

Optimization of Quantitative Financial Trading Strategies Based on Machine Learning: Prediction and Decision Models for Stock and Derivatives Markets

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Abstract: Machine learning has become a cornerstone of quantitative finance, which allows for data-driven forecasting, strategy optimization, and trading-by-dot decision making. It analyzes the application of machine learning models such as recurrent neural networks (RNNs), long short term memory (LSTM) networks, and reinforcement learning (RL) in order to generate optimal predictive models and adaptive trading techniques. The research is based on historical stock and derivative market data and follows a rigorous process that includes data preprocessing, feature engineering and model training using random forests and gradient boosting. Our experimental evidence shows that LSTM performs better on long-term trends and ensemble models on short-term trends. The RL model significantly enhances risk-adjusted returns, with higher Sharpe ratios and lower drawdowns than standard strategies, suggesting real-time market flexibility. The study highlights the positive effects of machine learning in improving trading performance, which will be applicable to other trading scenarios.

Keywords: Machine Learning, Quantitative Finance, Predictive Modeling, Reinforcement Learning, Trading Strategy Optimization.

1. Introduction

Machine learning has had a dramatic impact on quantitative finance, by allowing for more data-based, flexible methods of forecasting, strategy-optimisation and decision-making in financial trading. Traditional quantitative finance approaches based on static, rule-based models or linear relationships are ill-equipped to represent modern financial markets. Machine learning, by contrast, is a set of powerful tools that can process vast amounts of market data, discover deep patterns, and make real-time changes to adapt to the changing conditions. This flexibility is critical in the world of trading, especially high-frequency trading (HFT) where trades are made in milliseconds, and low-frequency trading (LFT) where trend analysis for a long period of time is vital. In this paper, we investigate two main applications of machine learning to quantitative finance: prediction modelling and strategy optimization. Predictive modelling aims to make predictions about price movements and volatility in stock and derivatives markets using powerful machine learning techniques like random forests, gradient boosting and long short-term memory (LSTM) networks. They have been proven successful

Optimization Techniques In Quantitative Economic Models

Mikulás Luptáčik

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