A drawing of a cartoon character

Description automatically generated

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https://github.com/jeff1evesque/ist-exit-portfolio | Final Project

Data Science: Portfolio

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# Introduction

This paper provides a summary of requirements met for the MS in Applied Data Science. A collection of three projects was chosen to help portray the learning achievements made during the IST program at Syracuse University. Various techniques ranging from data mining, exploratory data analysis (EDA), natural language processing (NLP), as well as predictive and financial modeling were performed. This often entailed using languages such as python, R, hadoop, as well as basic systems and cloud engineering. Since each IST course was roughly 10 weeks long, performing a meaningful project was sometimes challenging. Nonetheless, each course and respective project provided valuable experience in making actionable insight from collected data.

# Capstone Projects

|  |  |  |
| --- | --- | --- |
| Course | Capstone Project | Skills |
| FIN-654  Financial Analytics | **Portfolio Analysis**  Chosen stock tickers were analyzed to determine optimal portfolio allocation, using financial and time series modeling | Python, R, time series analysis, financial analysis, Shiny Dashboard |
| IST-664  Natural Language Processing | **Chatbot**  EDA was initially performed to study the data distribution. A trained classifier was ensembled with an LSTM/NMT model to producer the overall chatbot experience | Python, MongoDB / Hadoop, Jupyter Notebook, Time series analysis, Classification analysis, Natural language processing |
| IST-736  Text Mining | **Stock Market Sentiment Analysis**  An attempt was made to determine whether sentiment from financial analysts can predict the stock market. Topic modeling was performed to determine most relevant stock tickers. Sentiment analysis was performed on the same financial analyst tweets and were coupled with corresponding stock ticker price using granger analysis to determine whether sentiment could predict stock price | Topic modeling, Sentiment analysis, Time series analysis, Classification analysis, Signal analysis, Data mining, AWS, Jupyter Notebook |

## Portfolio Analysis (FIN-654)

Source Assignments: <https://github.com/jeff1evesque/fin-654-hw>

Source Project: <https://github.com/jeff1evesque/fin-654>

The course for this project focused on teaching methods and tools for decision making in the financial industry. We had a total of four assignments (roughly biweekly), performed as a group and turned in for grading. Each assignment generally entailed a skeleton R code in a word document, sometimes requiring finesse, and often accompanied by questions requiring financial interpretation. What was interesting about this course, was that the final project was an encapsulation of these four group assignments. Individually, we were allowed to recycle any components obtained/learned from these course assignments to satisfy a final project topic approved by the professor.

Since the course was 10 weeks long, it’s almost over before getting the grasp of some of the course materials. Earlier assignments taught us risk management as a function of supply, volatility, as well as interpretation of statistical measures including data moments, heteroscedasticity, autocorrelation, standard deviation, and kurtosis. Concepts were visualized using ggplot in R. During the middle of the course (roughly week 5/6), I started looking for potential data sources related to publicly traded companies portraying risk. I found a dataset on the “World’s Biggest Data Breaches & Hacks”[[1]](#footnote-1), and considered it as a candidate data source. I wanted to study ways to minimize risk of breaches either before occurring, or minimizing the blast effect after as function of modern portfolio analysis. As weeks 7-9 unfolded, we learned more sophisticated R tools, and financial theories. Assignments[[2]](#footnote-2) were visualized using flexdashboard[[3]](#footnote-3) or shinydashboard[[4]](#footnote-4) (instead of snippets of R in a word document). New risk measures were introduced, not limited to:

* Value At Risk
* Expected Shortfall
* Efficient Frontier
* Markowitz Model

We were able to take financial scenarios for the last two assignments, and provide business remarks regarding asset allocation, as well as recommend the distribution of supply goods to purchase in order to reduce risk at a given price. Assignment 4[[5]](#footnote-5) provided a scenario of “A freight forwarder with a fleet of bulk carriers want to optimize their portfolio of metals markets with entry into the nickel business and use tramp trade. They have allocated $250 million to purchase metals”. Using supplied information, we were able to make recommendation regarding how the $250 million should be dispersed into purchasing nickel, copper, and aluminum. By roughly week 8, we had about 2 weeks to potentially integrate concepts learned from the assignment 4 into a final project. At this point I had to iron out the ambiguous data source into a viable final project topic. I decided to select all companies that was breached, if the company name was able to inner join against a list of ticker symbol dataset using the quandl API. I had originally wanted to construct a more meaningful project topic, due to time constraint reduced the problem statement “how can I reduce the risk of a portfolio consisting of companies recently breached?”.

