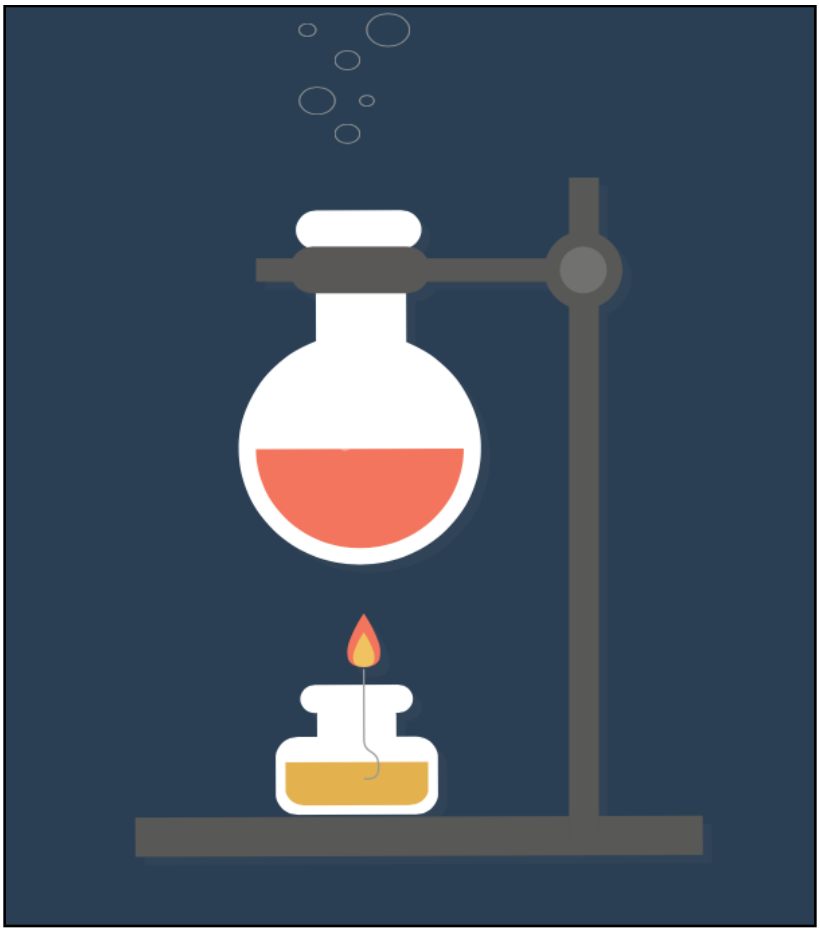
Quantum Finance

Documentation



Data Visualization & Analytics

Fall 2016

Created by Adam Lieberman & Binglun Li

Setup and Installation

Let's get up and running

System Requirements

Python 2.7.9: This can be downloaded from the official python website: **https://www.python.org/downloads/release/python-279/**. Please click to the link and download the correct python 2.7.9 package for your operating system. Instructions should come with the installer. After python 2.7.9 has been installed in your system, please make the python 2.7.9 interpreter your default interpreter or project console in your integrated development environment or your terminal/command window. With this installed, we need to install the following packages with respective versions. Before doing so, we need to install pip. Please refer to the following link to download pip: **https://pip.pypa.io/en/stable/installing/**. Alternatively, you can download the Anaconda distribution from **https://www.continuum.io/downloads**. This distribution will contain many of the libraries that we need install. It will also come bundled with pip. It is highly recommended that anaconda be downloaded. With pip installed, we are ready to download the following libraries with respective versions. To do so we will go to the terminal. Type in python -- version and make sure it displays python 2.7.9. We will then pip install the following packages.

