NATIONAL UNIVERSITY OF SINGAPORE

Master's of Computing (General-Track)

Alpha Tree Search and Machine Learning Approaches to Optimising Real Estate Portfolios

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Department of Computer Science

Internal Capstone Project for AY2023/2024

ABSTRACT

An internal project about applying genetic algorithm to search for optimal alphas. State the major contribution:

DECLARATION

I hereby declare that this project report is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in this report.

This report has also not been submitted for any degree in any university previously.

ACKNOWLEDGEMENT

I would like to thank Professor Liu Lili for her guidance, support and encouragement throughout the course of this project. Working with Professor Lili has been a great learning experience, getting to learn much more about machine learning and its applications to finance in solving some challenges faced by industry practitioners.

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CONTENTS

1 Introduction **2**

1.1 Problem Definition 2

1.2 Motivations 2

1.3 Major Contribution and Creativity 2

I Background **1**

2 Financial Terminology and Concepts **2**

2.1 Key Terms 2

2.1.1 Stock 2

2.1.2 Real Estate Investment Trusts (REITs) 2

2.1.3 Portfolio 2

2.2 Evaluating Investments with Data 2

2.2.1 Technical Analysis with Price Volume Data 2

2.2.1.1 Profits and Loss (PnL) 2

2.2.1.2 Risk and Volatility 2

2.2.1.3 Sharpe Ratio 2

2.2.2 Fundamental Analysis with Financial Statements . . . 2

2.2.2.1 Income Statement 2

2.2.2.2 Balance Sheet 2

2.2.2.3 Cash Flow Statement 2

2.2.3 Alpha Formulas 2

2.2.4 Other Methods of Analyses 2

3 Literature Review of Portfolio Optimisation Techniques **3**

3.1 Optimal Portfolio Theory 3

3.2 Traditional Time-Series Analysis 3

3.3 Machine Learning Techniques 3

3.4 Comparison of Techniques 3

3.4.1 Scope 3

3.4.2 Profitability 3

3.4.3 Predictive Accuracy 3

II Innovation **1**

4 Datasets **2**

4.1 Extended Fundamental Data Features 2

4.2 Feature Selection with Decision Trees 2

5 Methodology **3**

5.1 Machine Learning for REITs Portfolio Optimisation 4

5.1.1 MLR / NN / LSTM Predictions with Extended Features 4

5.1.2 Trade Execution Logic 4

5.1.3 Performance Evaluation 4

5.2 Genetic Algorithm Search for Outperforming Alphas 4

5.2.1 Alpha Tree 4

5.2.2 Application of Genetic Algorithms to Alpha Trees . . . 4

5.2.2.1 Objective Function 4

5.2.2.2 Selection 4

5.2.2.3 Crossover 4

5.2.2.4 Mutation 4

5.2.3 Portfolio Allocation Using Alpha 4

5.2.4 Performance Evaluation 4

III Experiments **1**

6 Post-processed Financial Datasets **2**

7 Machine Learning Results **3**

7.1 Evaluating Stock Price Predictions 3

7.1.1 Multiple Linear Regression (MLR) 3

7.1.2 Neural Networks (NN) 3

7.1.3 Long-Short Term Memory (LSTM) 3

7.2 Trade Execution Results with Different Parameters 3

7.3 Overall Evaluation of Performances 3

8 Alpha Tree Search Results **4**

8.1 Alphas Generated 4

8.1.1 Initial Set 4

8.1.2 Intermediate Alphas 4

8.1.3 Best Performing Alphas 4

8.2 Portfolio Allocation Results with Best Performing Alphas . . . 4

8.3 Overall Evaluation of Performance 4

9 Conclusion **5**

9.1 Benchmarking Against Index Funds 5

9.2 Comparing Results with Literature Review 5

9.3 Key Findings 5

9.4 Major Contribution and Creativity 5

9.5 Future Work 5

9.5.1 More Operators and Features for Alphas 5

CHAPTER 1

INTRODUCTION

The saying goes that once a profitable trading formula has been discovered and traded on by enough people, its profits will be eroded away and it will cease to be profitable. Traders and investors appear to be playing a never-ending game of "Hide-and-Seek" in search of profitable trading strategies. Due to the evolving nature of the financial markets, traditional financial time-series forecasting models which are static in nature are becoming less effective than Machine Learning models and dynamic algorithms in identifying the best investments (Sheth & Shah, 2023). The success of Machine Learning has led to numerous research papers applying a myriad of Machine Learning techniques to predict stock prices (Obthong, Tantisantiwong, Jeamwatthanachai, & Wills, 2020). However, fewer papers that apply these approaches in the Real Estate sector and these papers largely focus on future stock price prediction rather than portfolio allocation as a whole (Habbab & Kampouridis, 2024). Many of these papers also use price-volume data without fundamental financial data as inputs. In 2022, the global real estate sector was worth more than $380 trillion and worth more than the global equity and bond markets combined (Tostevin & Rushton, 2023), with approximately 893 listed Real Estate Investment Trusts (REITs) (Nareit, 2024). Hence, addressing the research gaps in this area is particularly valuable.

