Let's Get Optimized

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Project Overview and Objectives

- Given $10,000, what is the optimum portfolio allocation
- Assets span Cryptocurrency and traditional assets (stocks)
- Apply portfolio optimization methods and forecasting methods

Portfolio Components

| Crypto Assets	Traditional Assets
Ripple (XRP)	Apple (AAPL)
Solana (SOL)	Amazon (AMZN)
Dogecoin (DOG)	Bank of America (BAC)
Ethereum (ETH)	Costco (COST)
Bitcoin (BTC)	Disney (DISN)
Cardano (ADA)	Domino's Pizza (DPZ)
Litecoin (LTC)	Google (GOOG)
Uniswap (UNI)	Coca Cola (KO)
Cryptocom Coin (CRO)	McDonald's Corp (MCD)
USD Coin (USDC)	Microsoft (MSFT)
	Nordic American Tanker (NAT)
	Starbucks (SBUX)
	Tesla (TSLA)

Portfolio Asset Allocation
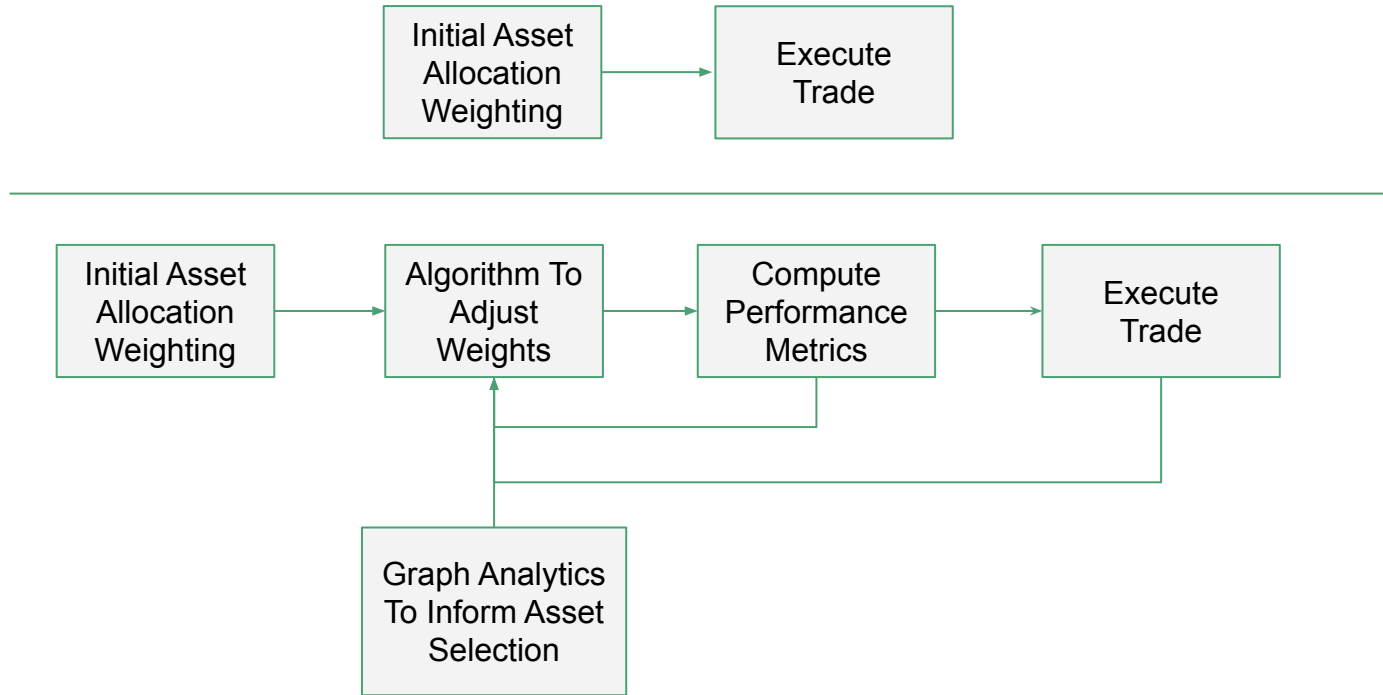
Approach

- Download and standardize historical data
- Leverage Portfolio Optimization Libraries to determine overall weighting
  - Use Blackman-Litterman Allocation
- Determine portfolio asset weighting
  - Compute overall returns across the portfolio of assets
- Use a graph database to determine the similarity of assets based on a collection of measures
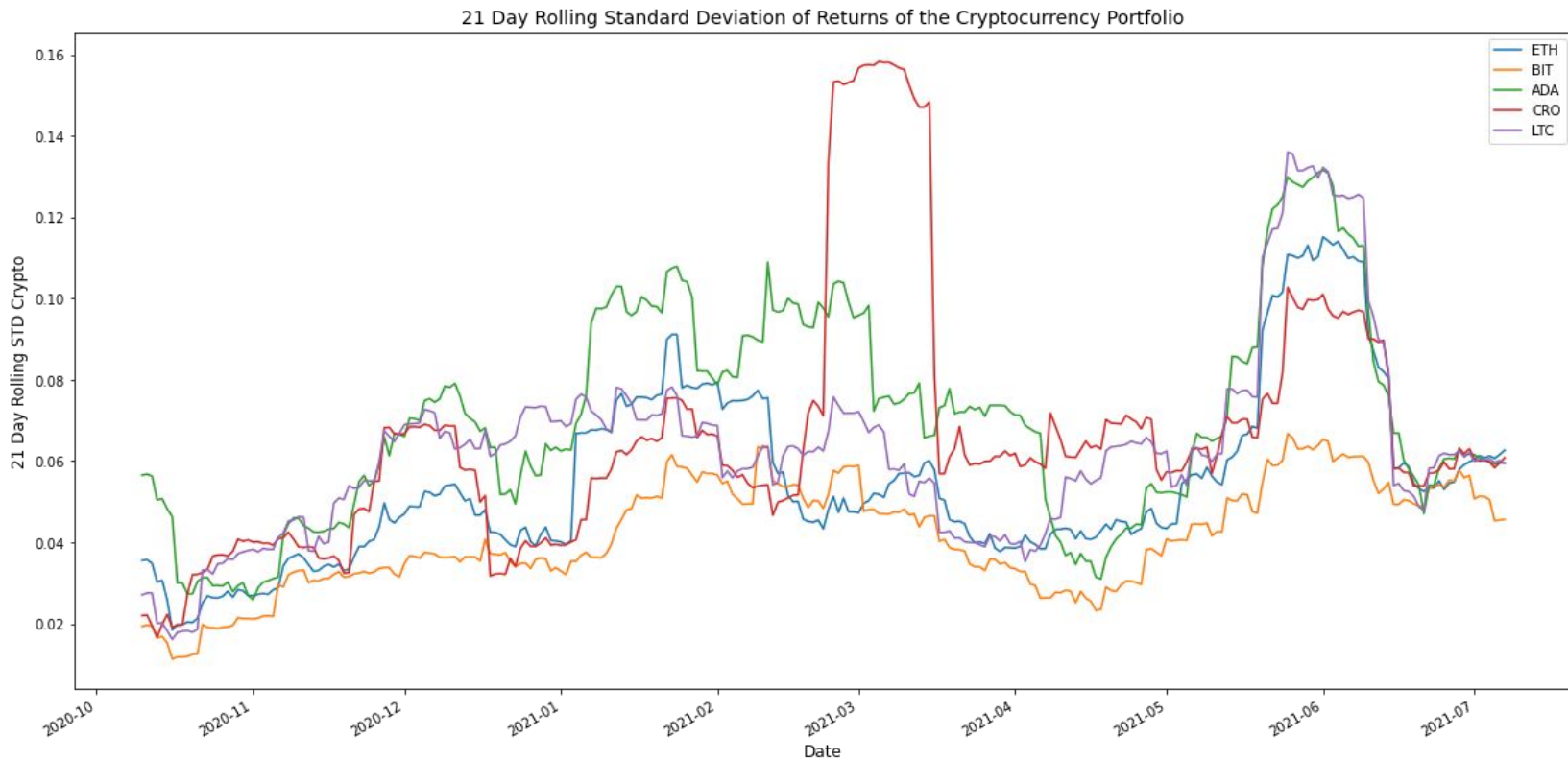 - Can be extended to other non-numeric measures
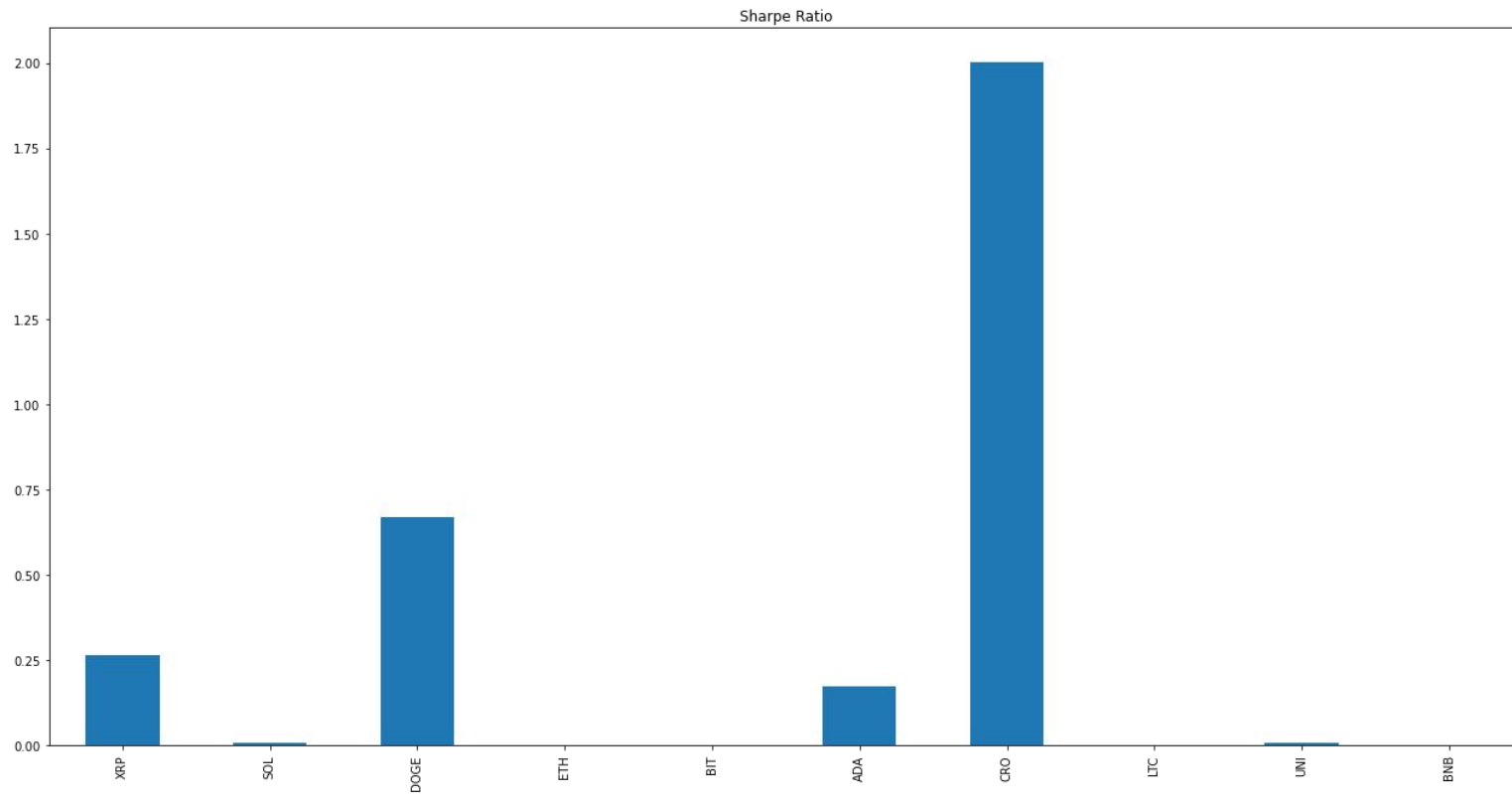
Percent Change Plots

