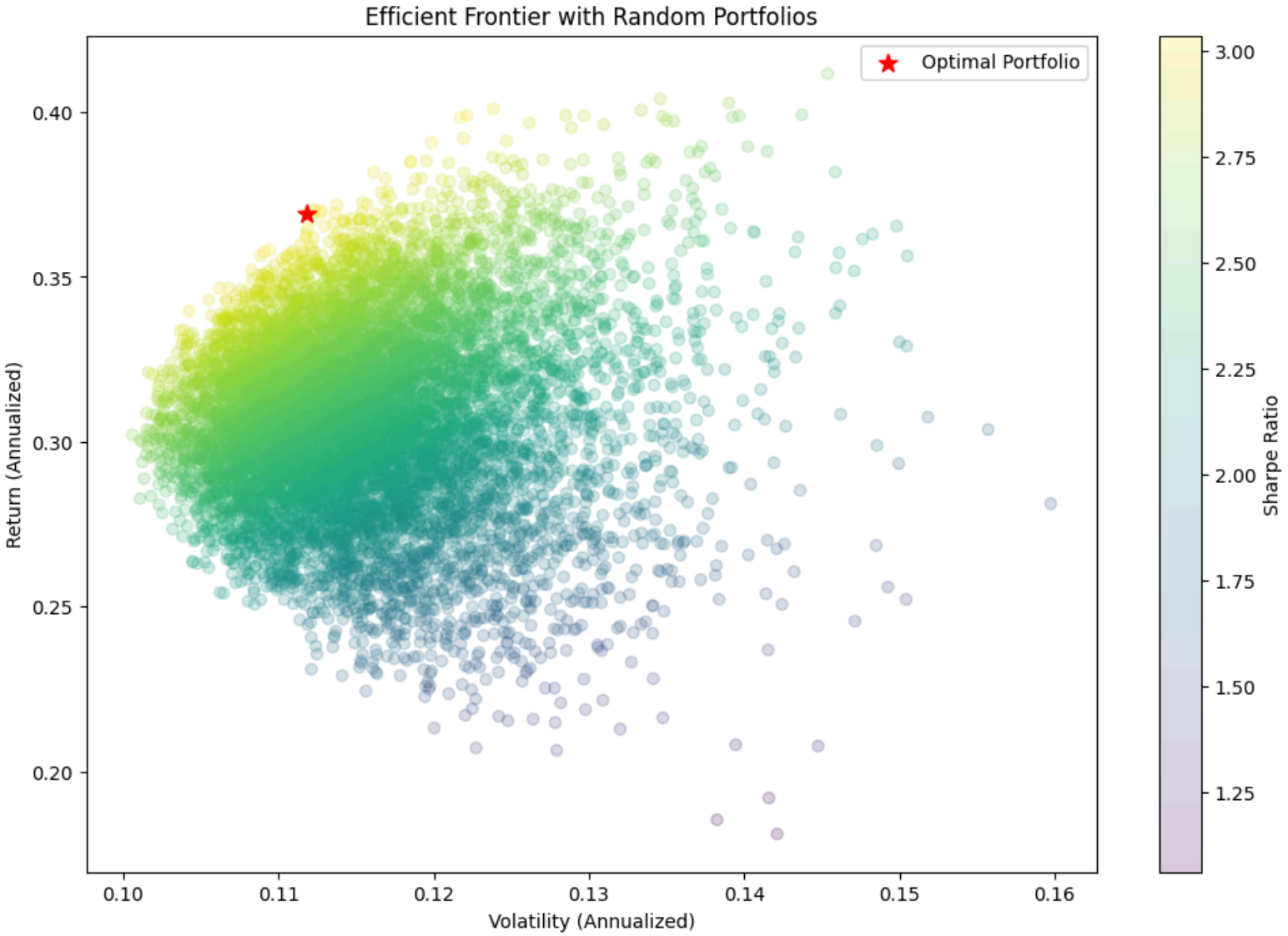
QUANT CLUB/QUANT TASK

BY SOHAM AGARWAL | FRESHMAN | 24CH10039



OVERVIEW | REQUISITES | APPROACH | OUTCOME | APPENDIX

Overview

Portfolio Optimization & Back testing Challenge

https://drive.google.com/file/d/1sowtUGVhJUjUeRcT3LQVdKMzNN-8BtoG/view?usp=drive_link