Flask 0.10.1: pip install flask==0.10.1
Flask-Moment 0.5.1: pip install flask-moment==0.5.1
Flask-Script 2.0.5: pip install flask-script==2.0.5
Jinja2 2.8: pip install jinja2==2.8
Lxml 3.6.0: pip install lxml==3.6.0
Matplotlib 1.4.3: pip install matplotlb==1.4.3
Datetime: pip install datetime
Requests 2.10.0: pip install requests==2.10.0
Pandas 0.18.1: pip install pandas==0.18.1
Pandas Datareader 0.2.1: pip install pandas-datareader==0.2.1

Numpy 1.9.2: pip install numpy==1.9.2
Beautifulsoup4 4.4.1: pip install beautifulsoup4==4.4.1
Scipy 0.16.1: pip install scipy==0.16.1
Joblib: pip install joblib

On the Quantum Finance development environment, we had the following libraries installed:

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Django==1.8.1
EasyProcess==0.2.3
Flask==0.10.1
Flask-Moment==0.5.1
Flask-Script==2.0.5
Ghost.py==0.2.3
Jinja2==2.8
MarkupSafe==0.23
MySQL-python==1.2.5
Pillow==3.4.2
Polygon2==2.0.6
PyAlgoTrade==0.17
PySide==1.2.4
PySocks==1.5.7
Pygments==2.1
Quandl==2.8.9
TTFQuery==1.0.4
Theano==0.6.0
VPython==6.10
Werkzeug==0.11.10
appdirs==1.4.0
appnope==0.1.0
astroid==1.4.4
backports-abc==0.4
backports.ssl-match-hostname==3.5.0.1
beautifulsoup4==4.4.1
blist==1.3.6
boto==2.39.0
certifi==2015.11.20.1
click==6.6
colorama==0.3.6
cv2==1.0
cvxopt==1.1.8
deap==1.0.2
decorator==4.0.6
dill==0.2.4
folium==0.2.1
fonttools==2.3
funcsigs==0.4
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functools32==3.2.3.post2
future==0.15.2
geopy==1.11.0
ghost==0.4.1
gnureadline==6.3.3
gym==0.0.2
ipykernel==4.2.2
ipython==4.1.0rc2
ipython-genutils==0.1.0
ipywidgets==4.1.1
itsdangerous==0.24
joblib==0.10.3
jsonschema==2.5.1
jupyter==1.0.0
jupyter-client==4.1.1
jupyter-console==4.1.0
jupyter-core==4.0.6
lazy-object-proxy==1.2.1
lrlclib==1.0
lxml==3.6.0
matplotlib==1.4.3
mistune==0.7.1
mock==1.3.0
nbconvert==4.1.0
nbformat==4.0.1
nltk==3.0.2
nose==1.3.7
notebook==4.1.0
numpy==1.9.2
oauthlib==0.7.2
pandas==0.18.1
pandas-datareader==0.2.1
path.py==8.1.2
pbr==1.3.0
peewee==2.8.3
pexpect==4.0.1
pickleshare==0.6
plotly==1.12.2
ptyprocess==0.5.1
pyPdf==1.13
pygal==2.2.3
pylint==1.5.4
pyparsing==2.0.3
pyscreenshot==0.4.2
python-dateutil==2.4.2
python-highcharts==0.2.0
pytz==2016.4
pyxley==0.0.9
pyzmq==15.2.0
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qtconsole==4.1.1
requests==2.10.0
requests-file==1.4
requests-oauthlib==0.4.2
scikit-learn==0.15.0
scikits.statsmodels==0.3.1
scipy==0.16.1
selenium==3.0.1
simplegeneric==0.8.1
simplejson==3.8.1
singledispatch==3.4.0.3
six==1.10.0
sklearn==0.0
stem==1.4.0
terminado==0.6
textblob==0.9.0
tinydb==3.2.1
tornado==4.3
traitlets==4.1.0
tweepy==3.3.0
twython==3.2.0
vboxapi==1.0
virtualenv==13.1.0
wrapt==1.10.6
wsgiref==0.1.2
wxPython==3.0.0.0
wxPython-common==3.0.0.0
yahoo-finance==1.2.1
```

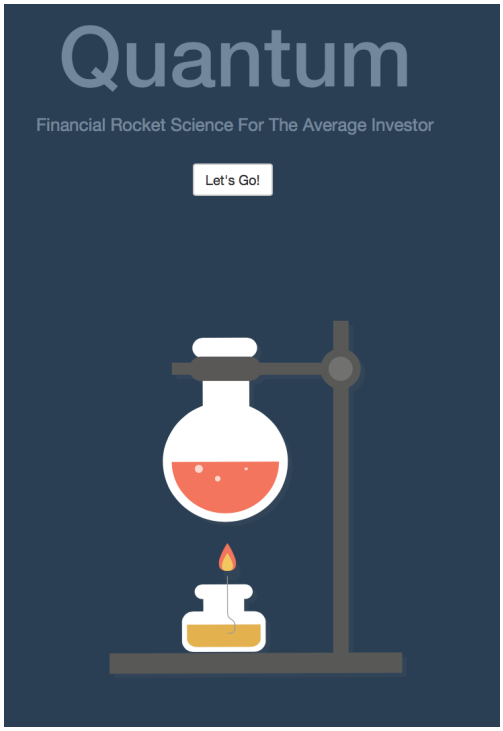
To quickly download the environment you can copy and paste all the above packages or the selected packages into a text file (call it dependencies.txt) then go to the terminal and type in pip install dependencies.txt. All dependencies should download. To make sure all dependencies are downloaded with the correct version, please type pip freeze into the terminal.
We now have our development environment setup to run the application.