Daily Crypto Returns
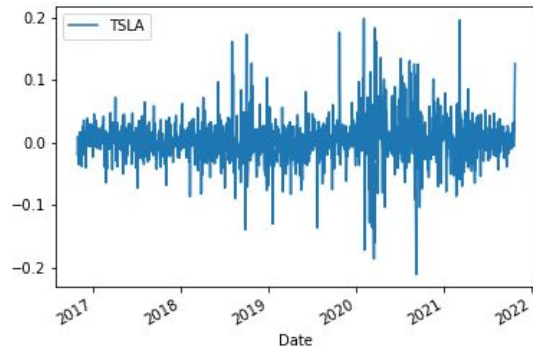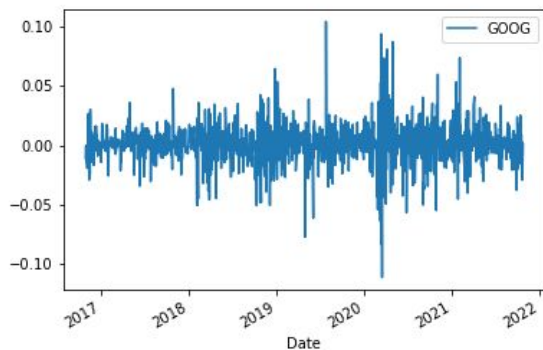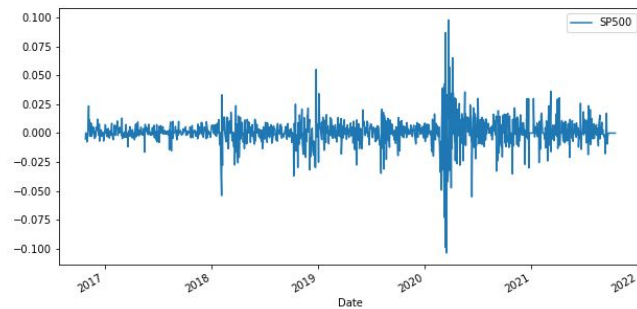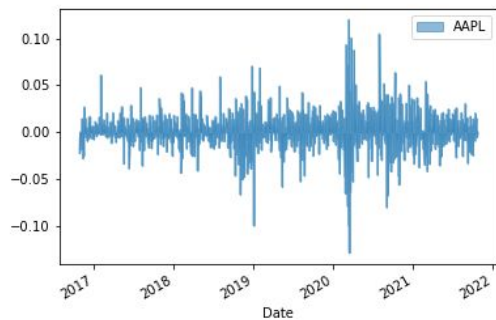
Daily Returns of The Portfolio of Crypto Assets
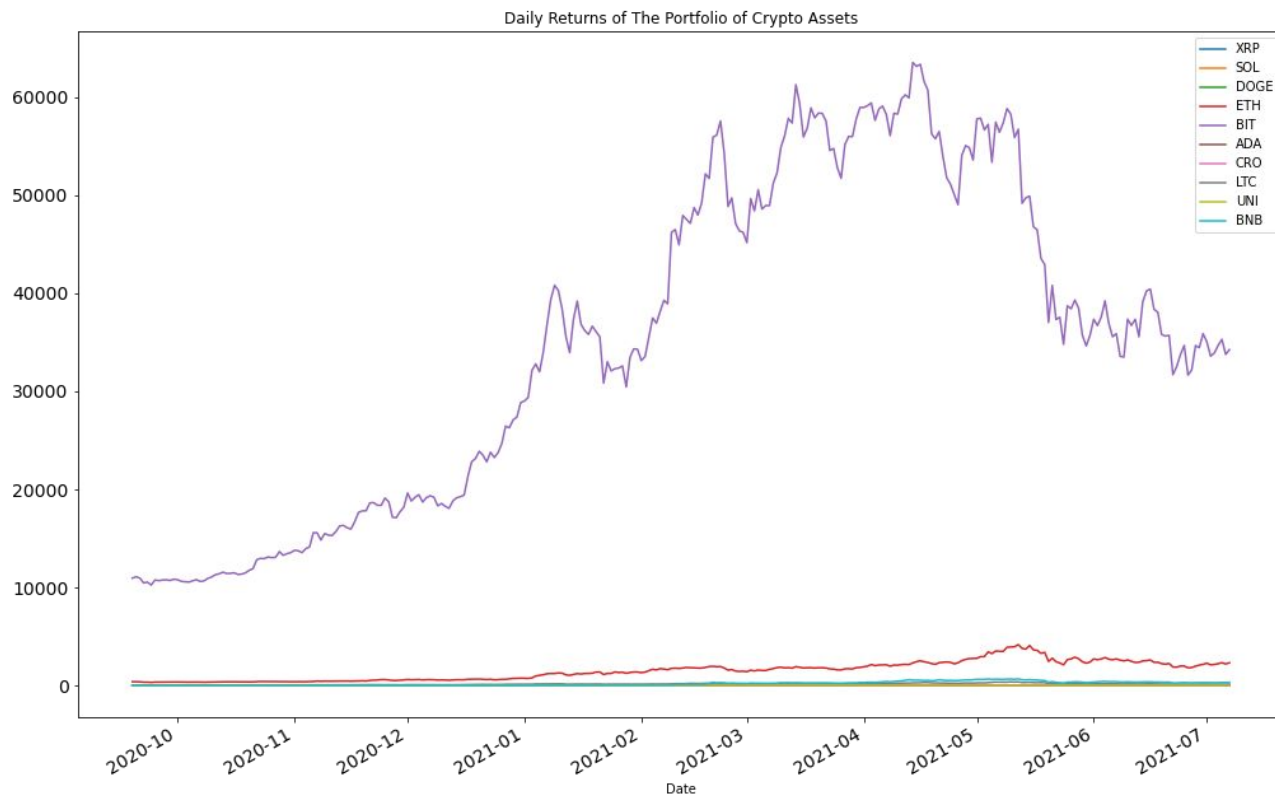
21 Day Rolling Standard Deviation (Cryptocurrency)