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The task serves a major purpose for testing the knowledge of :

- Finding Best Stocks [with Reasoning]
- Factor Investing

  Parameter weightage

- Performance analysis
- Backtesting and optimization

Selecting stocks

- Primarily i am focusing on bringing in diversity in the portfolio
- Ensuring multiple sectors are involved , so as to reduce any sector specific risk.

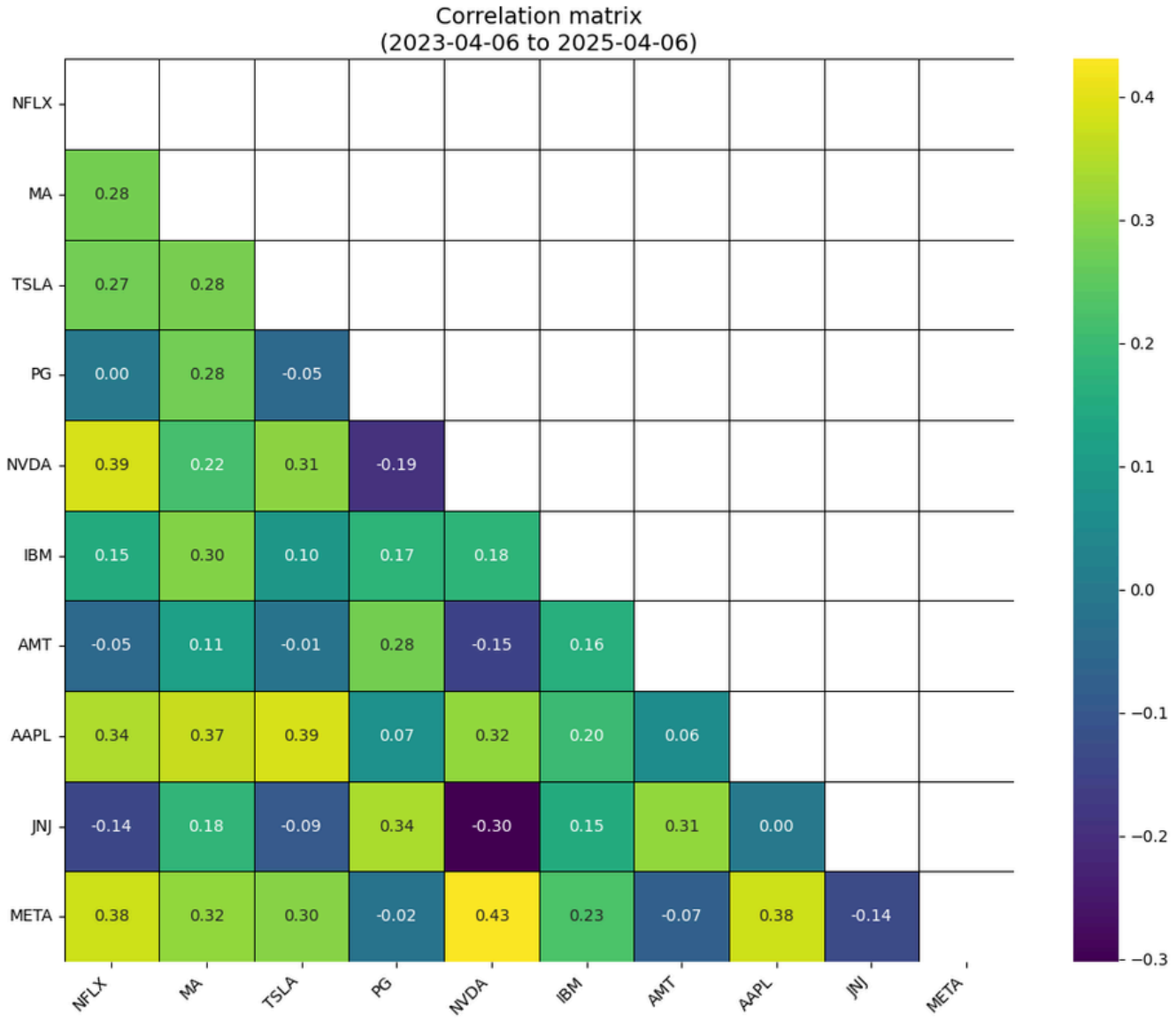
MA	Banking and Finance sector , MASTERCARD is a global leader in payment technology, facilitating seamless connections among consumers, financial institutions, merchants, and governments worldwide.
AAPL , MSFT, NVDA , META , TSLA	With tech and electronics giants like APPLE , MICROSOFT, NVIDIA , META ,TESLA we aim to achieve a balanced and forward-looking investment approach that aligns with the evolving technological landscape and provide an overall thrust to our portfolio , due to all rounder coverage in entire market by these companies
NFLX , PG , JNJ	Consumer Based Companies like NETFLIX , PROCTER & GAMBLE , and JOHNSON & JOHNSON are well-regarded for their innovation, customer-centric approaches, and strong brand reputations. Their strong brand reputation and their increasing market , encourages us to nourish our portfolio with it.
AMT	AMERICAN & TOWER CORP. is a leading company in the real estate sector of US market. Gold and real estate are all time rising assets , which consistently can help grow the portfolio very well
IBM	International business machines corp. is a leading company in the IT Sector with a strong reputation. and with AI / ML upgrading daily , IBM persistently is offering large computational powers and its cloud services making a large value of the company gradually.

