Optimus Prime

Cryptocurrency Portfolio Optimisation

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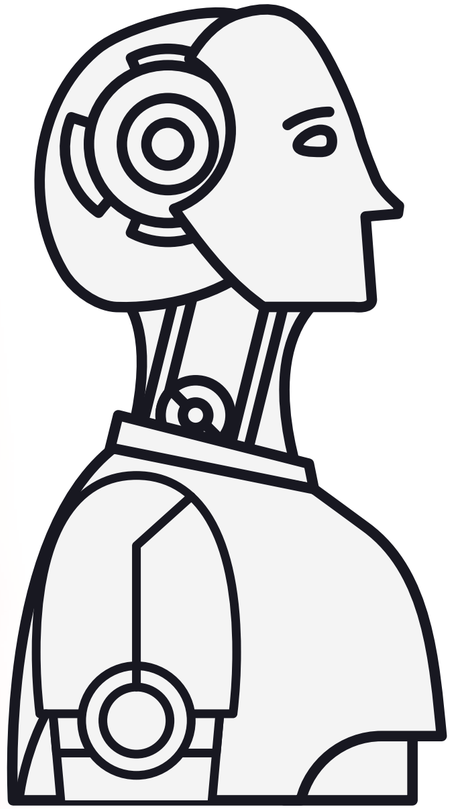


Discussion points

Project 1: Analyse a cryptocurrency portfolio and recommend portfolio allocations based on a number of risk-reward metrics

Questions:

- How do we fetch the historical price data for the specified cryptocurrencies?
- How have the cryptocurrencies in the user's portfolio performed on risk-reward metrics?
- What are the ideal weightages for each cryptocurrency asset within the user's portfolio?
- What methods do we use to forecast the portfolio?
- How do we visualise the portfolio strategy data?

Step by step of optimsation

1 **Data Preparation**

Portfolio input
API
Cleanup

2 **Data Analysis**

Risk-reward metrics
Calculation of weightages and portfolio allocation

3 **Projection**

Autoregressive modelling
Monte Carlo Simulations

4 **Visualisation**

Basic overview (Tableau)
Price history line charts
Risk-reward ratios charts
Portfolio allocation charts

How do we fetch the historical price data for the specified cryptocurrencies?

The yahoo finance (yf) library pulls historical OHLCV datasets from Yahoo! Finance API

This is grabbed and stored into a pandas dataframe

How have the cryptocurrencies in the user's portfolio performed on risk-reward metrics?

Calculate ticker daily returns

More efficient operations and higher productivity leads to success and expansion.

Calculate risk reward ratios

Using the daily returns, we can calculate 4 risk-reward ratios:

- Sharpe ratio
- Sortino ratio
- Adjusted Sortino ratio
- Gain-to-pain ratio

Using functions to calculate each

```
# Calculate each of the following risk-reward ratio types
sharpe = da.calculate_sharpe_ratio(ticker_list, portfolio_df)
sortino =  da.calculate_sortino_ratio(ticker_list, portfolio_df)
adjusted_sortino = da.calculate_adjusted_sortino(ticker_list, portfolio_df)
gain_pain_ratio = da.calculate_gain_pain_ratio(ticker_list, portfolio_df)
```

Weights, Forecasting and autoregression

What are the ideal weightages for each crypto asset ?

***if existing portfolio, portfolio choice = "1". user_portfolio is included fro comparison**

4 sets of recommended weights based on each risk-reward ratio

	sharpe	sortino	adj_sortino	gain_pain	user_portfolio
BTC-USD	0.473684	0.475656	0.475654	0.479847	0.604481
ETH-USD	0.526316	0.524344	0.524346	0.520153	0.395519

Weights = asset's ratio divided by the sum of all cryptocurrency ratios in the portfolio

