Quantum Finance

Scientific Investing for the average investor

Adam Lieberman, Binglun Li, Wai Man Si, Jason Kolbush, Ai He, Anzhi Mou

Motivation

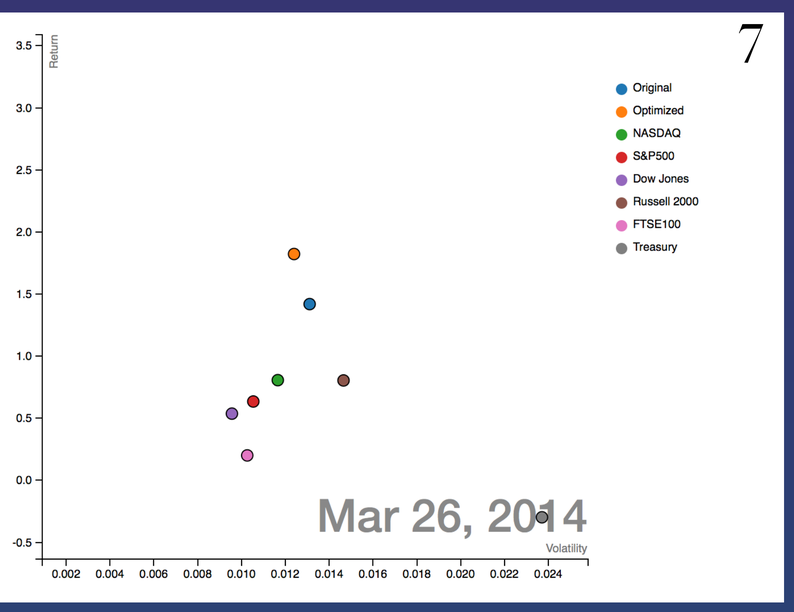
Over 156 million Americans are invested in the stock market, over half of them being the average investor. Current portfolio management tools target sophisticated audiences with relative quantitative backgrounds, leaving the average investor at an unfair advantage. Quantum Finance creates visualizations and interactions tunneled underneath with complex machine learning and optimization algorithms that allow the user to understand where their portfolio needs improvement and what actions need to be taken to achieve this improvement. Giving users the option to adjust their portfolio weights or invest in recommended equities, users will have a portfolio that is less risky, has higher return, and is more diverse.

Our Approach

To find the optimal portfolio holdings, we use mean variance optimization with a Sharpe Ratio objective function. Over the time frame this will find the optimal weights to maximize return and minimize risk. To discover new equities to add to the portfolio, we use forward step-wise regression. Here, we sequentially test the sharpe ratio against all S&P500 stocks to discover a specified number of stocks given by the user. Additionally, we compute important financial metrics and ratios as comparison between the users' original portfolio and the newly optimized portfolio. We then use D3 interactive visualizations to show the user this data.

Experiments

7



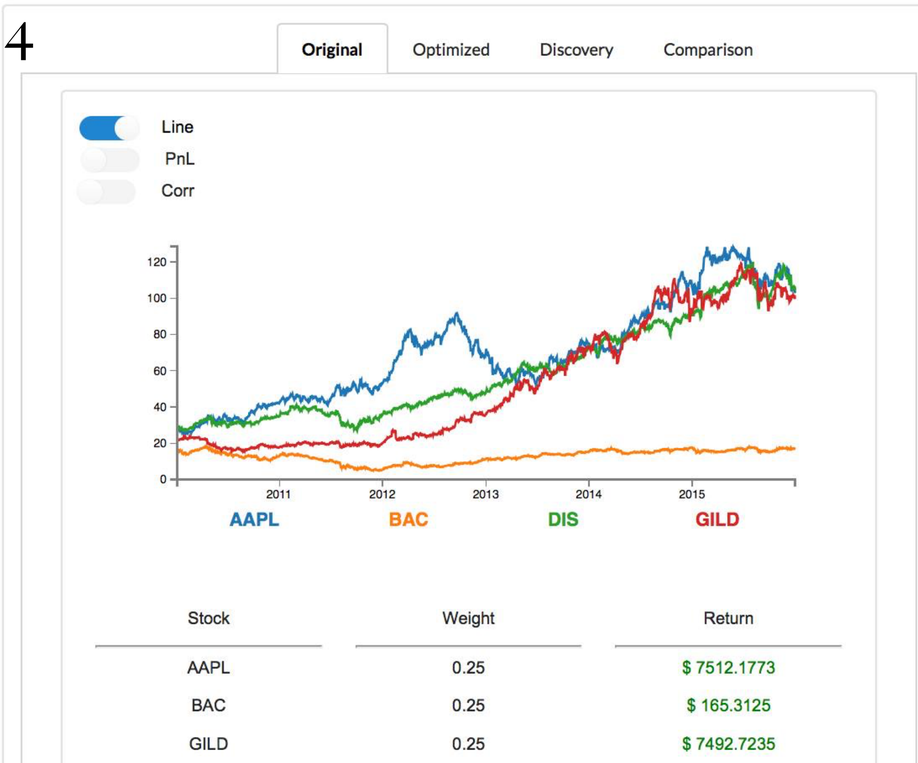
8

	Original	Optimized
Cumulative Return	-0.05786860946	0.0547913783961
Final Portfolio Value	$ 94213.139054	$ 105479.13784
Average Daily Returns	-5.18813290754e-05	0.00024662627407
Volatility	0.0124156385696	0.0162049401553
Beta	1.16465990603	1.10900753408
Gain Loss Ratio	0.988810482914	1.04291647371
Upside Potential Ratio	0.502859464536	0.525314011018
Information Ratio	-0.0358999672986	0.00543495458668
Sharpe Ratio	-0.0663349718033	0.241597357982
Jensen's Alpha	-0.133101327735	-0.0168464055517