Calculating correlation matrix :

helps statistically determine there is less negative correlation between the stocks in the portfolio ,

making a robust portfolio

Based on the returns collected from the past two years , we can evaluate the variance and thus the covariance and this matrix of each covariance for all pairs of (companies) X (companies) gives the covariance matrix	Represents how two stocks returns are interdependent $\textbf{Covariance} = \frac{var(xy)}{var(x)\ var(y)}$



Adjusting weights :

Parameters:

Generally the most common factors and parameters used while constructing an optimal portfolio are..

PRICE/BOOK RATIO	This compares a stock's price to its accounting book value per share. A low P/B is also a classic indicator for the **Value** factor, suggesting a stock might be cheap relative to its net asset value.
PRICE/EARNING RATIO	This compares a stock's price to its earnings per share. A low P/E is a classic indicator for the Value factor, suggesting a stock might be cheap relative to its earnings power.
BETA FACTOR	This measures a stock's volatility relative to the overall market. It's the primary parameter for the Low Volatility or Minimum Volatility factor. The goal there is to find stocks with lower market risk. But almost ineffective for our analysis .
MOMENTUM SCORE	Momentum score accounts for its current and previous price into evaluating its future potential. with it analysts can determine the strength of an upward or downward trend. But sometimes it can also cause to fall for a Bullish/Bearish trap.
50/200 MA distance	Its class yet great strategy used in portfolio management : but due to data availability and probable issues in their analysis, it may cause the portfolio to be aggressive
EPS VALUE	Important factor to determine the Earning stability of the company by calculating the EPS = std.(earning in the fiscal year) no of shares in total
Debt to Equity (D/E)	Lower debt / equity or negative one gives a financial leverage and adds to safety factor. Data reveals the insecurity faced by the user , but immediate judgement based on D/E ratio may not be always correct

weight score = linearly dependent vector of the three parameters

<Why?>

A low **Price / book value** suggests that the company is not over valued , indicating potential for investment opportunities seeking safety. Also Investors often look for such companies as they may be undervalued by the market, presenting a chance for growth and profit.

However, it's crucial to ensure that the low ratio is not due to any underlying issues within the company. By examining factors like earnings stability, management efficiency, and industry trends, investors can make more informed decisions.