21 Day Rolling Standard Deviation of Returns of the Cryptocurrency Portfolio
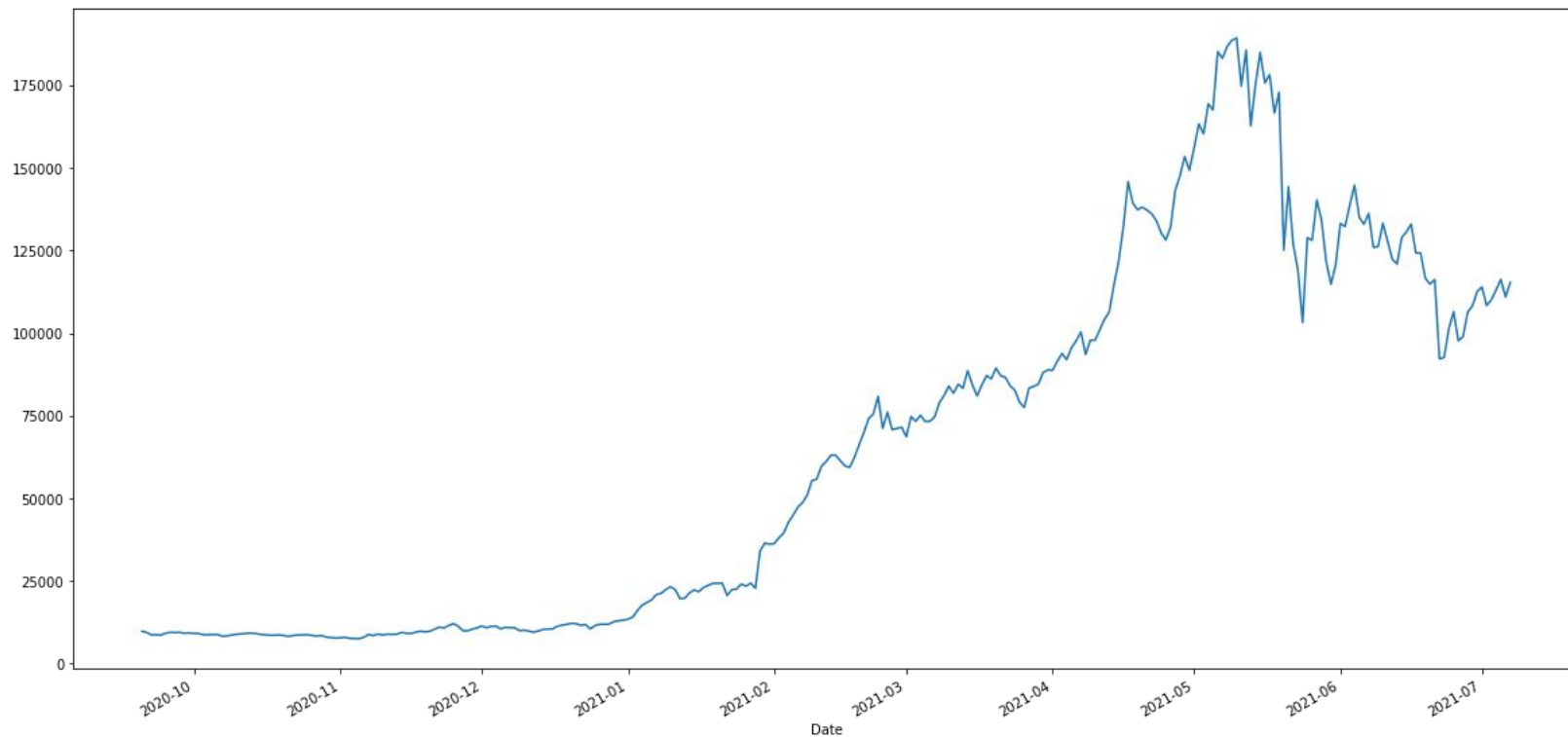
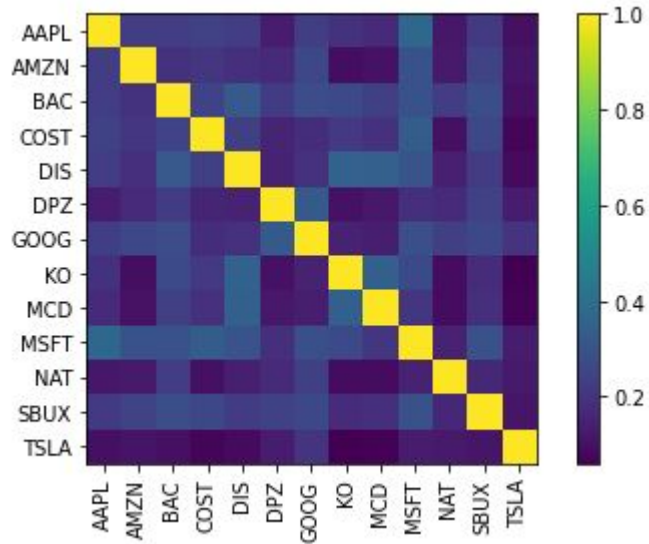# Sharpe Ratio

