Quantitative Finance > Portfolio Management

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Deep Reinforcement Learning for Optimal Portfolio Allocation: A Comparative Study with Mean-Variance Optimization

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Portfolio Management is the process of overseeing a group of investments, referred to as a portfolio, with the objective of achieving predetermined investment goals. Portfolio optimization is a key component that involves allocating the portfolio assets so as to maximize returns while minimizing risk taken. It is typically carried out by financial professionals who use a combination of quantitative techniques and investment expertise to make decisions about the portfolio allocation.
Recent applications of Deep Reinforcement Learning (DRL) have shown promising results when used to optimize portfolio allocation by training model-free agents on historical market data. Many of these methods compare their results against basic benchmarks or other state-of-the-art DRL agents

but often fail to compare their performance against traditional methods used by financial professionals in practical settings. One of the most commonly used methods for this task is Mean-Variance Portfolio Optimization (MVO), which uses historical time series information to estimate expected asset returns and covariances, which are then used to optimize for an investment objective.
Our work is a thorough comparison between model-free DRL and MVO for optimal portfolio allocation. We detail the specifics of how to make DRL for portfolio optimization work in practice, also noting the adjustments needed for MVO. Backtest results demonstrate strong performance of the DRL agent across many metrics, including Sharpe ratio, maximum drawdowns, and absolute returns.

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