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Online Portfolio Selection Pattern Matching

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Introduction: Alex Kwon

- Researcher at Hudson & Thames Quantitative Research.
- Incoming Quantitative Trading Intern at Marshall Wace.
- Rising Senior at University of California, Berkeley.

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Overview

Online Portfolio Selection

Correlation Driven Nonparametric Learning

Universal Portfolio

Correlation Driven Nonparametric Learning - K

Market Symmetry

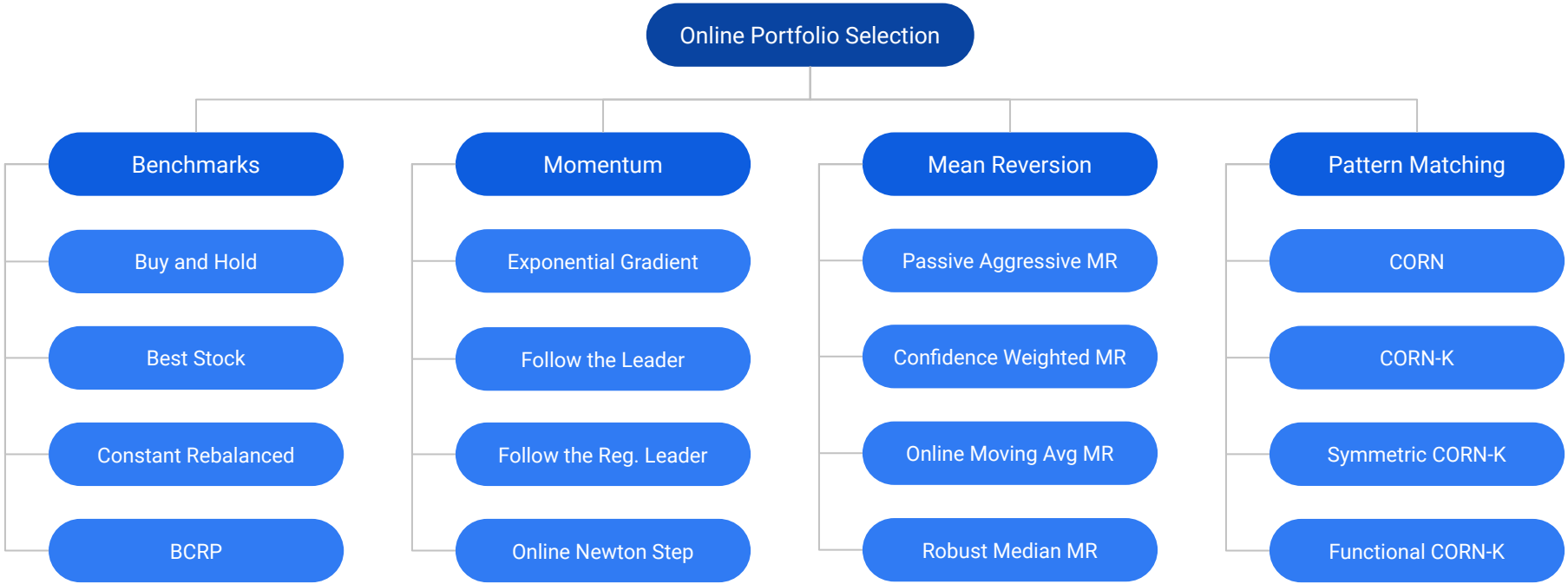
Symmetric Correlation Driven Nonparametric Learning - K

Functional Correlation Driven Nonparametric Learning - K

Results

Online Portfolio Selection

- Portfolio Selection
    - Sequential allocation among a set of assets to maximize the final return of investment.
- Online Learning
    - Computationally efficient algorithms to handle large scale applications.


Online Portfolio Selection
Benchmarks
Buy and Hold
Best Stock
Constant Rebalanced
BCRP
Momentum
Exponential Gradient
Follow the Leader
Follow the Reg. Leader
Online Newton Step
Mean Reversion
Passive Aggressive MR
Confidence Weighted MR
Online Moving Avg MR
Robust Median MR
Pattern Matching
CORN
CORN-K
Symmetric CORN-K
Functional CORN-K