1.1 Problem Definition

Optimising Real Estate Portfolios

1.2 Motivations

1.3 Major Contribution and Creativity

I. Background

CHAPTER 2

FINANCIAL TERMINOLOGY AND CONCEPTS

2.1 Key Terms

2.1.1 Stock

2.1.2 Real Estate Investment Trusts (REITs)

2.1.3 Portfolio

2.2 Evaluating Investments with Data

2.2.1 Technical Analysis with Price Volume Data

2.2.1.1 Profits and Loss (PnL)

2.2.1.2 Risk and Volatility

2.2.1.3 Sharpe Ratio

2.2.2 Fundamental Analysis with Financial Statements

2.2.2.1 Income Statement

2.2.2.2 Balance Sheet

2.2.2.3 Cash Flow Statement

2.2.3 Alpha Formulas

2.2.4 Other Methods of Analyses

CHAPTER 3

LITERATURE REVIEW OF PORTFOLIO OPTIMISATION TECHNIQUES

3.1 Optimal Portfolio Theory

3.2 Traditional Time-Series Analysis

3.3 Machine Learning Techniques

3.4 Comparison of Techniques

3.4.1 Scope

3.4.2 Profitability

3.4.3 Predictive Accuracy

II. Innovation

CHAPTER 4

DATASETS

4.1 Extended Fundamental Data Features

4.2 Feature Selection with Decision Trees

CHAPTER 5

METHODOLOGY

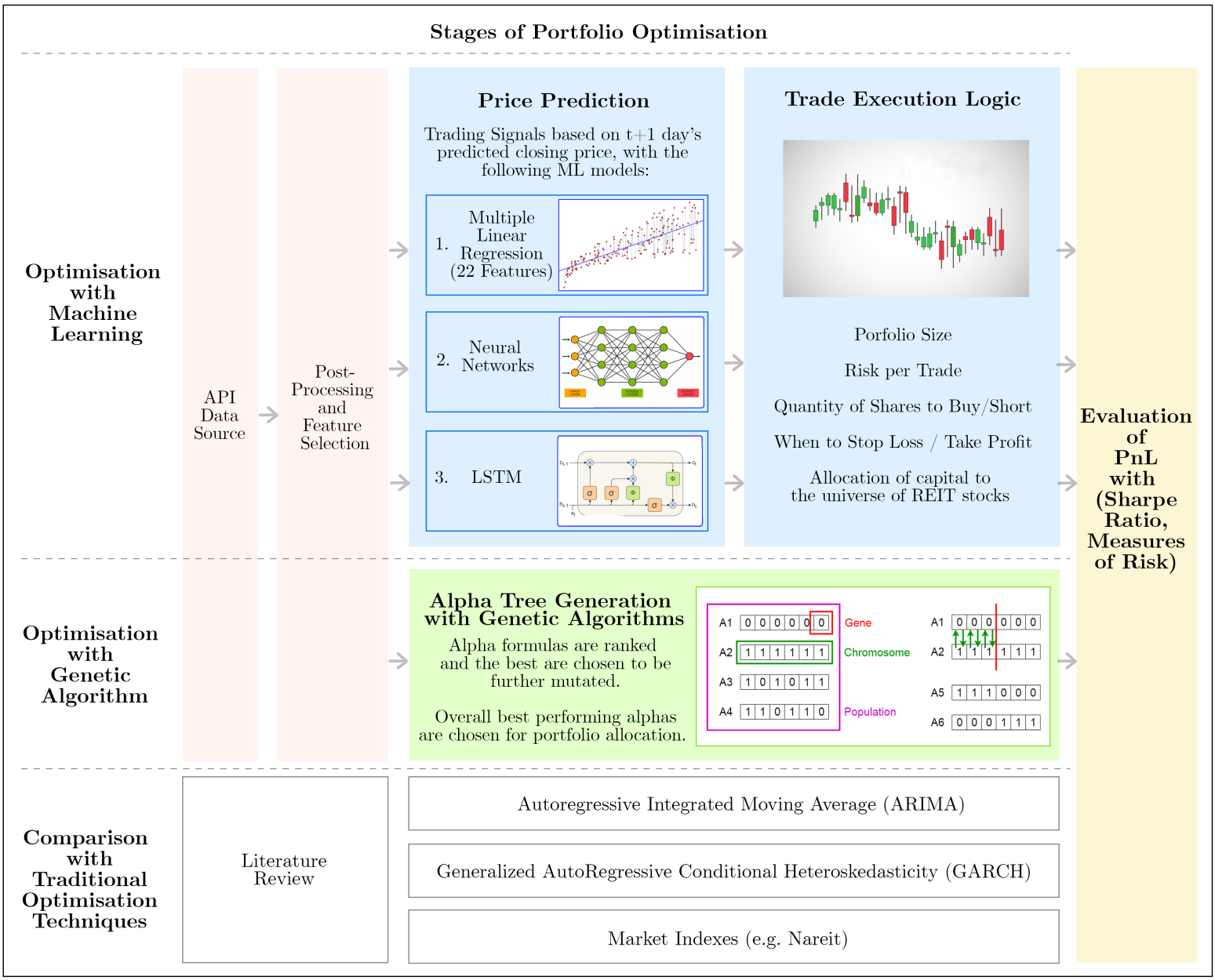

Figure 5.1: Write some caption here