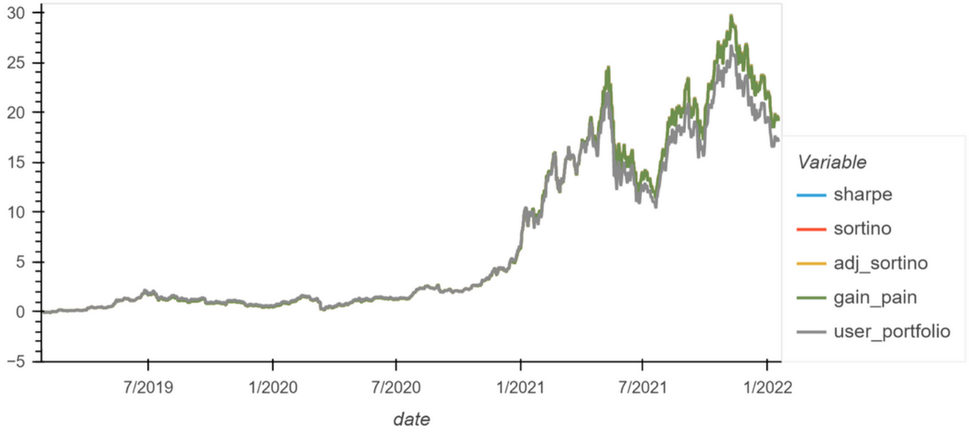
Negative R-R ratios are winsorized to 0, such that the user will be advised to invest S0.00 in that asset.
Example output:

```
Portfolio allocation recommendations
Based on historical returns from 2019-01-19 to 2022-01-17
Total portfolio value: $108267.38
============================================================

Metric: Sharpe Ratio
--------------
ETH-USD                          1.66
Recommended % of total portfolio 52.63%
Recommended value allocation     $56982.83

BTC-USD                          1.49
Recommended % of total portfolio 47.37%
Recommended value allocation     $51284.55
```

Autoregressive modelling

View whole graph

True



Monte Carlo Simulations

```
Key in number of years to forecast: 1
Running Monte Carlo simulation number 0.
Running Monte Carlo simulation number 10.
Running Monte Carlo simulation number 20.
Running Monte Carlo simulation number 30.
Running Monte Carlo simulation number 40.
Running Monte Carlo simulation number 50.
Running Monte Carlo simulation number 60.
Running Monte Carlo simulation number 70.
Running Monte Carlo simulation number 80.
Running Monte Carlo simulation number 90.
```

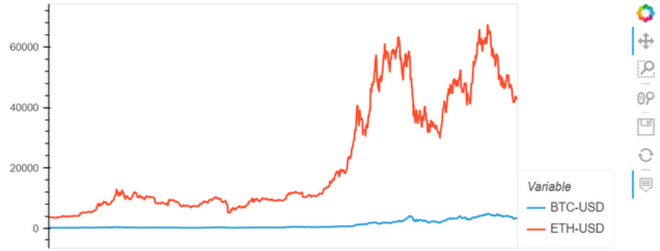
What methods to forecast the portfolio?

Visualisations
Part 1

How was the data visualised? Part 1

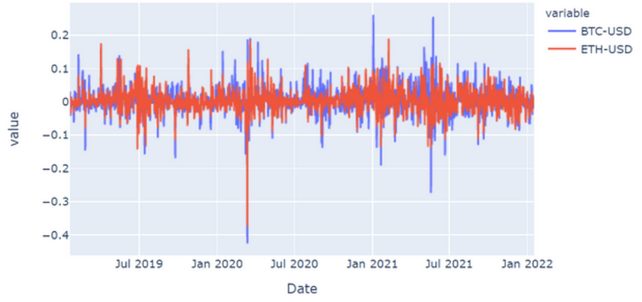
Daily Returns of tickers | Cumulative Returns of tickers | Risk of tickers | Portfolio Analysis

historical data of tickers with 1d intervals



Date	BTC-USD	ETH-USD
2019-01-19	0.028996	0.019336
2019-01-20	-0.040509	-0.034210
2019-01-21	-0.019393	-0.006937
2019-01-22	0.013569	0.007982
2019-01-23	-0.010905	-0.005397

daily returns

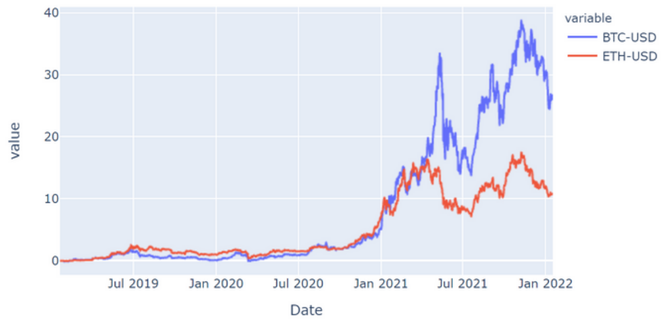


Daily Returns of tickers | Cumulative Returns of tickers | Risk of tickers | Historical Returns of my portfolio

