Student: Jordan Weintraub

Project Title: Portfolio Optimization with Factor Allocation

Project Sponsor: Manish Chakrabarti

Project Synopsis: The objective of this project is to construct a portfolio utilizing a factor investment strategy that will generate excess returns relative to our index benchmark given a certain level of risk. To do so, we are looking to optimize our risk/return by generating the highest information ratio that we can achieve. This project will be based upon a quantamental strategy that uses mathematical models and big data to analyze fundamental factors. We will be gaining insight as well as exposure into investment strategy, portfolio allocation, quantitative and qualitative analysis, machine learning and optimization methods. By completion, we hope to have a well-defined strategy, paper and presentation on our approach and findings.

Project Procedure: To achieve our desired goal, the project will begin with an extensive amount of research into areas of factor investing, machine learning, portfolio allocation, and optimization. Each member will specialize in one area but will have a strong foundation in all aspects of the project. We will be pulling real-time data using a Bloomberg API to ensure our data is accurate. Once we have conducted an extensive amount of research, we will begin building a neural network that takes certain factors as its input features and uses a set amount of hyperparameters to control the process. Numerous cross sectional regression tests and time-series analysis will be conducted to determine which multi-factor combination works best in the given market environment. We will also deploy optimization techniques to ensure we are selecting the best multi-factor combination to input into our neural network. Our neural network will run each stock that fits our parameters against our chosen factors and will select which securities we should have in our portfolio. We will also build out a transactional cost model to ensure that our portfolio is still generating a large information ratio after taking into account transaction and turnover costs.

Milestones and Dates:
September 11th: Have our Bloomberg API working and begin performing cross sectional studies on several factors. We should have completed enough research at this phase to start putting together our presentation for the Quant Conference.

September 18th: Completed rough copy of presentation for Quant Conference. Will hopefully be able to present our desired outcome, preliminary research, approach and next steps moving forward.

October 9th: Begin building out our neural network. Should have an understanding of what multi-factor combination performs best in certain market conditions. Using our theoretical understanding of what “should perform best”, it is time to begin implementing our findings into the neural network in order to optimize performance.

November 6th: Have a working neural network. Once we have one properly functioning, we will be consistently improving and tweaking our model. There will be numerous changes to our model in order to achieve a high degree of accuracy as well as performance. This will require continuous tweaking to ensure the highest level of efficiency.

November 20th: Have a working neural network with a high degree of accuracy. Should be able to identify our ideal input features and hyperparameters. Result should output a selection of stocks that together will optimize our information ratio of a portfolio when. Several back tests will be conducted to validate the results. Once we have achieved consistent results, we will be ready to begin putting our final paper and presentation together.

December 4th: Present our findings to our audience. This is an extremely optimistic outlook, as I realistically expect us to take much longer to get a working neural network together. This may take months to achieve. Once we have a working neural network, we will be able to make consistent progress.

Technical: We will be using Python to test our covariance matrices, perform cross-sectional studies and time-series analysis, and back test our findings. We may also end up using R as this is the language outlined in one of our focus textbooks listed below.

Books:

Title: Portfolio Risk Analysis
Written by: Gregory Connor, Lisa Goldberg and Robert Korajczyk

Title: Machine Learning for Factor Investing
Written by: Guillaume Coqueret and Tony Guida

Title: Machine Learning for Asset Managers
Written by: Marcos M. Lopez de Prado

Literature: I have complied an assortment of literature focused on topics such as Factor Investing, Portfolio Optimization, Machine Learning, Neural Networks, Investment Allocation, and several others. Data sources include Fama French Data Library, Axioma, MSCI, Archive Q Finance (arXiv), Invesco, Qontigo, Deutsche Bank Quantitative Strategy Team and QuantUniversity. I have saved each piece of literature I am using and would be happy to share the folder with you per your request.