

Introduction to Exchange Traded Fund (ETF) Sector Rotation Strategy

Motivation

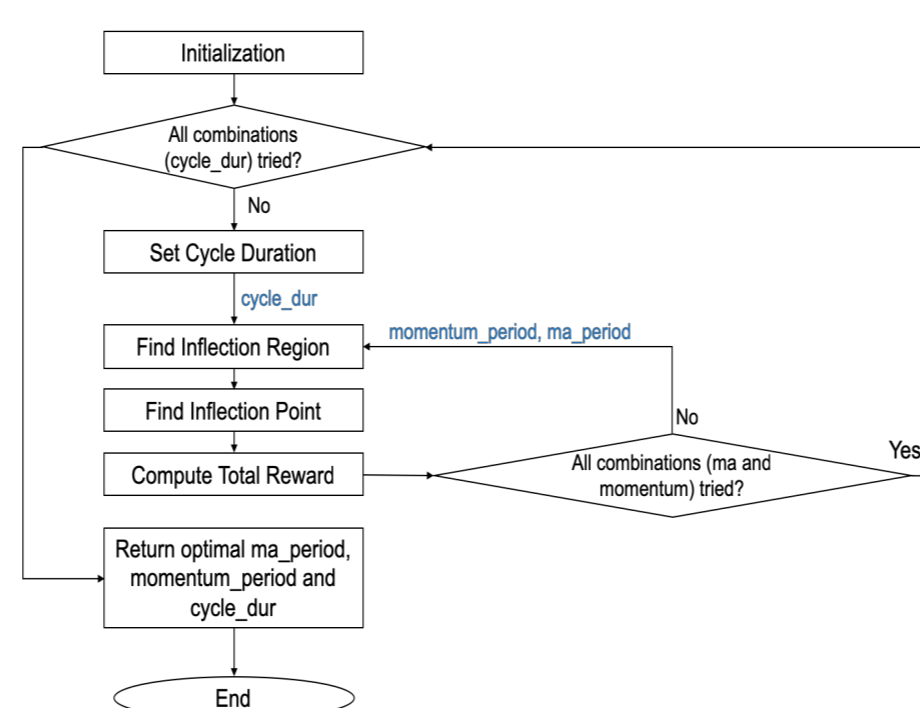
Exchange Traded Fund (ETF) sector rotation strategy is a significant strategy where investor invests in industry ETFs that outperform based on the business cycle. Despite its promise, there exists **challenges** in implementation that **CERS-DR aims to overcome**

- 1 Difficulty in cycle identification** due to short-term noise and different cycle durations
- 2 Difficulty in optimising portfolio construction** to maximise returns
- 3 Difficulty in optimising portfolio rebalancing** to dynamically respond to market changes

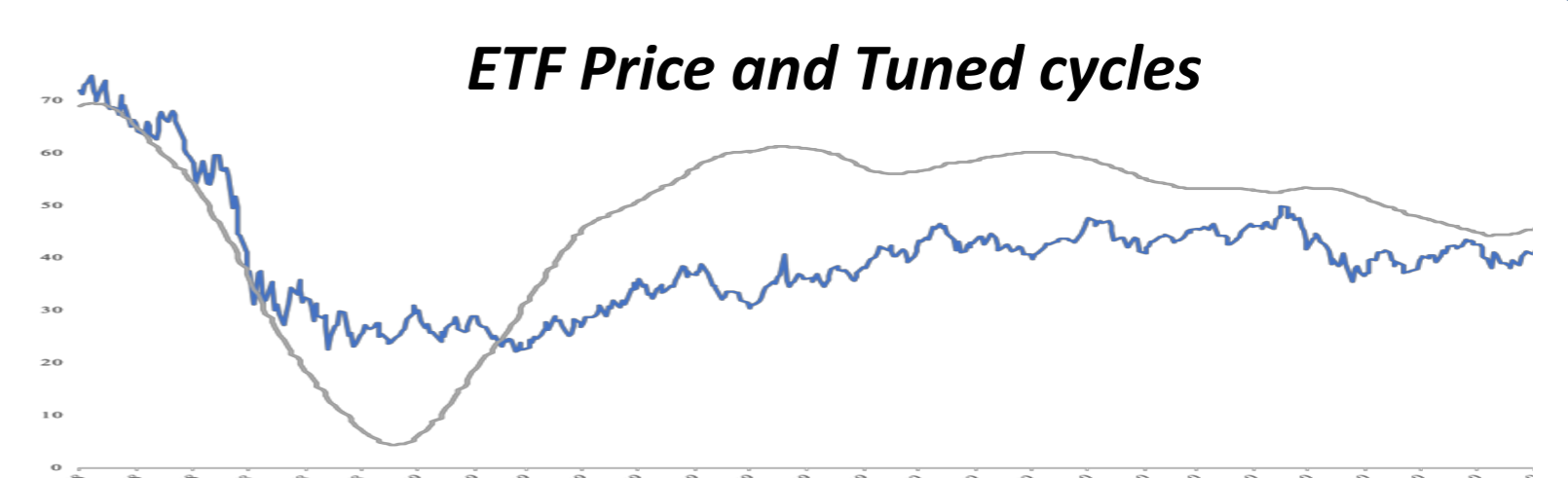
3 Components of CERS-DR

Proposed Solution and Methodology

1 Dual Reinforcement Learning (RL) Agent tunes moving average, momentum and cycle duration to find cycles that **fit different sectors' characteristics**