Since my background was much stronger in Python instead of R, at roughly week 7 (before the topic solidified), I started coding the data mining/integration into the R shinydashboard using reticulate[[6]](#footnote-6). This allowed me to perform numpy/panda operations[[7]](#footnote-7) on imported data. Once the data was in the right format, I was able to ship it back to R for visualization using ggplot2 (or equivalent). Specifically, I saved the earlier “World’s Biggest Data Breaches & Hacks”, along with a similar dataset from “Privacy Rights Clearinghouse”[[8]](#footnote-8) locally. These two datasets were merged into a dataframe in python, then inner joined against a list of stock ticker symbols obtained from the quandl API[[9]](#footnote-9).

From the shinydashboard, I was able to visualize through a series of barcharts, which tickers were riskier individually, by reviewing the variance of ticker volume. Since I had massaged/formatted timeseries data in a dataframe format, I decided to recycle code from other courses, in order to perform time series analysis on the overall portfolio. Specifically, I performed a side-by-side comparison between LSTM vs ARIMA ability to predict the portfolio price. Similar Efficient Frontier and General Pareto Distribution code from previous assignment(s) was recycled and visualized within the same shinydashboard. Ultimately, I was able to produce a shinydashboard similar to assignment 4, showcasing some exploratory analysis, more complicated timeseries analysis (ARIMA and LSTM), as well as financial analysis concepts learned during the course.

## Chatbot (IST-664)

Source: <https://github.com/jeff1evesque/ist-664>

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## Stock Market Sentiment Analysis (IST-736)

Source: <https://github.com/jeff1evesque/ist-736>

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# Conclusion & Follow-up Interests

As discussed above, IST-664 involved an attempt to create a chatbot through numerous ensembled machine learning (ML) modeling on a personal laptop. While some parts were functional, the overall endeavor was greatly restricted by compute resources. On comparison, recent release of ChatGPT reportedly costs $100,000 a day to run[[10]](#footnote-10). Desired outcomes in “Data Science” are often at mercy of available data and compute resources. What I have learned generalized from the IST-664 chatbot vs. ChatGPT, my interests towards Cloud Native technologies supporting Big Data and streaming analysis have grown immensely. As retrospect, it’s interesting to see the evolution of “Data Science”. While practitioners perform varying degree of EDA to help contextualize problems for humans, we’re in the age where AI/ML frameworks are just beginning to dynamically solve problems orders of magnitude more sophisticated.

For these reasons, I have taken lessons learned from this program, and have expanded into the development of a platform (jefflevesque.com) to aggregate streaming data to facilitate generating and sharing ML models. For example, IST-736 have become a small part of the overall effort – just one stream, and one datalake of many that people can access. This segment actually ingests roughly 200 stock ticker price every minute during the business day, eventually consumed into a parquet partitioned datalake. To expand on FIN-654, candlestick analysis has been devised as an Apache Flink application on the same ingest stream. While the exact streaming codebase is private, an example demo codebase[[11]](#footnote-11) has been publicly released. Future plans may include integration of FIN-654 concepts including the Efficient Frontier as well as the Markowitz model. However, a greater desire of adding additional data streams or developing neural networks may take precedence.

Various fields within “Data Science” often try to visualize data to help contextualize a problem set. It will be interesting to see whether simple data science questions become less prevalent with time. In FIN-654, a staple component of the course was R with Shiny dashboard. However, it is not unimaginable that in the future, a ChatGPT equivalent can expose an API over the internet to directly answer the actual desired problem set. The IST program at Syracuse has afforded me foundational experience in applied Data Science, with a sharper sense of direction. T.S. Eliot once said ‘The journey not the arrival matters’. While numerous learning objectives have been met in this program, my journey as practitioner has only just begun.

1. https://informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/ [↑](#footnote-ref-1)
2. https://github.com/jeff1evesque/fin-654-hw/tree/master/hw3 [↑](#footnote-ref-2)
3. https://posit.co/blog/flexdashboard-easy-interactive-dashboards-for-r/rd [↑](#footnote-ref-3)
4. https://rstudio.github.io/shinydashboard/ [↑](#footnote-ref-4)
5. https://github.com/jeff1evesque/fin-654-hw/tree/master/hw4 [↑](#footnote-ref-5)
6. https://rstudio.github.io/reticulate/ [↑](#footnote-ref-6)
7. https://github.com/jeff1evesque/fin-654/blob/master/python/dataframe.py [↑](#footnote-ref-7)
8. https://privacyrights.org/data-breaches [↑](#footnote-ref-8)
9. https://www.quandl.com/ [↑](#footnote-ref-9)
10. https://www.ciocoverage.com/openais-chatgpt-reportedly-costs-100000-a-day-to-run/ [↑](#footnote-ref-10)
11. https://github.com/jeff1evesque/kinesis-analytics-demo [↑](#footnote-ref-11)