Therefore to examine earnings stability : we have **std(EPS Value)** which help to evaluate the consistency of a company's profitability over time. By analyzing it we can estimate

- Financial health
- Ability to generate profits

A stable or growing EPS trend is often a positive indicator, suggesting that the company is effectively managing its operations and maintaining its competitive edge.

<how does **p/e ratio** comes into play here then > totally the industry trends and consistent earnings of the company can be ensured with the p/e ratio.

> High P/E ratio := expect higher earnings growth
>
> compared to companies with a lower P/E ratio , and Conversely true .

Back testing :

Rebalancing :

Has a great impact on the strategies used , in order to make sure that portfolio is actually as per the weight it was originally decided to be

Due to the active price rise and fall , the weights does not remain the same as initially justified , for that purpose the portfolio can become aggressively biased.

We must allegedly believe on the analysis we have done and the parameters we have decided to optimize our portfolio , if certain stock performed well , our total would increase and the weight of that certain stock would increase , so to again distribute down the weights we originally estimated we will again

<STRATEGY>

Chosen parameters are P/E ratio , P/B value and the EPS value , for that initially i took a 50/30/20 as the inital weights in calculating the score of the stock and then i optimized it using effecient frontier , and got the optimal values for the weights to be used and thus the optimal weightage for the stocks.

Sharpe ratio

```python
import numpy as np

def calculate_sharpe(returns, risk_free_rate=0.02):
    excess_returns = returns - (risk_free_rate/252)
    return np.sqrt(252) * excess_returns.mean() / excess_returns.std()
```

Drawdown

```python
def calculate_drawdown(returns):
    cumulative = (1 + returns).cumprod()
    peak = cumulative.expanding().max()
    return (cumulative - peak).min()
```

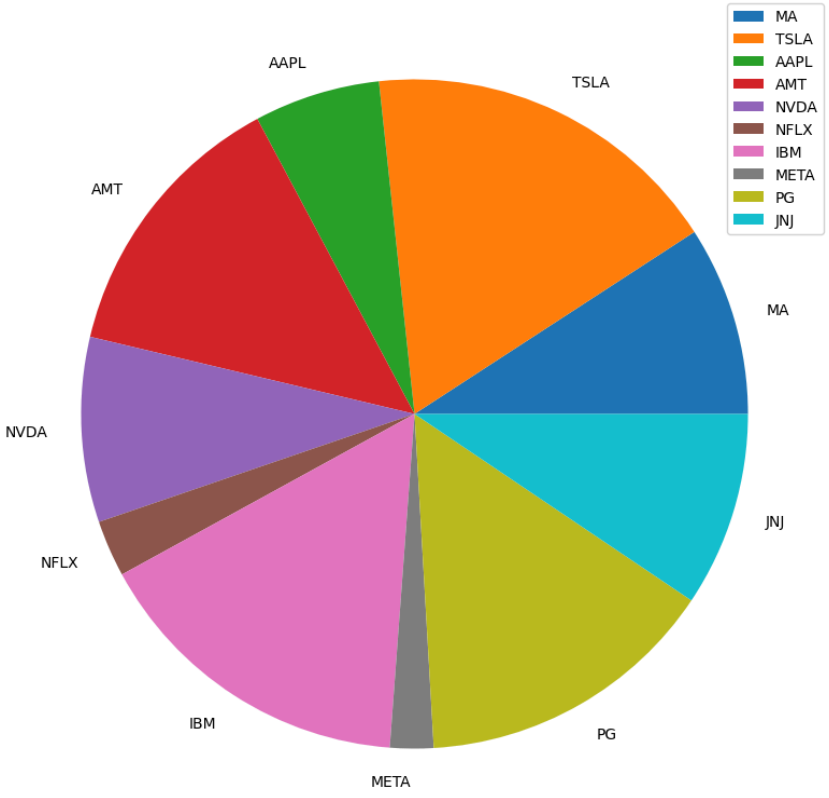
✓ 0.0s

Returns

```python
def calculate_returns(returns):
    cumulative = (1 + returns).prod() - 1
    annualized = (1 + cumulative)**(252/len(returns)) - 1
    return cumulative, annualized
```

