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Title: Portfolio Optimisation using Reinforcement Learning and Deep Learning

Description

This project aims to explore the application of AI techniques, specifically reinforcement learning and deep learning, for portfolio optimisation in the field of finance. Portfolio optimisation is a complex problem which requires a balance between maximising returns and minimising risk while diversifying investments. Reinforcement learning algorithms can be incorporated to make investment decisions by maximising a reward signal, while deep learning algorithms can help analyse large volumes of financial data to identify patterns and relationships that inform investment decisions. By integrating these AI techniques into the portfolio optimisation process, the project aims to improve investment strategies and potentially enhance returns for investors.

The project will consist of a comprehensive literature review of the current state of the art in AI-based portfolio optimisation, identifying key concepts and methodologies. Real-world financial data, specifically stocks will be collected from API's like Yahoo finance, Bloomberg, etc and used to develop and implement a trading strategy on the principles of reinforcement learning and deep learning for the optimisation of a financial portfolio.

The effectiveness of the AI-based trading strategy will be assessed in comparison to traditional portfolio optimisation methods. The study intends to demonstrate the usefulness of AI techniques in solving the challenging issue of portfolio optimisation.

The project's approach involves a combination of technology, including programming languages Python and frameworks/libraries such as TensorFlow or PyTorch for implementing the AI algorithms.

Objectives

Primary Objectives:

- Develop and implement a Reinforcement learning/ Deep learning based trading strategy

- Evaluate the performance of AI-based portfolio optimisation algorithms by comparing the performance of the developed AI strategy against traditional portfolio optimisation techniques
- Analyse and conclude the effectiveness of AI techniques in portfolio optimisation, such as the strengths, weaknesses and trade-offs of AI-based approaches and their potential advantages over traditional methods.

Secondary Objectives:

- Review recent research reports, books and articles on AI-based portfolio optimisation to identify the key theories, techniques and algorithms used in the industry.
- To evaluate the possible future performance of investment portfolios by using Monte Carlo simulation techniques. This entails using random sampling to produce a variety of simulated market situations based on historical financial data.

Tertiary Objectives:

- Investigate and study state-of-the-art strategies to improve the efficiency of AI algorithms for portfolio optimisation by incorporating:
 - Ensemble methods
 - Transfer learning
 - Attention mechanisms.

Ethics

No ethical considerations. As the financial stock data is publicly available for use by providers like Yahoo Finance API, Bloomberg stocks data API etc.

Resources

No special requirements as of now. However, while training the deep learning algorithms if the training time and data seem too large then a system with GPU support or a Cloud Service Provider would be desired.