Running the Application

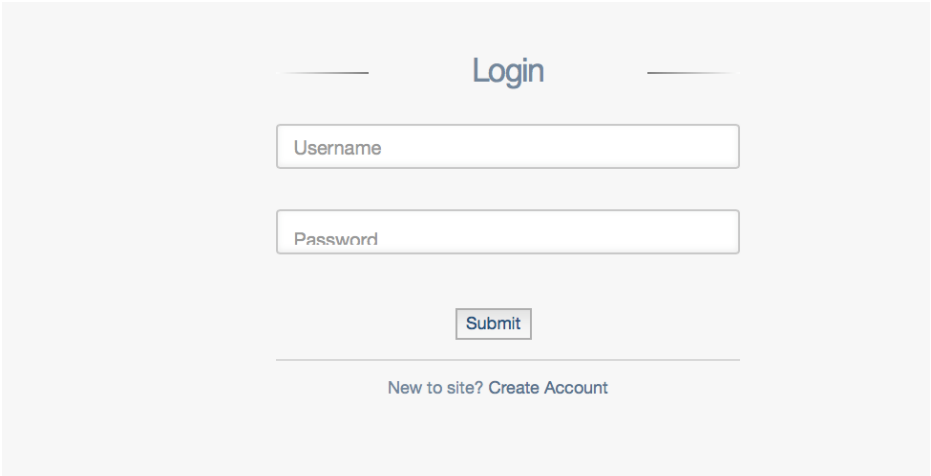
To run the code cd into the project (team09final) directory. Then run python app.py. Your console will print an output that has something similar as follows:

*Running on http://127.0.0.1:5000/ (press CTRL+c to quit)

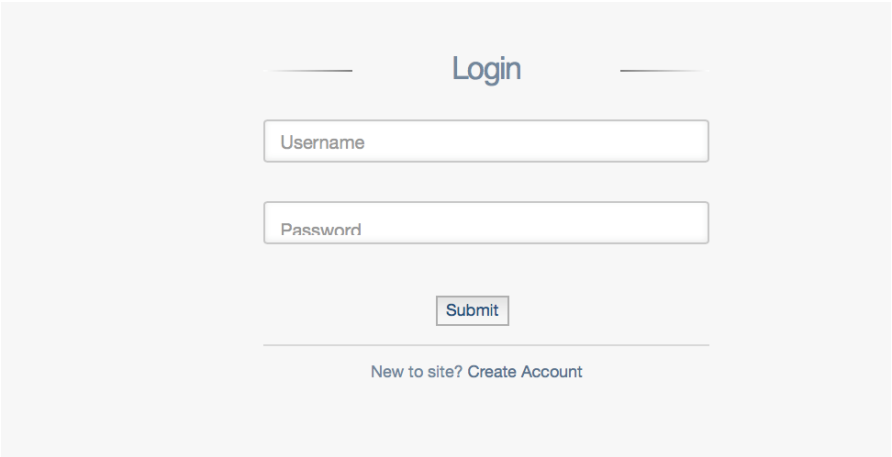
Go to your browser (tested on Google Chrome and Safari) and type in the http link displayed. Hit enter. Your screen will then change to



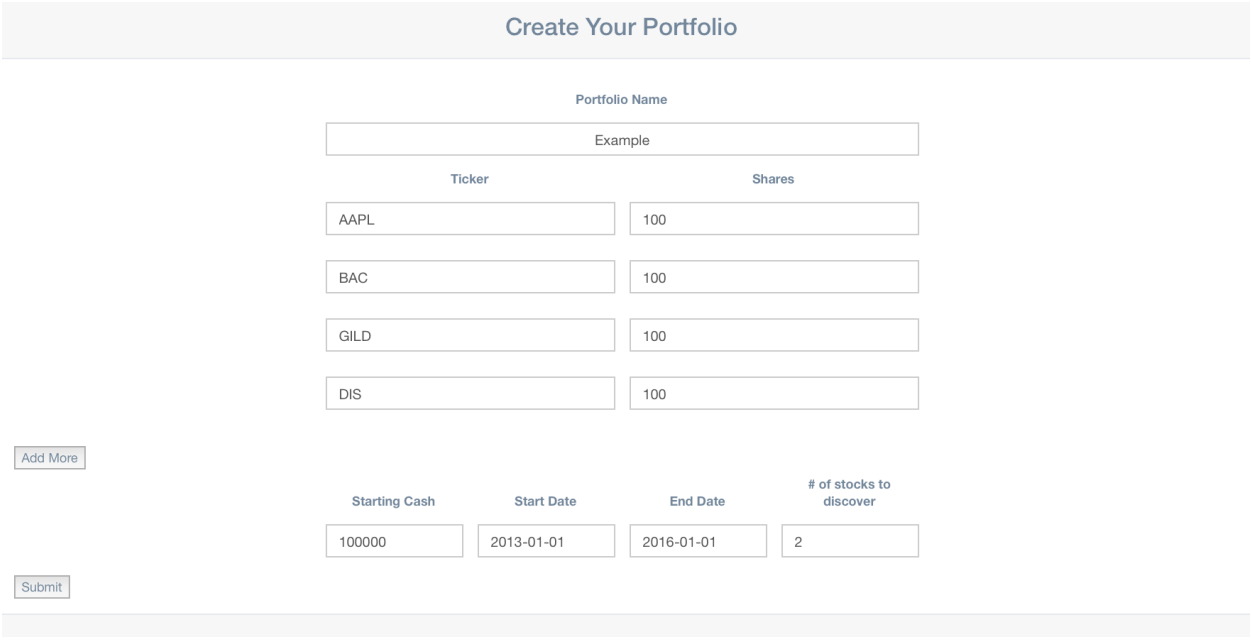
Click on the Let's Go! button and your screen will be directed to the log-in page.



