Interim Report

Interim Report submitted. Pending Advisor to evaluate.

Give a summary of your accomplishments in the first phase of the project.

project seeks to apply the genetic algorithm outside the field of biology and adapt it to REITs portfolio allocation by writing my own python scripts in jupyter notebooks. Lastly, for 3) writing and presentation, I have collated all findings from my research findings in the past 12 weeks here: (https://tinyurl.com/researchfindingsleongweiming), started work on the final report here: (https://tinyurl.com/finalreportleongweiming) and created a Github repo for jupyter notebooks for code for the adapted genetic algorithm here: (https://github.com/ivanleongwm/339)

I also updated Prof LiLi once every two weeks either by email or through teams call and really appreciate all the guidance and support Prof Lili has given me along the way. My other efforts includes reviewing more than 30 research papers, attending bloomberg events to try to get access to bloomberg data (subsequently finding an alternative in yahoo finance) and joining worldquant as a part-time research consultant to learn how to build and search for alphas.

What knowledge/skills (both technical and non-technical) did you gain?

computing, I took IT5005 Artificial Intelligence this semester, and took several coursera courses to brush up on my understanding of machine learning. I learnt how to write a genetic algorithm in python and to write code to optimise a portfolio of stocks based on an alpha formula and have published it to the github link above.

In terms of soft-skills, I learnt how to communicate my research ideas better across with my professor, by writing detailed email updates and asking questions during our meetings over Microsoft teams. I also worked collaboratively with the other students under Prof LiLi by sharing the yahoo finance api with Jia Jie so that he can also use the relevant datasets.

In terms of portfolio optimisation, I read all the papers shared by my professor and found more papers from arxiv, and reviewed about 30 papers in total on the topic of using machine learning to optimise stocks, find alphas and on portfolio optimisation.

What are the difficulties/challenges you faced this phase of the project, if any? How did you overcome (or plan to overcome) them?

The greatest challenge I faced was finding a novel solution without replicating the works of other researchers, given that I am still learning and new to the field of portfolio optimisation. I overcame this through my discussions with my Prof LiLi, my fellow students, consulting quants at Worldquant and reviewing the scope of work by researchers in research papers. I learnt that quants are considering the possibility of applying genetic algorithms to find novel and evolving solutions to problems in finance and came up with the idea of cross-applying the genetic algorithm to REITs portfolio allocation to search for the optimal portfolio allocation.

The second difficulty I faced was coming up with the architecture and workflow for the search algo to optimise REITs allocation. In this regard, I consulted the workflow used in certain research papers like “Alpha-GPT: Human-AI Interactive Alpha Mining for Quantitative Investment”, how quant formulas are run at WorldQuant and also checked with my professor.

Explain how did you address your defined objectives in the course of the first phase of the project.

The defined objectives according to my professor and the capstone guidelines are to define a clear objective, scope and methodology for the project. With regards to the clear objectives, I cleared the topic of the research paper with my professor: An Alpha Tree Search Approach to Optimising Real Estate Portfolios and decided to use genetic algorithms to search for an optimal portfolio allocation before comparing it against benchmarks, traditional measures and 2 common machine learning models. The scope of this project is scoped to a finite universe of Real Estate Investment Trust (REITs) stocks which are chosen from the US, European and Asian REITs, 3 of the largest REITs for generalisable results. The methodology of the project was also defined first to select the relevant stocks, 10 stocks from each of the three markets and the top 5 most popular alpha formulas. Following experimentation will be conducted where a search tree will be created based on the alpha formulas, defining a goal state and using genetic algorithms to optimise the alpha weights based on historical data from yahoo finance. The profit and loss from the allocation will then be computed and the genetic algorithm will be evaluated by comparing it

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