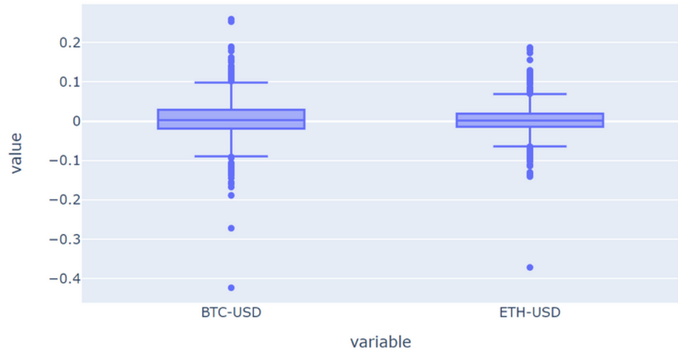
cumulative returns overtime

Date	BTC-USD	ETH-USD
2019-01-19	0.028996	0.019336
2019-01-20	-0.012688	-0.015535
2019-01-21	-0.031835	-0.022365
2019-01-22	-0.018699	-0.014561
2019-01-23	-0.029400	-0.019880

Cumulative Returns



Visual Representation of Risk

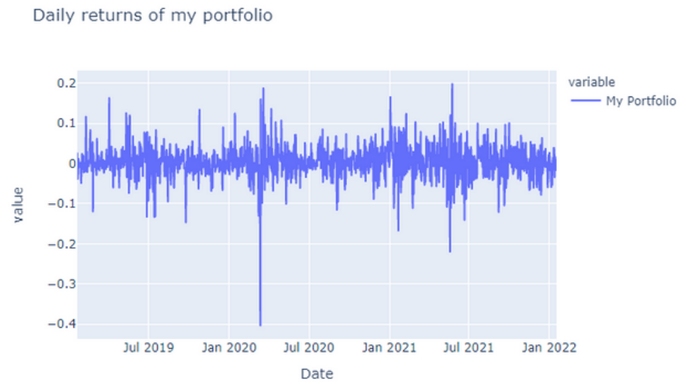


How was the data visualised? Part 1 - existing portfolio

Daily Returns of tickers | Cumulative Returns of tickers | Risk of tickers | Historical Returns of my portfolio