Sharpe Ratio

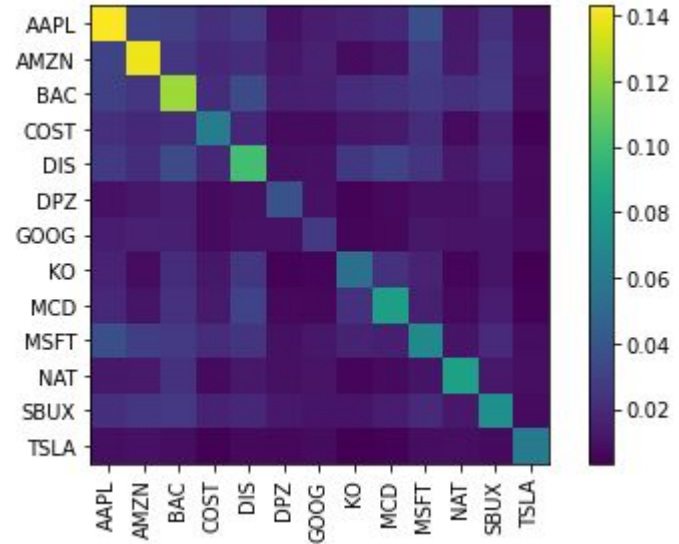# Sharpe Ratio Optimized Portfolio (Crypto Only, $10,000 Initial Investment)
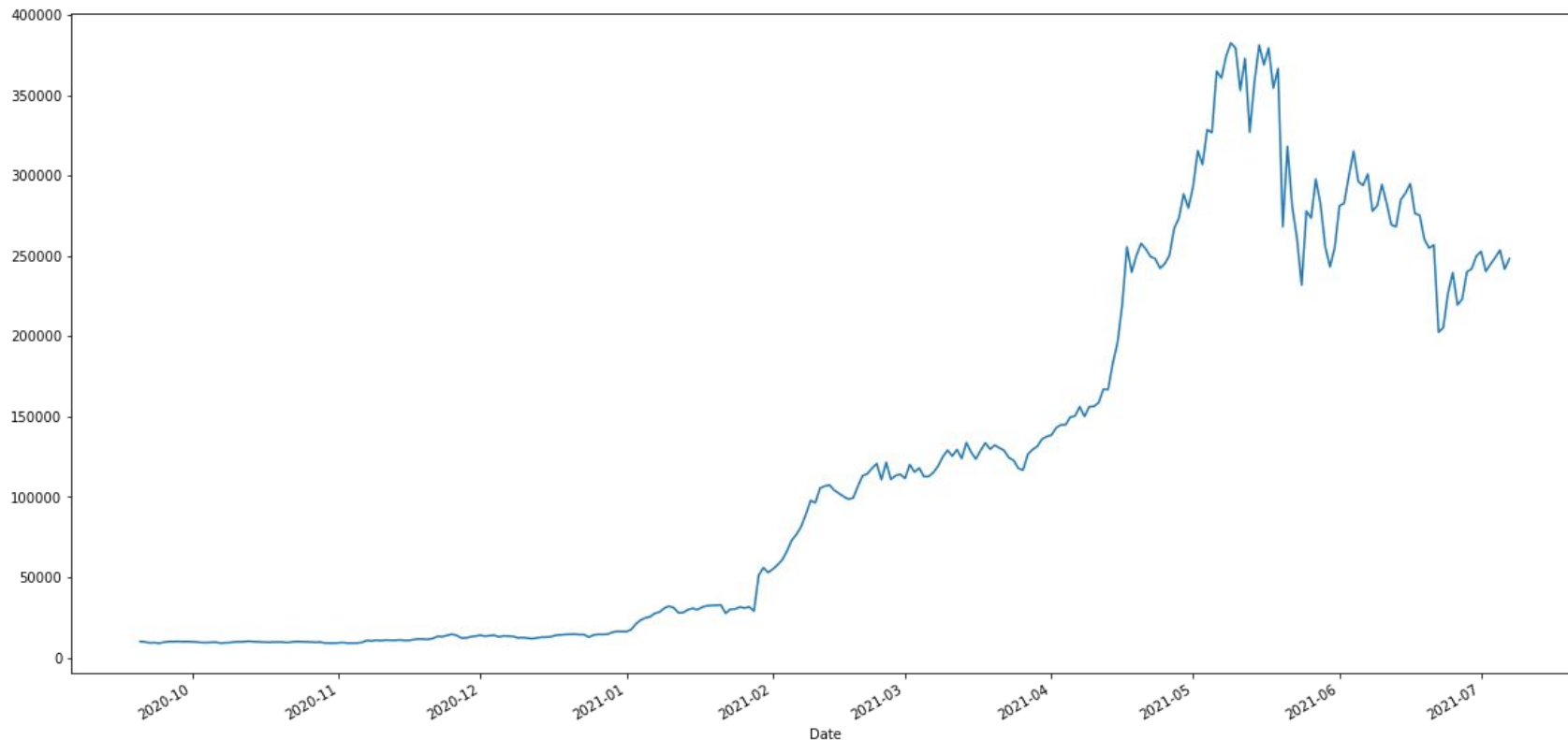
Non-Correlated Portfolio Returns (Crypto Only, $10,000 Initial Investment)

Covariance Matrices

Covariance Based On Returns

Covariance Of Market Prior Measures

Capturing Market Risk Of All Assets (Market Priors)