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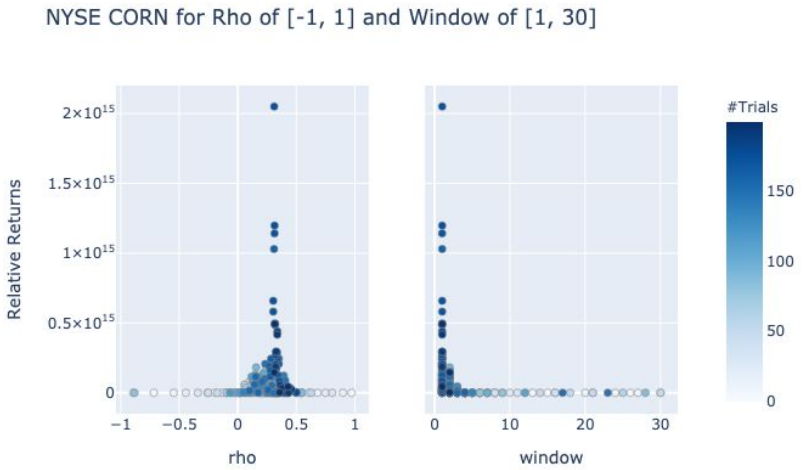
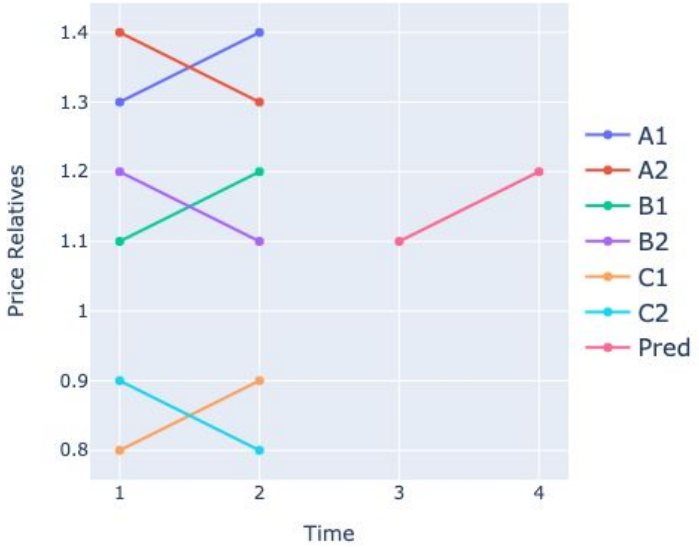
Correlation Driven Nonparametric Learning

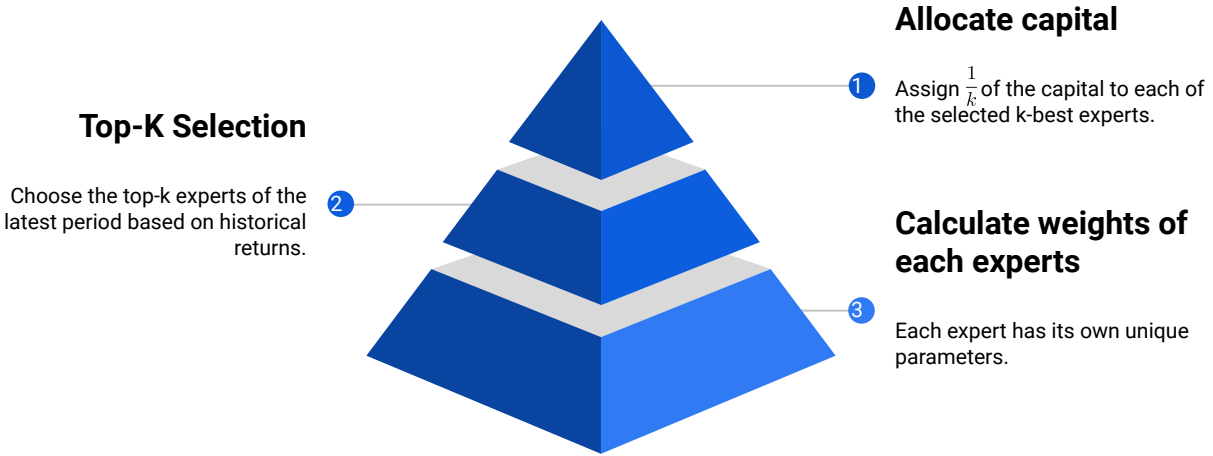
- Correlation between two different market windows.



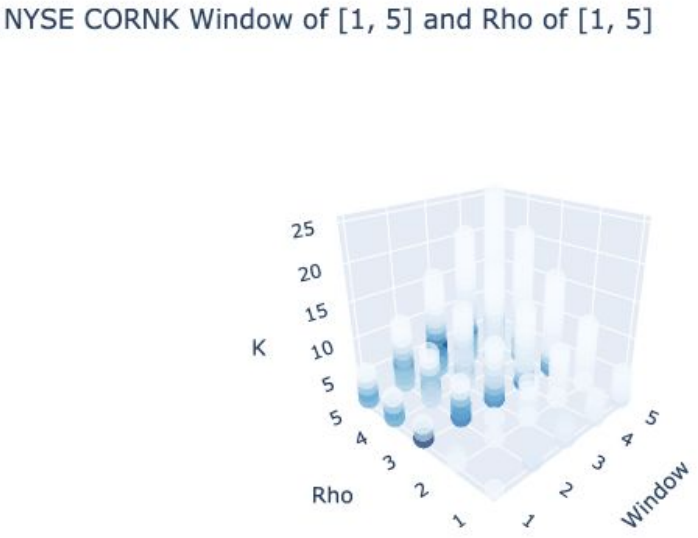


Universal Portfolio

- Ensemble method that acts as a fund of funds.
- Top K: Allocating $\frac{1}{k}$ of the total capital to the k best performing experts.