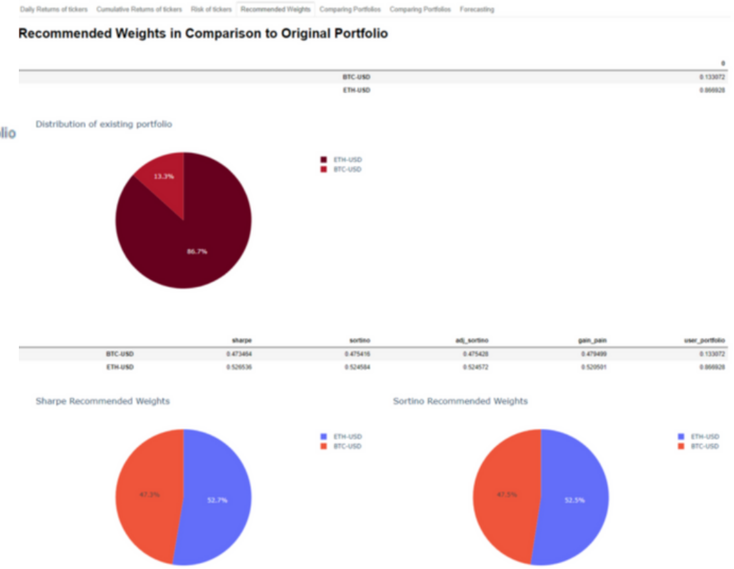
Portfolio Analysis

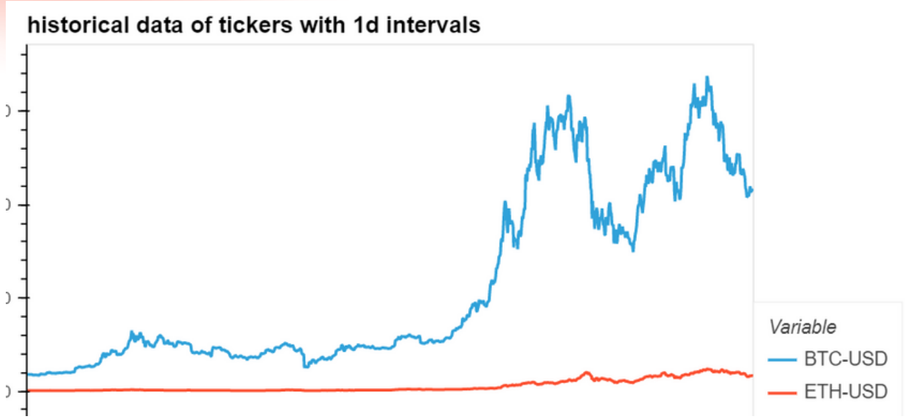
Date	My Portfolio
2019-01-19	0.025175
2019-01-20	-0.038018
2019-01-21	-0.014467
2019-01-22	0.011359
2019-01-23	-0.008727

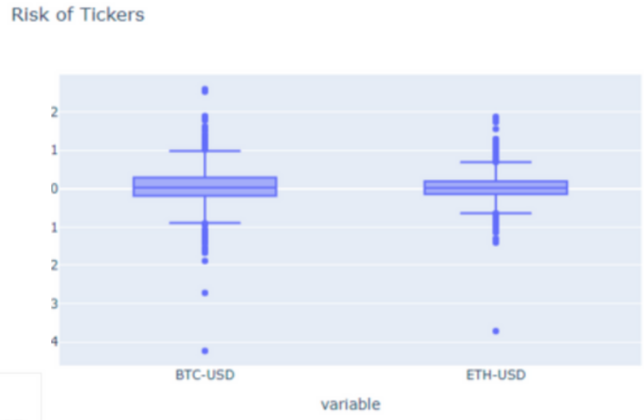


Visualisations
Part 2

How was the data visualised? Part 2







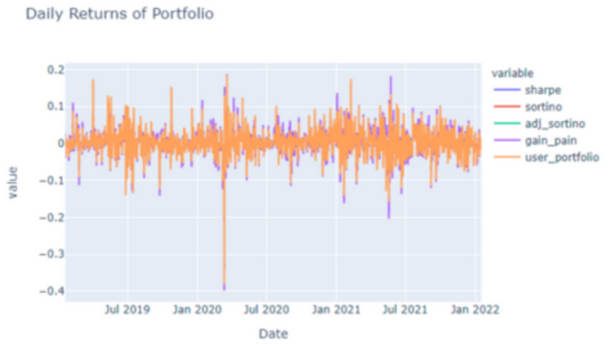
How was the data visualised? Part 2

Daily Returns of tickers | Cumulative Returns of tickers | Risk of tickers | Recommended Weights | Comparing Portfolios | Comparing Portfolios | Forecasting