Every asset in the **market** portfolio contributes a certain amount of risk to the portfolio. Standard theory suggests that investors must be compensated for the risk that they take, so we can attribute to each asset an expected compensation (i.e **prior** estimate of returns). This is quantified by the market-implied risk premium, which is the market's excess return divided by its variance.
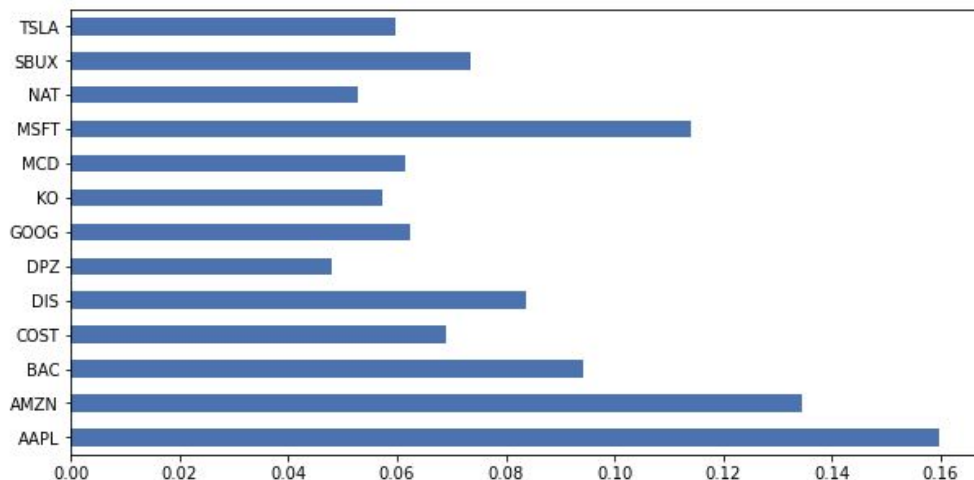
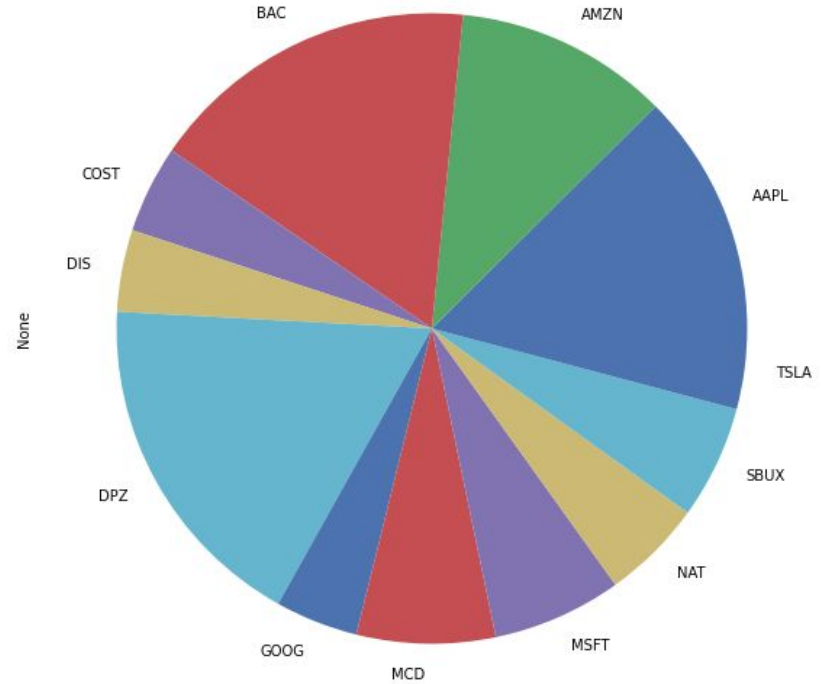# Returns Estimate

