# An algorithm to detect & implement a pair trading strategy from a basket of financial assets

## Proposal

## Introduction

Pair trading is an attractive strategy by hedge funds to seize the arbitrage opportunities between two assets. The process is market-neutral, meaning it does not depend on the market expectations. This paper proposes a criterion including the Hurst Exponent, OPTICS cluster, Correlation, and Cointegration tests for selecting eligible asset pairs. Afterward, we implement the pair trading strategy that comprises time series and machine learning techniques.

## Research Hypothesis

It is hypothesized that our algorithm will discover the closely related or connected pairs in the market, and there exist pair trading arbitrage opportunities. In addition, we hypothesize machine learning and time series algorithms will enhance the profitability of the pair trading.

## Research Plan

Firstly, the top 100 US ETFs during 2017 and 2022 are chosen as the asset to conduct our research because ETFs are less volatile and display great stationarity after differencing. Secondly, we use Principal Component Analysis to calculate the hedging ratio, subtract the hedging part, and derive the residuals. Afterward, we perform Hurst Exponent checking, OPTICs clustering, Correlation, and Cointegration tests on the residuals to determine whether the particular pair can be mean-reverting and stationary. After the pair selection period, we backtest the profit using a threshold-based trading model to examine the yield of the traditional pair trading model. Finally, we implement ARIMA-based and machine learning-based backtesting to investigate the profitability of our model.

## Expected Conclusion

Our algorithm is anticipated to cluster the assets into groups and select the most correlated and profitable trading pairs. The ARIMA and machine learning algorithms are expected to outperform the threshold-based pair trading model. Further analysis could be done on capturing the patterns of the residual difference of prices after hedging.