✓ 0.1s

Current portfolio and Optimized portfolio

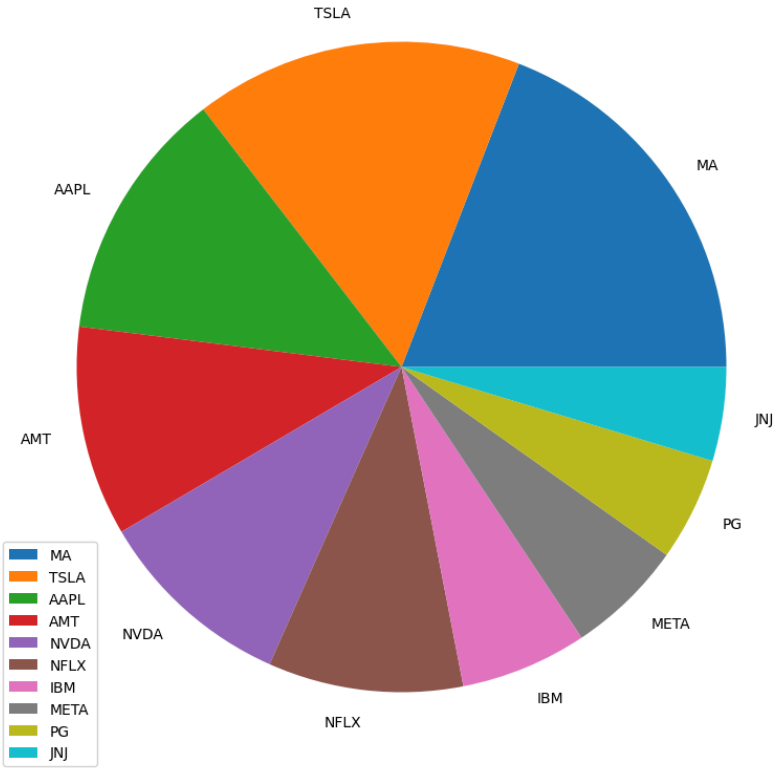


OPTIMIZED

	Ticker	Optimal_Weights
1	MA	9.153259
2	TSLA	17.552700
3	AAPL	6.108558
4	AMT	13.479138
5	NVDA	8.937760
6	NFLX	2.730999
7	IBM	15.853982
8	META	2.102045
9	PG	14.674143
10	JNJ	9.407416

UNOPTIMIZED

	Ticker	weights
1	MA	0.191134
2	TSLA	0.163333
3	AAPL	0.125664
4	AMT	0.104450
5	NVDA	0.098886
6	NFLX	0.097038
7	IBM	0.063046
8	META	0.058382
9	PG	0.051433
10	JNJ	0.046635



EFFECIENT FRONTIER

The optimized sharpe ratio is not the maximum one but , which also has optimum volatility