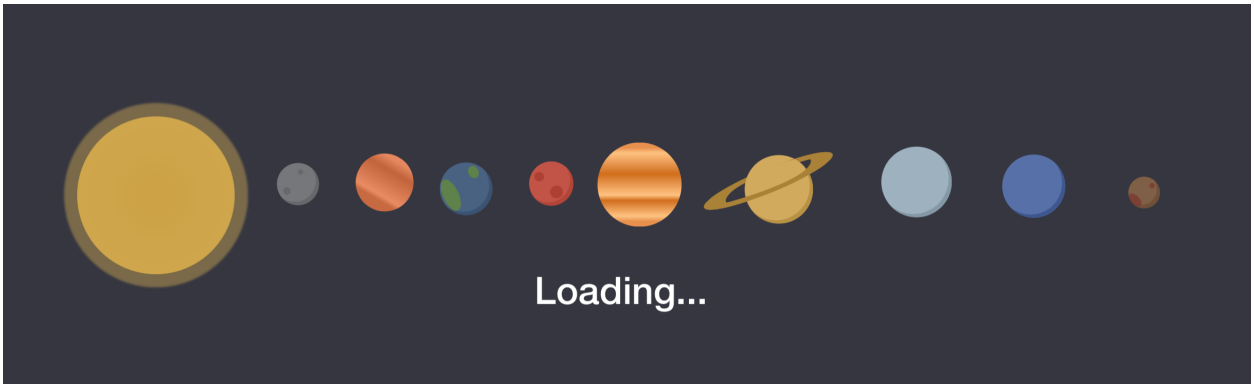
We have set up a username and password for you. The username is QuantumFinance and the password is cse6242. Note, you can create your own account by clicking on the Create Account link at the bottom of the page. If you choose to do that you will be directed to the following screen:



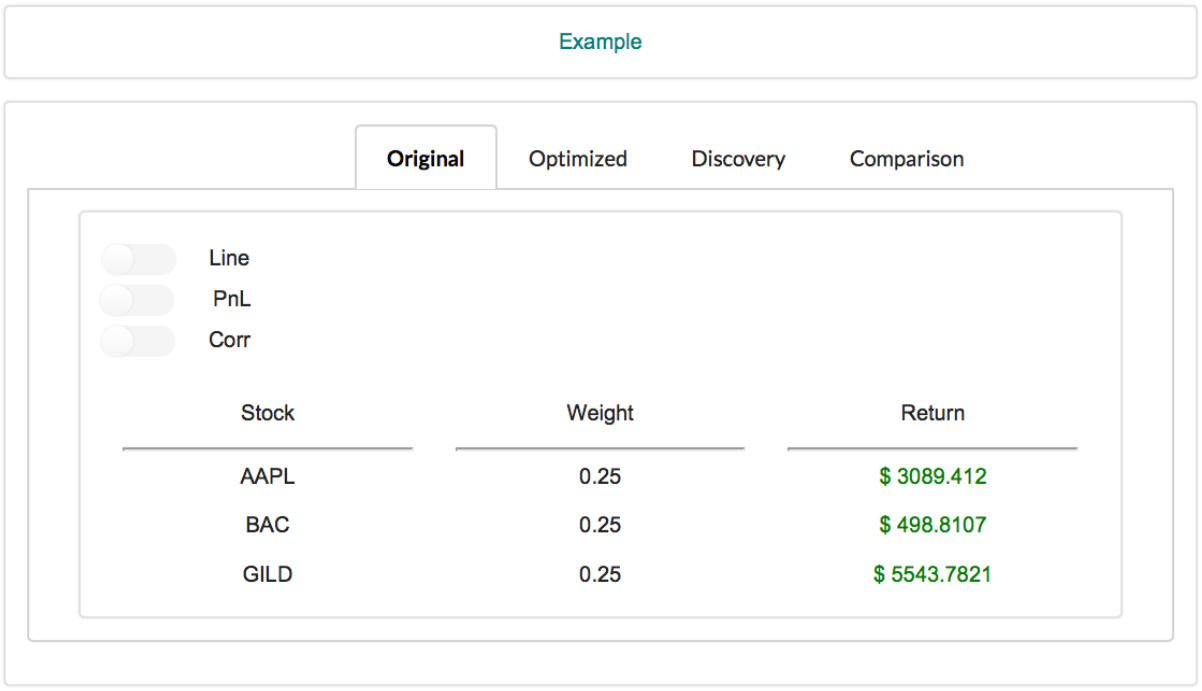
Log in and you will be directed to the Create Your Portfolio page. Here, you will enter in a name for your portfolio, the tickers and shares of your portfolio, your