Results and Analysis



Accurate tuned cycles, able to capture movement of the ETF prices

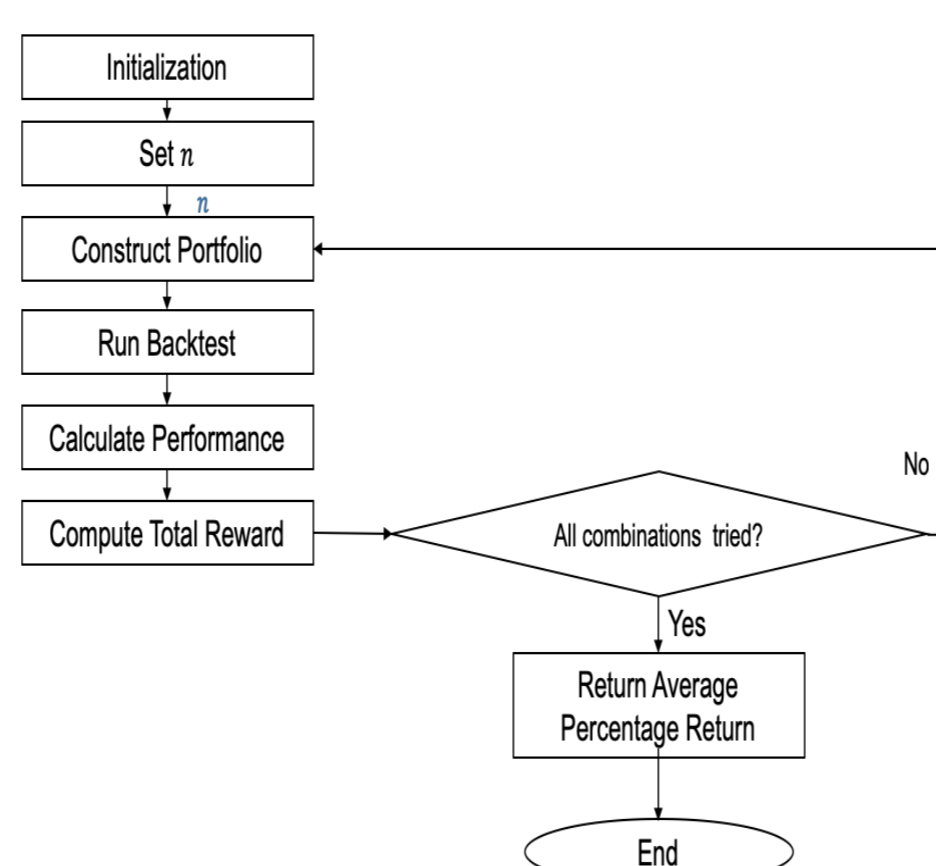
2 Dynamic Rebalancing Using RL & Neural Network maximises return from rebalancing by redistributing ETF weights at inflexion points of identified cycles

- A** Utilises the **inflexion points as rebalancing trigger**
- B** Able to perform effective **market summarisation**
- C** Evaluates the **optimum weight** to rebalance based on estimated upside potential of individual ETFs
- D** Trained using **history reexperience mechanism** to keep the agent up-to-date to most recent data

Metric	% Annual Return
S&P 500	10.4
Buy-and-hold	9.62
Monthly Rebalance	9.93
Quarterly Rebalance	9.96
Yearly Rebalancing	9.75
CERS-DR	13.06

CERS-DR **outperforms** S&P 500 index and other static rebalancing schemes by an average of **1.86%** in 10 simulations, showing **promising result**

3 Maximum-Reward RL Agent constructs portfolios of various sizes based on **asset correlation value** and find the portfolio size with the highest reward for each correlation value to maximise returns



Correlation	Total Reward for Each Portfolio Size						
	4	5	6	7	8	9	10
0.4 – 0.5	1.75	1.86	1.17	1.09	0.57	0.755	0.51
0.5 – 0.6	0.615	0.335	1.215	2.25	2.7	2.7	2.45
0.6 – 0.7	0.575	1.085	1.05	1.105	1.33	2.785	1.845
0.7 – 0.8	0.89	1.015	2.215	2.185	2.81	3.09	2.885

The asset correlation between the ETFs is **significant** in determining portfolio performance. Optimum portfolio size increases as asset correlation increases