

Team R-chitects

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Financial Portfolio Management Dashboard

R-Shiny Decision Support System

# **Abstract**

We have developed a shiny dashboard that allows the user to track the performance of S&P stocks, observe their forecast predictions and curate a stock portfolio based on the user’s financial goals and risk appetite. This solution was developed to support potential investors in for their portfolio management. The dashboard provides a comprehensive analysis of the stocks and descriptive, predictive and prescriptive analytics.

# **Business Problem**

For an Asset Manager who does not have the time and ability to carry out sophisticated financial analysis, the portfolio management dashboard is a very effective tool. Our solution addresses two key questions of the potential investor:

1. Which are the stocks that should I invest in?
2. How much should I invest in each of these stocks?

The dashboard generates a portfolio of stocks curated for four different profiles of investors:

1. The risk-averse investor: Minimize risk (selects top ‘x’ stocks with the least risk)
2. The high-return investor: Maximize return (selects top ‘x’ stocks with the most returns)
3. Balanced portfolio investor: Maximizes the sharpe ratio1
4. Specific goals investor: Maximizes sharpe ratio with risk and return constraints

On an average, the optimizer tool would match the S&P annual return of ~10% whereas the Asset Manager typically gets a return of 6% on his/her stock investments.

# **Analytics Problem**

The business problem can be formulated into an optimization problem with the objective of maximizing the Return-Risk ratio, with different user defined constraints (such as min expected return, number of stocks to be selected in the portfolio, max risk tolerance, etc.)

Maximize *([Return-(risk free return)/Risk] or [Max Returns] or [Minimum Risk] )* Subject to *([Overall returns] or [Minimum Weights] or [Maximum Weights])*

The success of the solution lies in its ability to generate multiple portfolios which curated to the specific investor’s risk appetite and financial goals.

By their nature, stock markets are inherently unpredictable, our predictions come with the underlying assumption that the returns will have an underlying risk (variance in return) associated with it.

# **Data**

We narrowed down our focus to S&P stocks which are typically more attractive for the Asset Managers whose clients are retail investors. The stock data is imported from Yahoo Finance (starting from Jan 1st, 2013)

Since the data is already in a clean, structured, and standardized format, we did not apply additional data cleaning methods. We used financial functions to generate returns/get inherent risk (standard deviation) for every stock.

The data granularity is at a daily level – This data is used to generate the technical indicators

# Methodology Selection

We designed the product to support the investor in each step of the decision process:

1. **Explore** (descriptive analytics): Identify the stocks and review their past performance. Filter down the stocks that have **good finance ratios/technical indicators.**
2. **Forecast** (predictive analytics): Estimate the expected growth of a stock based on current trends. The asset manager will use the analysis to **further filter the stocks for the portfolio**.
3. **Optimize** (prescriptive analytics): An optimized portfolio curated to the investor’s specifications. This allows the asset manager identify **how the money needs to be split across individual financial assets.**.

Pre-existing libraries such as ‘quantmod’, ‘PortfolioAnalytics’, ‘dplyr’ make ‘R’ the most ideal tool to develop this solution. Moreover, Shiny with R served as an excellent visualization tool.

# Model Building

The optimizer functionality in our dashboard helps cater to different segments of investors. The optimizer helps identify the optimal allocation to balance the portfolio. The different models help allocate weights to different based on different objective functions. The different objective functions help **maximize Sharpe Ratio / Returns or minimize the risk in the portfolio.**

# GUI Design and Functionality

The Yeti theme and sidebar panel layout in the app helps make the controls/user interface in the app neat and sleek for the end user. The interactive plots in the app helps user gain information at different hierarchic levels

# Conclusions

The present app helps build highly efficient balanced portfolio which helps asset manager manage the risks/get desired returns. The present app has a few limitations – The app has high quantitative bias. In further developments- The app should look to optimize risks and returns in more holistic terms.

# References

1. <https://moderndata.plot.ly/portfolio-optimization-using-r-and-plotly/>
2. <https://github.com/R-Finance/PortfolioAnalytics/>
3. <https://www.r-bloggers.com/forecasting-stock-returns-using-arima-model/>