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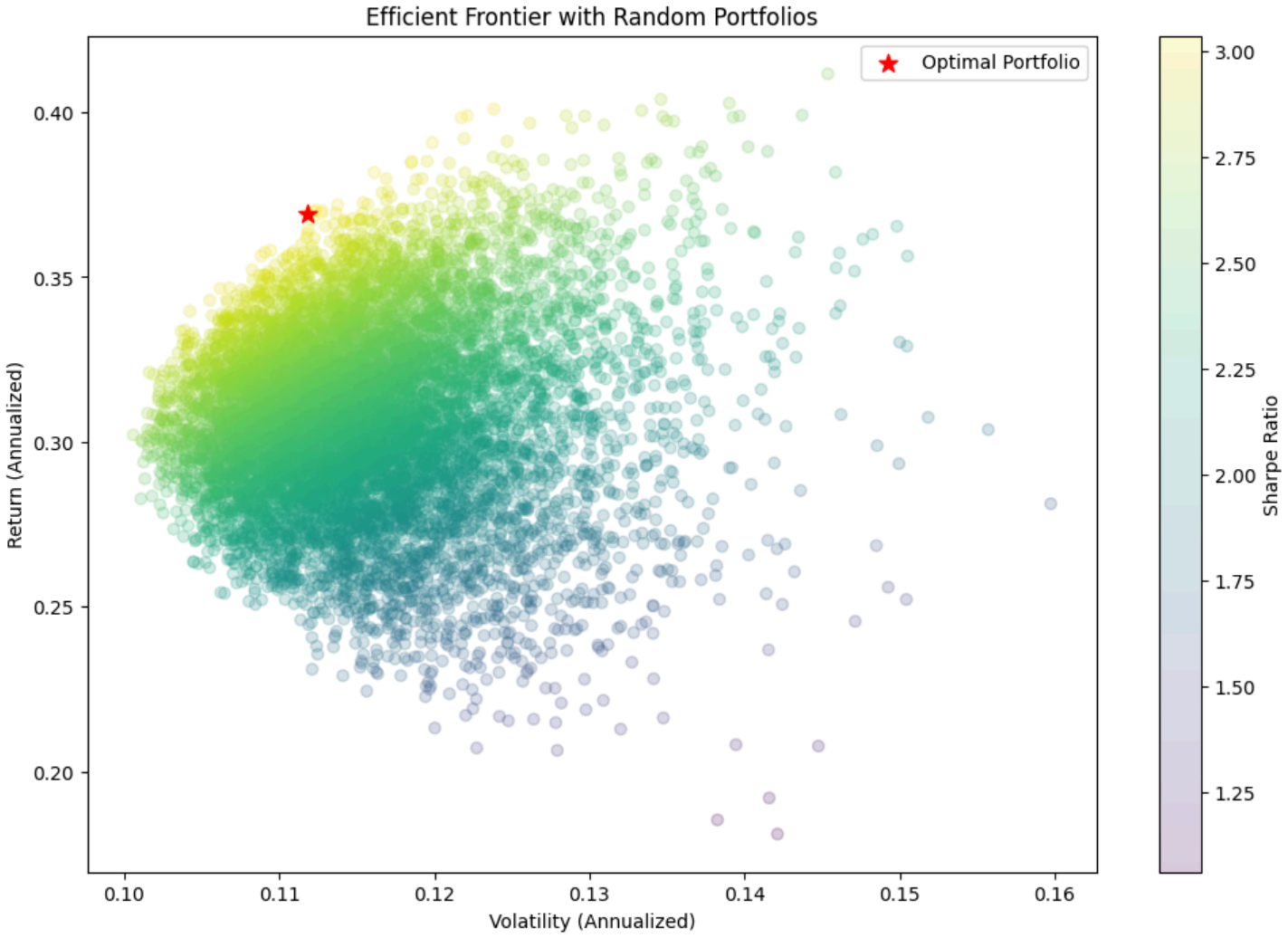
EFFECIENT FRONTIER IS A CRUCIAL PART OF MPT , AND HELPS TO optimize the allocation of assets in a portfolio to achieve the best possible return for a given level of risk. By plotting the set of portfolios that offer the highest expected return for each level of risk, investors can identify the most efficient combinations of assets. This visualization assists in making informed decisions.



Appendix

https://github.com/agarwalsoham993/portfolio_optimization

Library used :

Yfinance : https://github.com/atreadw1492/yahoo_fin

Numpy : https://numpy.org/devdocs/reference/

pandas : https://pandas.pydata.org/docs/reference/general_functions.html

seaborn : https://seaborn.pydata.org/generated/seaborn.objects.Plot.html

matplotlib：https://matplotlib.org/stable/api/index.html

Quant book for modern portfolio theory

🌐 Quant Club - Quant Book

For evaluating parameter and stocks :

https://finviz.com

For value and momentum understanding :

https://pages.stern.nyu.edu/~lpederse/papers/ValMomEverywhere.pdf

Thankyou

Hope I’ve met your requirements

With this report.

Contact

Soham Agarwal

contactsoham6@gmail.com | https://www.linkedin.com/in/agarwalsoham993/ | https://github.com/agarwalsoham993