To test our mean variance optimization algorithm we optimized a portfolio consisting of CMG, AAPL, KO, and MSFT (500 shares in each) from 11/1/2016 to 11/7/2016. Since then we have made $35,080 with our recommended optimized portfolio while only $6880 with our original portfolio. Thus, we have net $28,200 more with our optimized portfolio. Looking at our forward step-wise regression we are always recommended stocks in different sectors than are currently invested in. These stocks help smooth out the volatility if added into the portfolio. For instance, in a portfolio full of healthcare, energy, and financials; we were recommended two technology stocks giving us greater diversification.

Our Data

4

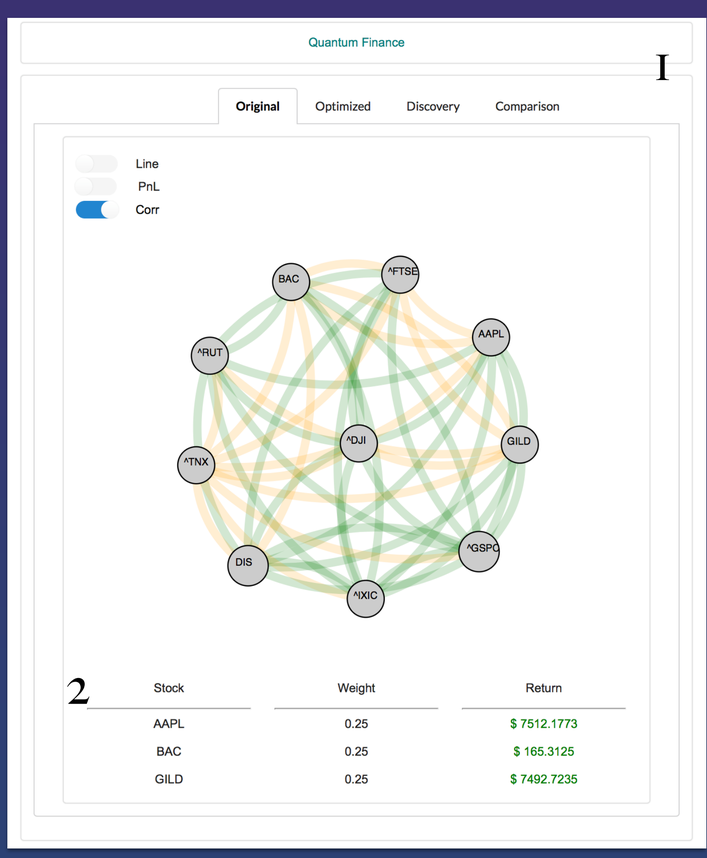


When a user enters their portfolio information: tickers, shares, dates, and number of stocks to be discovered, our python backend fires a web crawler that live scrapes Yahoo Finance. Adjusted close prices for all equities in the S&P500 and the users tickers are scraped and fed into a pandas data frame, which is then used as the basis of data in our backend. Additionally, we scrape company descriptions and full company name from Google Finance after our backend generates the recommended equities to add to the portfolio.

User-Friendly Interface

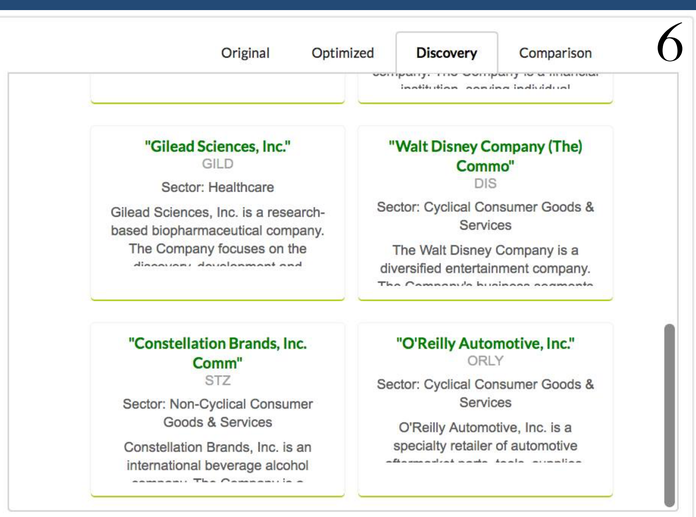
3

1



The Quantum Finance user interface displaying
(1) is the correlation chart between each stock in the portfolio along with each major stock index. A green path indicates there is a correlation of 0.5 or greater.
(2) displays the current stock tickers, weights, and return
(3) reveals a monthly profit and loss chart
(4) reveals line charts broken down per stock. Clicking on the optimized tab reveals the same data as the original tab except with updated weights and returns from the optimizer.
(5) is the discovery tab which has a radar chart for sector breakdown
(6) is the stock cards for the newly discovered equities
(7) displays a motion chart which shows a comparison between the optimized, original, and major stock indices
(8) displays the comparison metrics between the original and optimized portfolio

6



5