starting cash, a start date, end date, and a number of stocks to discover. Let us enter the following information in:



Let us now hit submit. A loading screen will appear while calculations and data are scraped in the background. You will see the following:

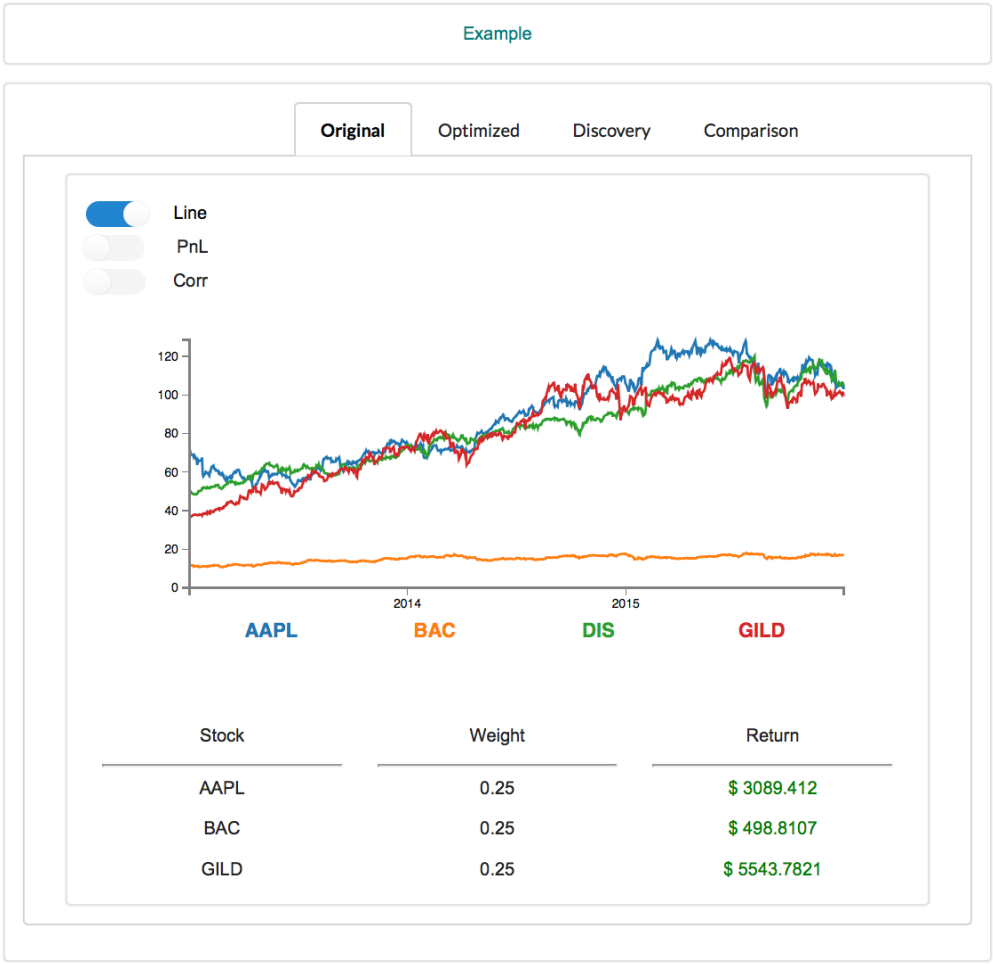


When the page finishes loading, the main application screen will appear.

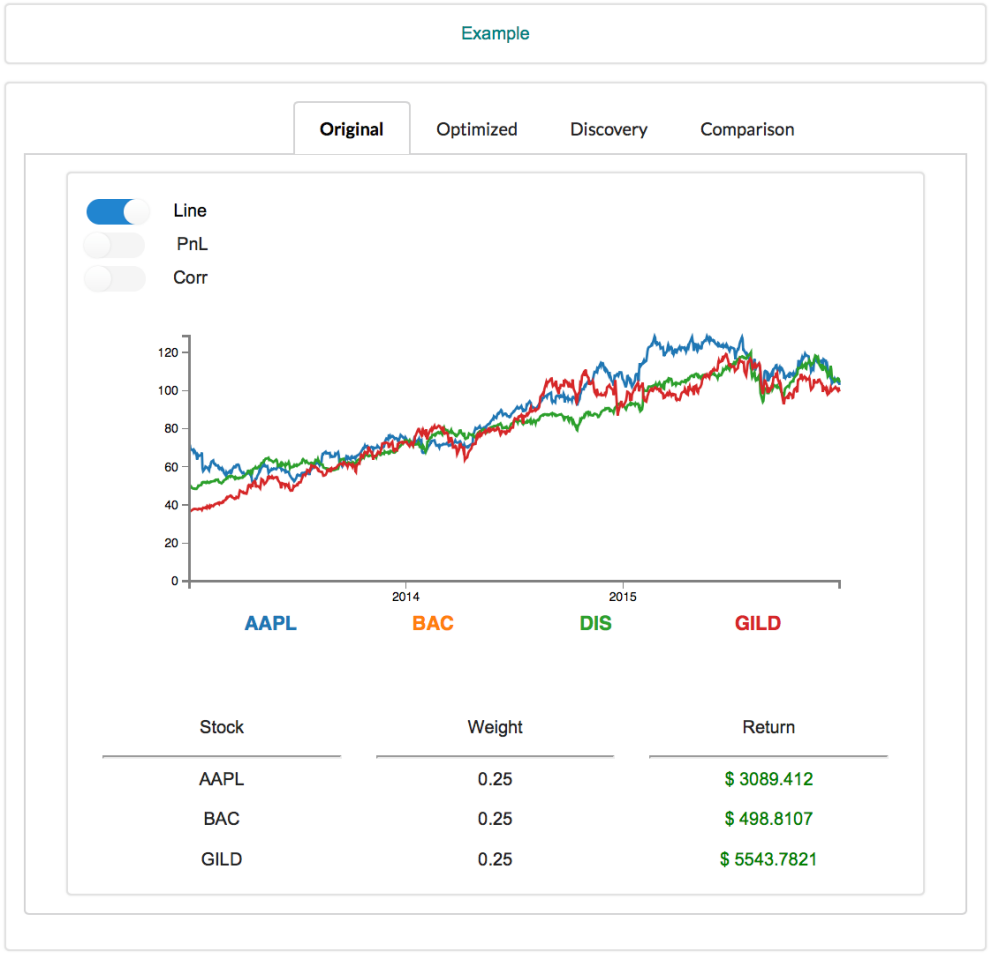


There are 4 tabs: original, optimized, discovery, and comparison. Let us discuss how each tab works.

