Master Thesis

Reinforcement Learning for Portfolio Management: A Comparative Analysis of DQN, PPO, and Advantage Actor-Critic

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Born on: 6 May 1991 in Dresden, Germany
Course: Computational Modelling and Simulation (CMS)
Matriculation number: 5128979
Matriculation year: 2022

to achieve the academic degree

M.Sc. (Master of Science)

First referee
Prof. Dr. Wolfgang E. Nagel

Second referee
Prof. Dr.-Ing. Roberto Calandra

Supervisor
Dr. Iryna Okhrin

Submitted on: 28 January 2025

Task for the preparation of a Master Thesis

Course: Computational Modelling and Simulation (CMS)
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Objectives of work

Momentan ist das besagte Thema in aller Munde. Insbesondere wird es gerade in vielen – wenn nicht sogar in allen – Medien diskutiert. Es ist momentan noch nicht abzusehen, ob und wann sich diese Situation ändert. Eine kurzfristige Verlagerung aus dem Fokus der Öffentlichkeit wird nicht erwartet. Als Ziel dieser Arbeit soll identifiziert werden, warum das Thema gerade so omnipräsent ist und wie dieser Effekt abgeschwächt werden könnte. Zusätzlich sind Methoden zu entwickeln, mit denen sich ein ähnlicher Vorgang zukünftig vermeiden lässt.

Focus of work

- Recherche & Analyse
- Entwicklung eines Konzeptes & Anwendung der entwickelten Methodik
- Dokumentation und grafische Aufbereitung der Ergebnisse
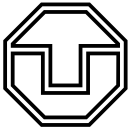
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Statement of authorship

I hereby certify that I have authored this document entitled *Reinforcement Learning for Portfolio Management: A Comparative Analysis of DQN, PPO, and Advantage Actor-Critic* independently and without undue assistance from third parties. No other than the resources and references indicated in this document have been used. I have marked both literal and accordingly adopted quotations as such. There were no additional persons involved in the intellectual preparation of the present document. I am aware that violations of this declaration may lead to subsequent withdrawal of the academic degree.

Dresden, 28 January 2025

Qaribiyan Qader

Abstract

This is an abstract. The abstract is written after finishing the work and should give an overview about the motivation, used methods, as well as the results. It is here to inform the reader about the core topics of the work and if it is relevant to his research. The abstract stands for itself and uses no components of the rest of the work. In consequence, there are no references nor citations used here. It should be around 100 to 250 words. There should always be an english version of your abstract, regardless of the language the work is actually written in.

Zusammenfassung

Das ist eine Zusammenfassung. Die Zusammenfassung wird geschrieben, nachdem die Arbeit ferttiggestellt ist und sollte einen Überblick über Motivation, Methoden und die Ergebnisse geben. Die Zusammenfassung informiert den Leser über die Kernthemen der Arbeit und ob die Arbeit für seine Forschung relevant ist. Die Zusammenfassung ist von der Arbeit entkoppelt und verwendet keine anderen Komponenten der Arbeit. In der Folge werden hier keine Referenzen oder Zitierungen genutzt. Sie sollte zwischen 100 und 250 Worten umfassen. Unabhängig von der Sprache, in der die Arbeit verfasst wurde, sollte es immer eine englische Version der Zusammenfassung geben.

Contents

Symbols and Acronyms

WYSIWYG   What You See Is What You Get   **GPU**   Graphics Processing Unit

CGV lab   Chair of Computer Graphics and Visualization

List of Figures

List of Tables

1 Introduction

The chapter should broadly contextualize your research and motivate your work.

1.1 Motivation

Here you motivate, why you are doing your research. dsdsd

1.2 Goal

This section should clarify, what should be achieved by the work.

1.3 Structure of the Work

Here the structure can be *briefly* explained.

2 Conclusion and Further Work

A Appendix I

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

B Appendix II

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Acknowledgement