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5.2 Genetic Algorithm Search for Outperforming Alphas

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5.2.2.1 Objective Function

5.2.2.2 Selection

5.2.2.3 Crossover

5.2.2.4 Mutation

5.2.3 Portfolio Allocation Using Alpha

5.2.4 Performance Evaluation

III. Experiments

CHAPTER 6

POST-PROCESSED FINANCIAL DATASETS

CHAPTER 7

MACHINE LEARNING RESULTS

7.1 Evaluating Stock Price Predictions

7.1.1 Multiple Linear Regression (MLR)

7.1.2 Neural Networks (NN)

7.1.3 Long-Short Term Memory (LSTM)

7.2 Trade Execution Results with Different Parameters

7.3 Overall Evaluation of Performances

CHAPTER 8

ALPHA TREE SEARCH RESULTS

8.1 Alphas Generated

8.1.1 Initial Set

8.1.2 Intermediate Alphas

8.1.3 Best Performing Alphas

8.2 Portfolio Allocation Results with Best Performing Alphas

8.3 Overall Evaluation of Performance

CHAPTER 9

CONCLUSION

9.1 Benchmarking Against Index Funds

9.2 Comparing Results with Literature Review

9.3 Key Findings

9.4 Major Contribution and Creativity

9.5 Future Work

9.5.1 More Operators and Features for Alphas

Figure 9.1: The Universe

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