The original tab shows your portfolio in it's current state. At the very bottom tickers with their corresponding weights and returns are shown. If you have more than 3 stocks in the portfolio you can scroll down further to see the tickers, weights, and returns of the rest of the stocks in the portfolio. There are also three toggles at the upper left hand side. Let us look at each toggle. Let us first toggle the line chart:



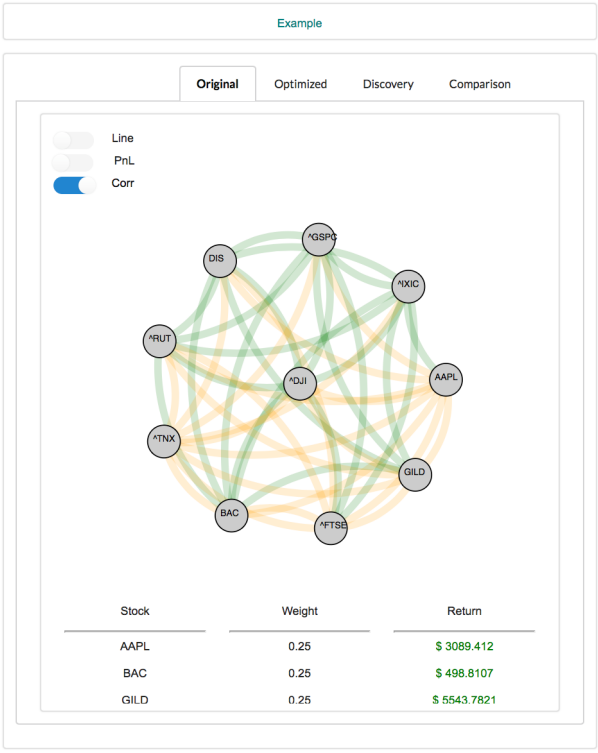
The line chart shows you how each stock in your portfolio has performed. This is an interactive line chart. You can click on the colored stock tickers at the bottom of the page to remove and add back in the lines. Let us click on BAC:



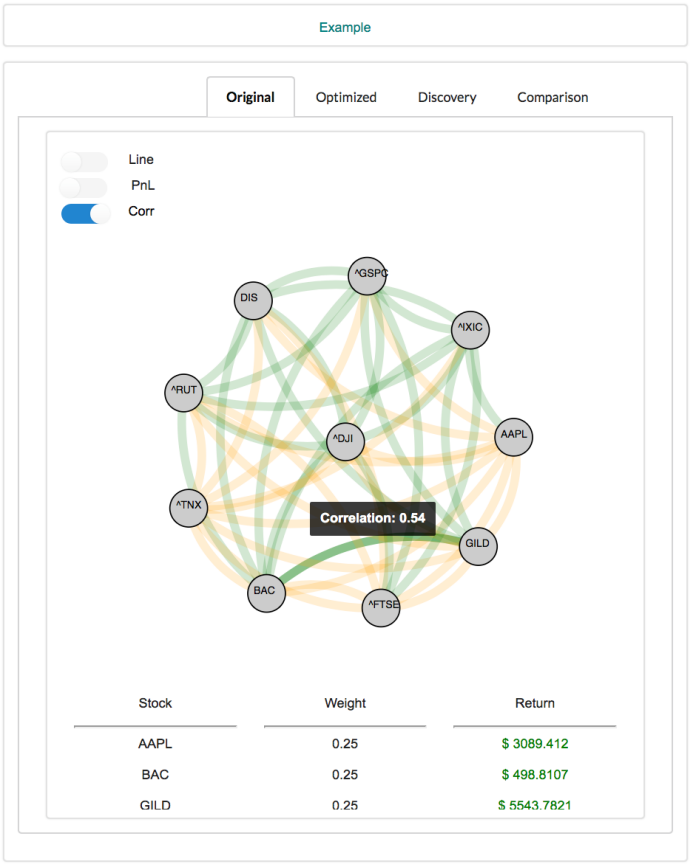
We see that the trend line has gone away. We can once again click BAC to add it back to the graph. Let us now look at the profit and loss chart. To do so we can toggle PnL:

This chart shows us how much our portfolio has profited or lost each month. A blue bar means a positive percent with the percentage shown on the y-axis and an orange bar means a negative percentage. We can scroll to the left to view the later months.