Portfolio Analysis

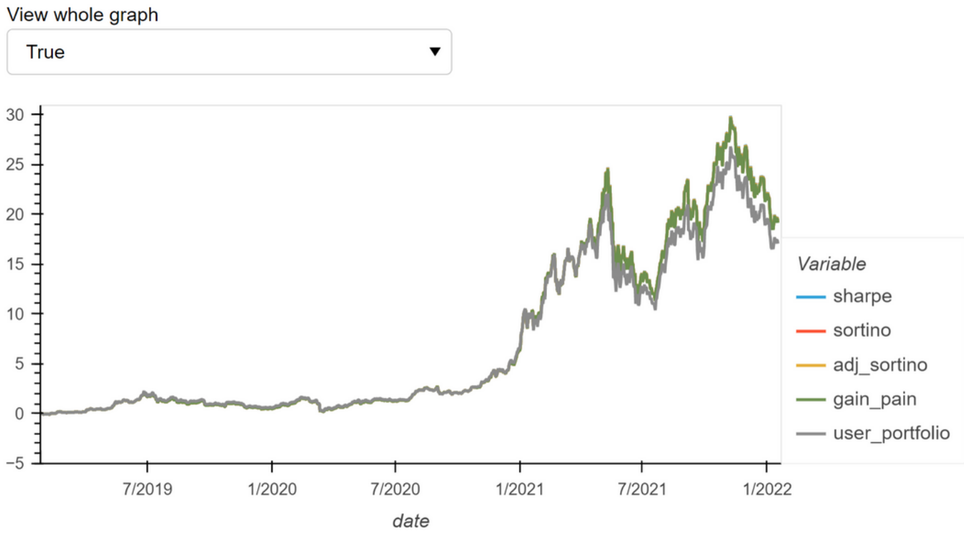
Portfolio Returns

Date	sharpe	sortino	adj_sortino	gain_pain	user_portfolio
2022-01-13	-0.033669	-0.033681	-0.033681	-0.033705	-0.031670
2022-01-14	0.015277	0.015291	0.015291	0.015320	0.012871
2022-01-15	0.003886	0.003894	0.003894	0.003912	0.002388
2022-01-16	0.002124	0.002139	0.002139	0.002170	-0.000461
2022-01-17	-0.012095	-0.012119	-0.012119	-0.012170	-0.007858

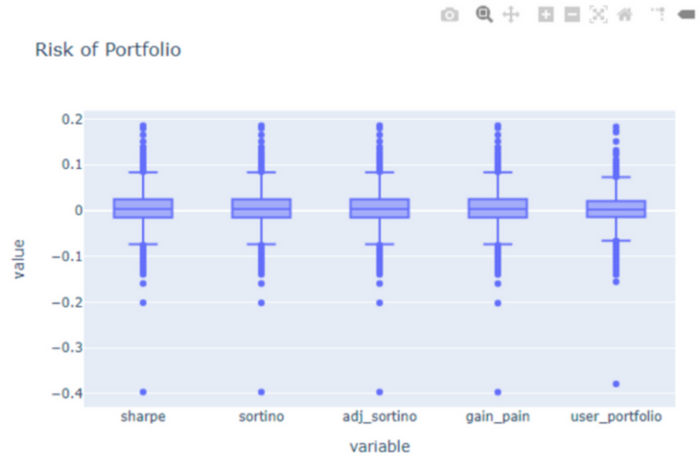


Portfolio Cumulative Returns

Date	sharpe	sortino	adj_sortino	gain_pain	user_portfolio
2019-01-19	0.023910	0.023928	0.023929	0.023968	0.020622
2019-01-20	-0.014172	-0.014167	-0.014167	-0.014155	-0.015149
2019-01-21	-0.026825	-0.026843	-0.026844	-0.026882	-0.023614
2019-01-22	-0.016483	-0.016491	-0.016491	-0.016508	-0.015094
2019-01-23	-0.024356	-0.024374	-0.024374	-0.024413	-0.021132



