced by the current war and high inflation values which only increase the current instability of the market.



2. *Detailed Analysis*

For the sake of this report, we have decided to stick with one ticker to elaborate conclusions for all the visualizations, so that the reader can easily follow the train of thought, therefore, the *AVAX* Coin was the chosen one. There are three time series graphics available to be analysed: the first one being with historical data of the closing price up to the current day. The *AVAX* behaviour can be parted into two major stages: an initial peak during February 2021, followed by a steady decrease, stabilizing the prices; And an aggressive continuous increasing trend seen from August to November 2021, that has been falling ever since, following the general trend of the crypto prices due to the already mentioned instabilities in the market. The two other time series graphics are based on predictions for the upcoming days and hours.

To present different perspectives based on the extracted indicators, we have divided this segment into three categories with three different types of plots so to be more visually appealing to explore. While observing the scatter plot between the *MOM* and the *ROC*, it is possible to access the correlation among these indicators, in this case we have fitted a non-linear trendline, the *Locally Weighted Scatterplot Smoothing* since visually it made more sense for the user to intuitively understand how the data points followed one another. On the *y-axis* margin, there is a *violin* graphic, that represents the data dispersion around the mean of the *ROC* indicator, so possible outliers are easily identified, for being far away from the central concentration of points. Moving on to a time analysis of the *EMA* indicator, here we are comparing the *EMA* with lag 7 with the difference between the *EMA* with the 20 day-lag and the previous one. Starting in the second week of April 2021, the rate of price change for the lag of 20 days changes faster than for the lag of 7 days. Lastly, for the *Volatility*, we wanted to plot indicators with different scales in a *scatter plot*, therefore we decided to apply a logarithm to the axis' value, considering a third dimension, the size, to incorporate an additional indicator. It is clear that the two variables in the axis have a strong relationship among themselves, and that RSI's values show a symmetrical behaviour among the points in the centre of the concentration of points.



Deployment

The back-end code and requirements can be accessed in the *Github* repository, which contains the app itself, an assets folder with the *CSS* code and styling elements and a *README* file. The decision to use the combination of *Dash* and *Heroku* was based on our familiarity with this platform in opposition to the lack of experience with *Streamlit* and *Bokeh*. A technical limitation faced throughout the development of the dashboard is its overall slowness while initializing. Provided we had more time to further improve the dash, we would have focused on creating more visualizations to deepen our analysis on the subject. The final dashboard can be consulted *here*.