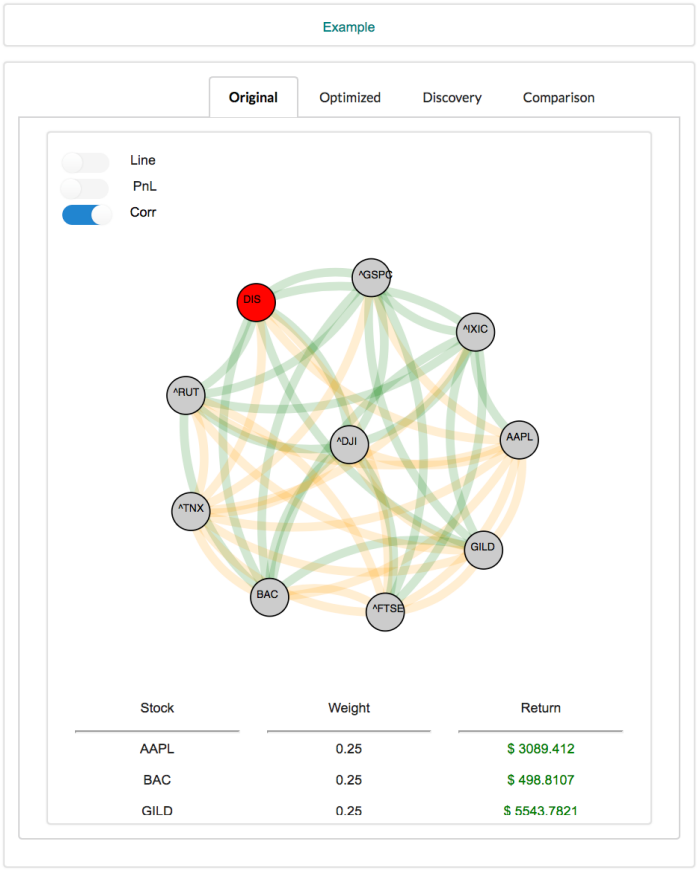
We can now toggle Corr to look at a force-diagram, which shows the correlations between each stock in our portfolio and the major stock indices.



You can hover over the paths between two nodes to see the correlation. A green path means that there is a correlation greater than or equal to 0.5 between the two nodes an an orange path means that there is a correlation less than 0.5.

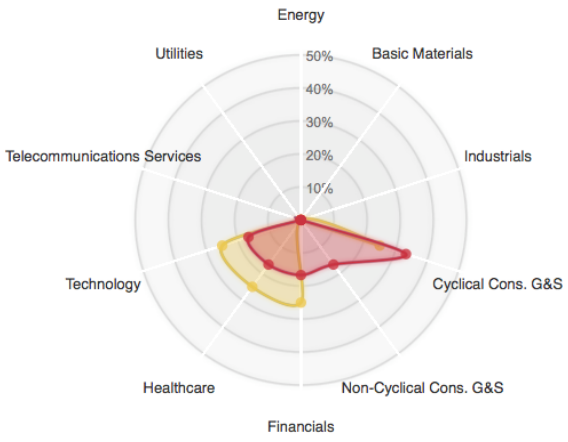


You can drag and rearrange the nodes as well as pin a node down. To pin a node down just double click on it. The pinned node will turn red. You can unpin it by double clicking it again. The node will then turn back to its original gray color.

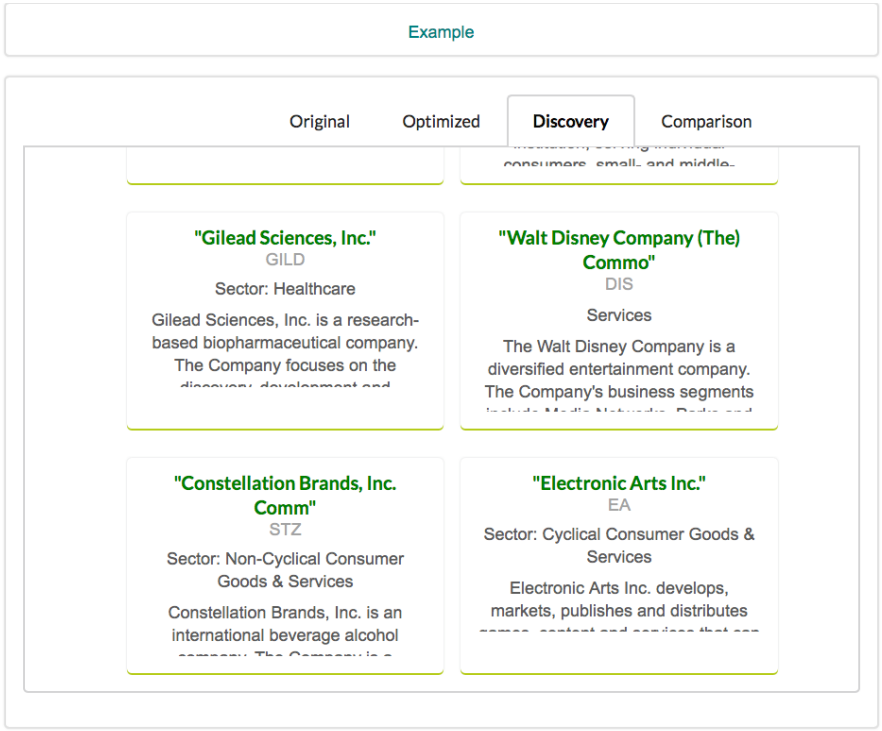


Let us now take a look at the optimized tab. The line chart and correlation chart will remain the same (they are placed there for convince), but the stock, weight, and return table at the bottom of the chart will change. Our mean variance optimizer has assigned new weights and computed new returns for the tickers in the original portfolio. There is also a new profit and loss chart for the optimized portfolio.