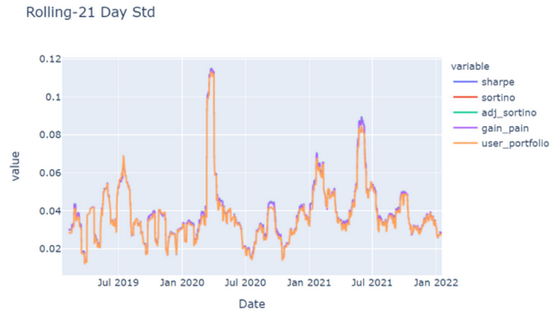
Visualised Risk of Each Portfolio



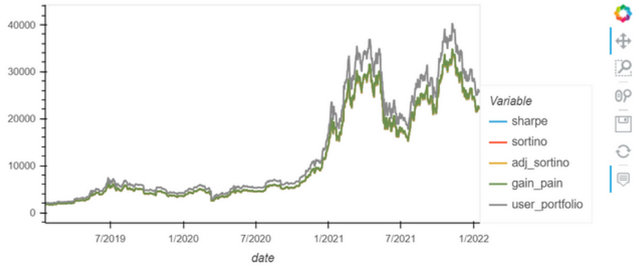
How was the data visualised? Part 2

Annual Standard Deviation

	0
sharpe	0.663182
sortino	0.662823
adj_sortino	0.662821
gain_pain	0.662077
user_portfolio	0.647552



Autoregression modelling



portfolio_returns_list

[Date 2019-01-19 1831.291037 2019-01-20 176

window: **0**

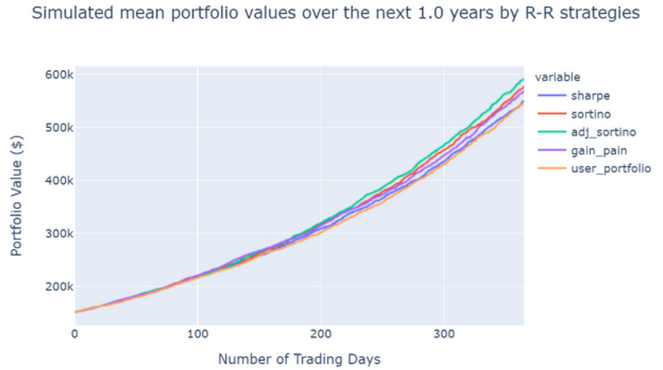
foward_looking: **0**

View whole graph

True

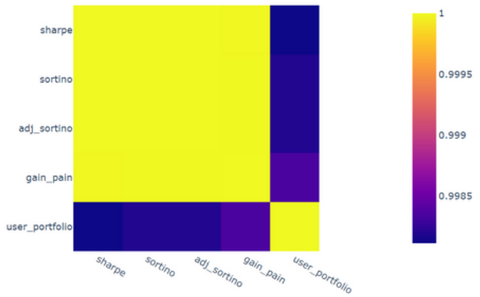
Mean Cumulative PNL

	sharpe	sortino	adj_sortino	gain_pain	user_portfolio
361	539378.657663	570359.035657	583125.621027	561925.874563	541451.251940
362	541875.711620	571087.008224	586888.451722	563104.008650	541459.162853
363	545447.331546	572221.929106	588573.848637	564734.605606	543048.461821
364	548951.611501	574110.182289	589718.557644	565866.200544	544847.029936
365	549346.499778	576990.234495	590568.596337	568945.985669	546795.871564



Correlation of portfolios

	sharpe	sortino	adj_sortino	gain_pain	user_portfolio
sharpe	1.000000	0.999999	0.999999	0.999992	0.998112
sortino	0.999999	1.000000	1.000000	0.999996	0.998190
adj_sortino	0.999999	1.000000	1.000000	0.999996	0.998190
gain_pain	0.999992	0.999996	0.999996	1.000000	0.998347
user_portfolio	0.998112	0.998190	0.998190	0.998347	1.000000



Global Crypto Funds See Record Gains in 2021

BarclayHedge releases 2021 data showing FX and crypto funds aggregates.

Crypto funds achieved steep gains, while FX funds lagged behind.

Saturday, 15/01/2022 | 15:23 GMT+11 by Nicholas Otieno

Improvements if we had more time...

- More financial metric information available for user, e.g. market cap, ROE...
- Using a published theoretical model for portfolio assessment (e.g. Black-Litterman model)
- Using an exchange API (especially CoinMarketCap or CoinGecko), to be more inclusive of small and micro-cap altcoins, and for retrieval of crypto data further back in time.
- Backtesting
- automated trading
- read in data from wallet or account e.g. alpaca. Was an issue do to ticker name compatibilities

Analyse a cryptocurrency portfolio and recommend portfolio allocations based on a number of risk-reward metrics

Do you have any questions?