- The **Black-Litterman (BL)** model takes a *Bayesian* approach to asset allocation. Specifically, it combines a prior estimate of returns (for example, the market-implied returns) with views on certain assets, to produce a posterior estimate of expected returns. The advantages of this are:
  - You can provide views on only a subset of assets and BL will meaningfully propagate it, taking into account the covariance with other assets.
  - You can provide confidence in your views.
  - Using Black-Litterman posterior returns results in much more stable portfolios than using mean-historical return.
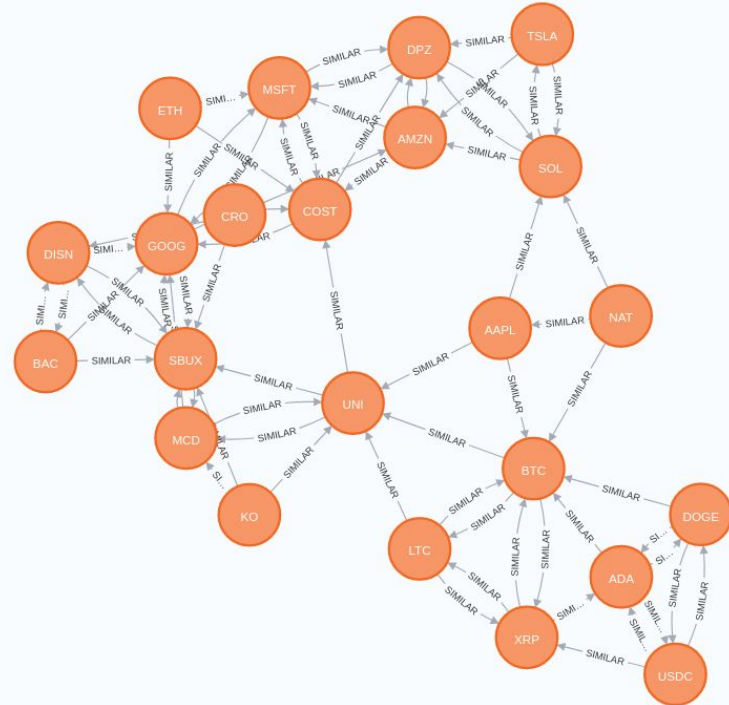
[Source:https://pyportfolioopt.readthedocs.io/en/latest/BlackLitterman.html?highlight=posterior#black-litterman-allocation]
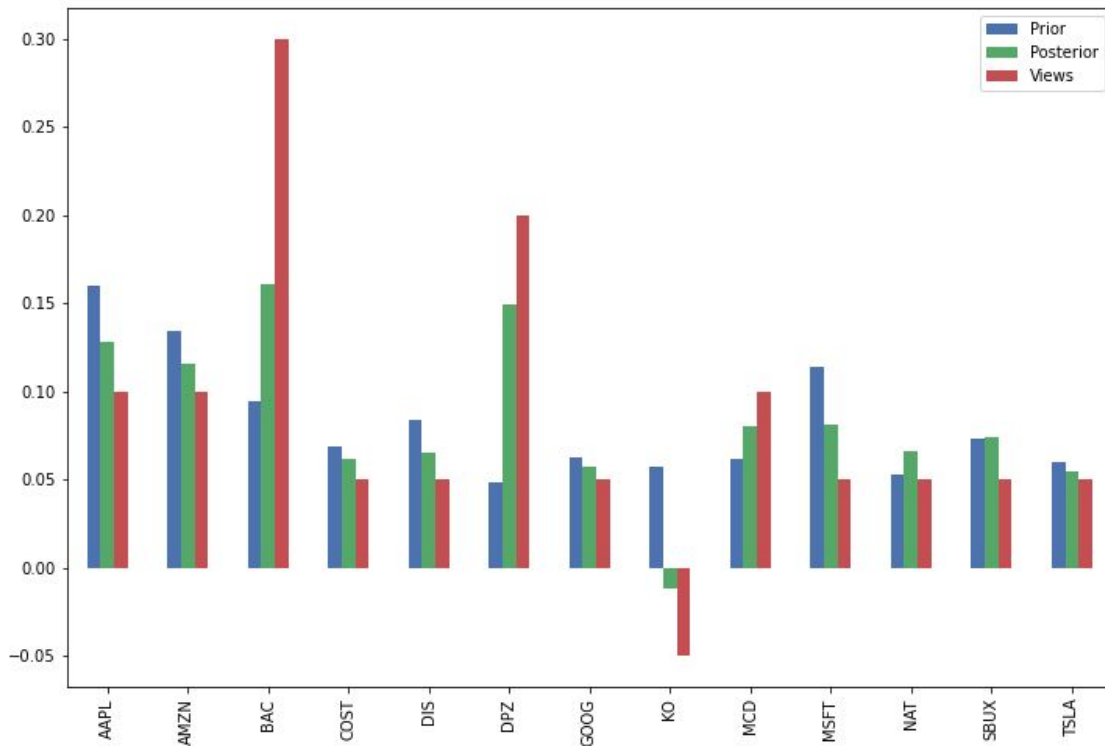
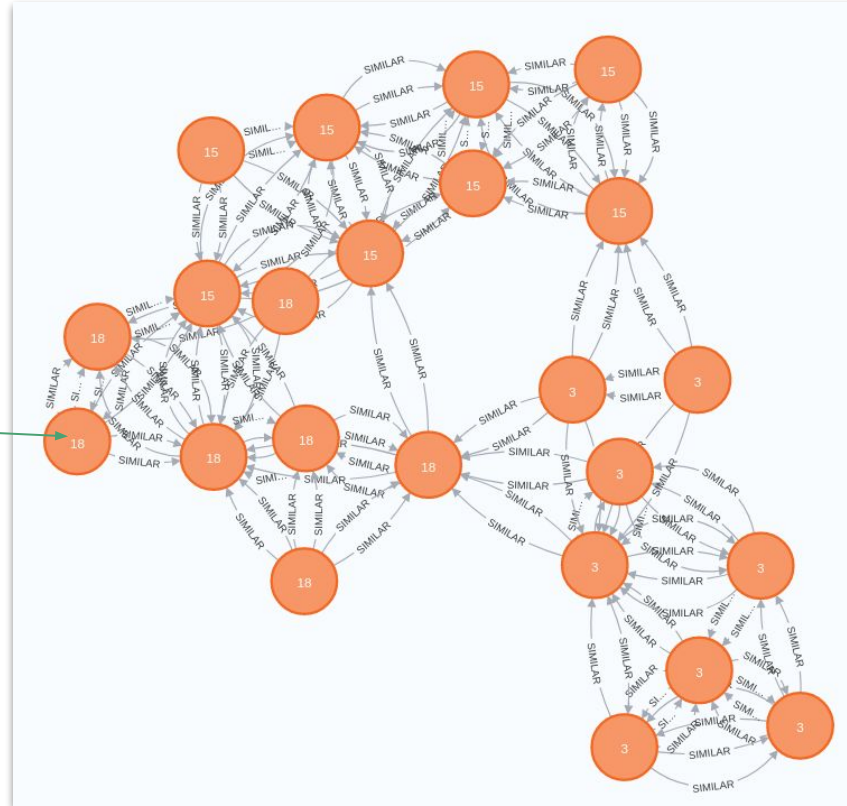# Portfolio Allocation

Final portfolio allocation

Similarity Measure Grouping Of Crypto & Traditional Assets

Asset Communities

Each asset is assigned a
community or grouping

Community Label

Grouping of Investments

Grouping of Investments is based on a community detection algorithm

- Using the Louvain community detection algorithm
- Measures the relative density of edges inside communities with respect to edges outside communities.
- Optimizing this value theoretically results in the best possible grouping of the nodes of a given network.

[Source: https://en.wikipedia.org/wiki/Louvain_method]

Community	Investment Groupings
3	["BTC", "USDC", "ADA"]
15	["ETH", "SOL", "AMZN"]
18	["CRO", "UNI", "BAC"]

Next Steps

- There are multiple approaches in optimizing portfolios
- Leverage alternate data and relationships that extend traditional asset performance metrics
- Graph analytics and machine learning can be used to uncover additional insight for portfolio managers
  - Tracking all Bitcoin transactions

Summary

Why use the Black-Litterman model?

The Black-Litterman (BL) Model is an analytical tool used by portfolio managers to optimize asset allocation within an investor's risk tolerance and market views.

What is next?

The next step is to implement a functioning dashboard that will be user friendly for the user, the black-litterman model is a great tool for major fund or portfolio managers.