Let us now take a look at the discovery tab. Here we first see a radar chart:

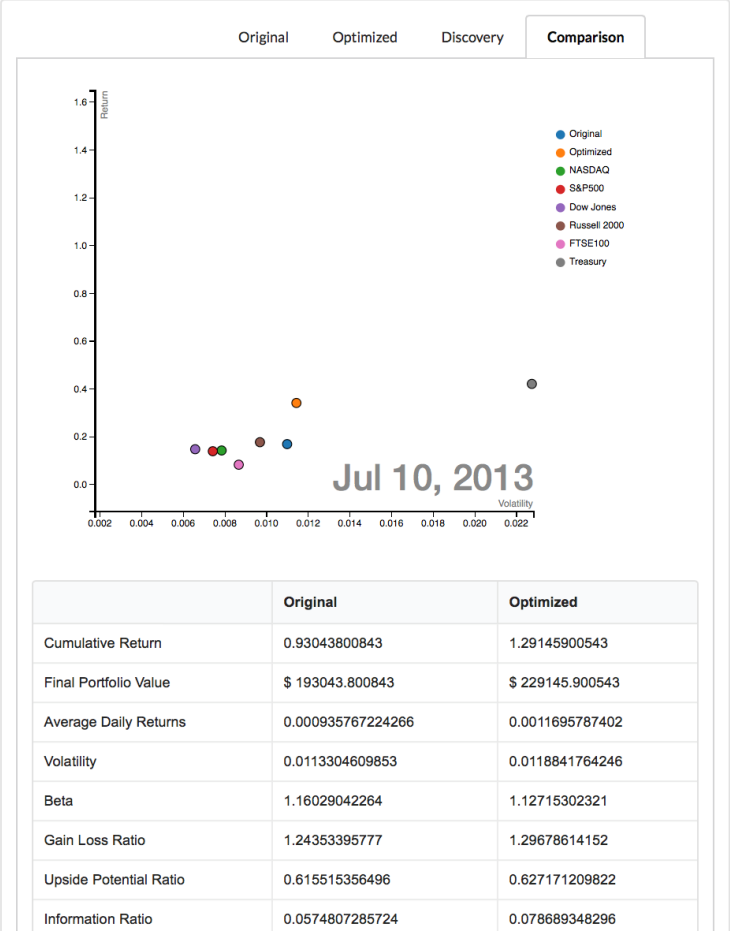


This shows the sector breakdown of our portfolio. The yellow is the original portfolio and the red is the new portfolio. The forward-stepwise regression tends to find new stocks that increase the portfolio sharpe ratio and create more diversification within the portfolio. Below the radar chart we see stock cards.



These give new information about the current stocks in the portfolio as well as the newly discovered stocks.

Finally, we have the comparison tab. This gives us a nice overview of the difference between the original and optimized portfolio. The first graph we see is a motion graph. This shows the return and risk of the optimized portfolio compared to the major stock indices. You can hover over the time period to watch the colored dots change in time.



	Original	Optimized
Cumulative Return	0.93043800843	1.29145900543
Final Portfolio Value	$ 193043.800843	$ 229145.900543
Average Daily Returns	0.000935767224266	0.0011695787402
Volatility	0.0113304609853	0.0118841764246
Beta	1.16029042264	1.12715302321
Gain Loss Ratio	1.24353395777	1.29678614152
Upside Potential Ratio	0.615515356496	0.627171209822
Information Ratio	0.0574807285724	0.078689348296

Below the motion chart, we have a table that compares the original and optimized portfolios with some standard industry metrics:

	Original	Optimized
Cumulative Return	0.93043800843	1.29145900543
Final Portfolio Value	$ 193043.800843	$ 229145.900543
Average Daily Returns	0.000935767224266	0.0011695787402
Volatility	0.0113304609853	0.0118841764246
Beta	1.16029042264	1.12715302321
Gain Loss Ratio	1.24353395777	1.29678614152
Upside Potential Ratio	0.615515356496	0.627171209822
Information Ratio	0.0574807285724	0.078689348296
Sharpe Ratio	1.31105382049	1.56228637545
Jensen's Alpha	0.371450122542	0.748435575076