NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Computer Science and Engineering
College of Engineering

Dynamic Portfolio Rebalancing

using Genetic Algorithm (GA) and Reinforcement Learning (RL)

Student: Eddy Lim Qing Yang Supervisor: Assoc Professor Quek Hiok Chai

Project aim

- Improve portfolio management by introducing dynamic portfolio rebalancing which accounts for risk.
- Explore the effectiveness of dynamic portfolio rebalancing using a novel risk algorithm optimised by GA and by using a RL agent.

Areas of focus	
Computer Science	**Finance**
• Maximize portfolio returns – utilize market trends	• Market risks – hedge against market risks • Behavioural risks – Utilize different risk adversity based on market trends
Main Strategies Utilized	
Tactical Asset Allocation – Dynamic Portfolio Rebalancing	Strategic Asset Allocation – Controlled base rates with dynamic risk profile

Method 1: Genetic Algorithm

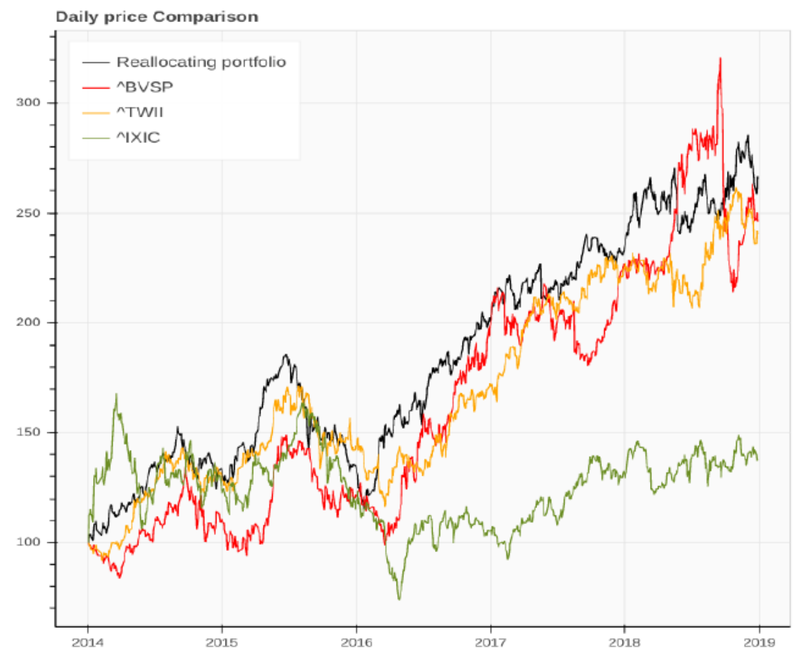
1. A novel risk algorithm takes account of the market conditions, risks and returns and determines portfolio composition in each market at each period for a group of markets.
2. Genetic algorithm is used to optimise parameters in risk algorithm unique to each market
3. Trend reversals in each period is determined by technical indicators and risk algorithm with optimised parameters is run per trend reversal

Method 2: Reinforcement Learning

1. A LSTM prediction model for stock prices is trained for the prices of individual markets
2. The LSTM predicted prices is used to reduce time lag on technical indicators to reflect true
3. Technical indicators used as state for Q-learning network
4. RL agent changes optimal portfolio composition per trend reversal

Results

- Able to display correct risk behaviours at correct market trends
- Able to reduce volatility of portfolio
- Able to outperform markets despite commission fees and reduce overall portfolio risk
- Effective in both global markets and individual stocks



Results

- Able to outperform markets despite commission fees and reduce portfolio risk
- Effective in global markets