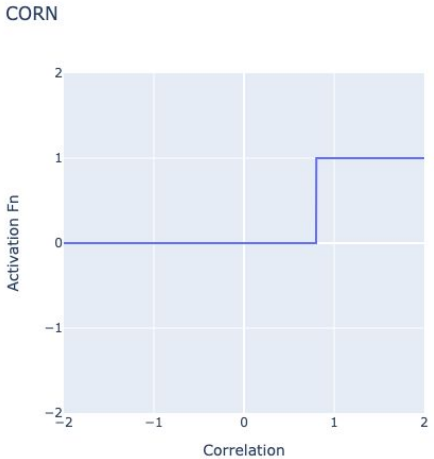


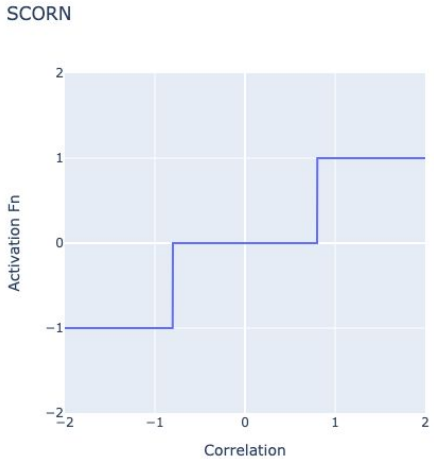
Correlation Driven Nonparametric Learning - K



Market Symmetry

$$b_t^\star(w,\rho) = \underset{b\in\Delta_m}{\arg\max} \sum_{j\in\{1,\ldots,t-1\}} v(j)\log b^\top x_i$$





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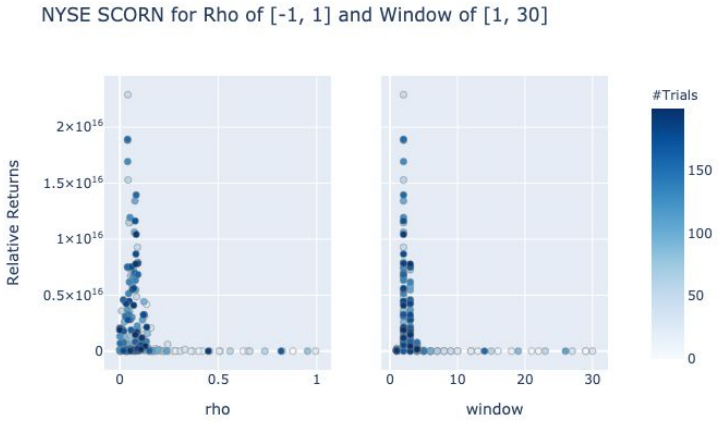
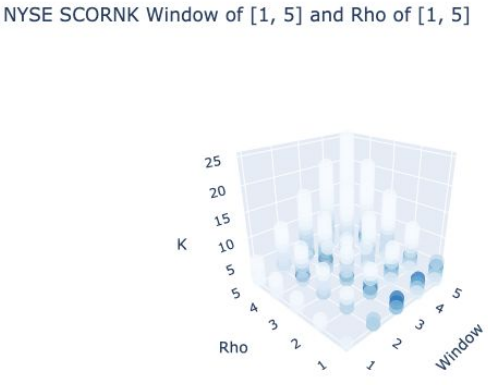
Symmetric CORN-K

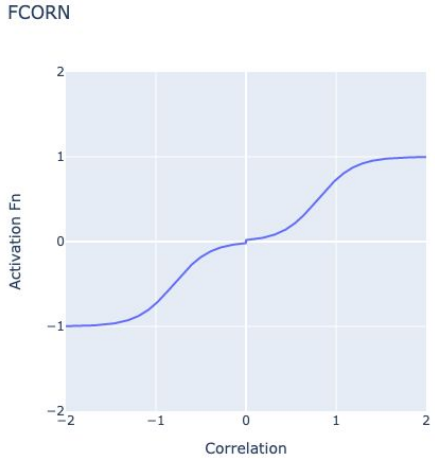
- Tracks the positive and negative correlation between market windows.

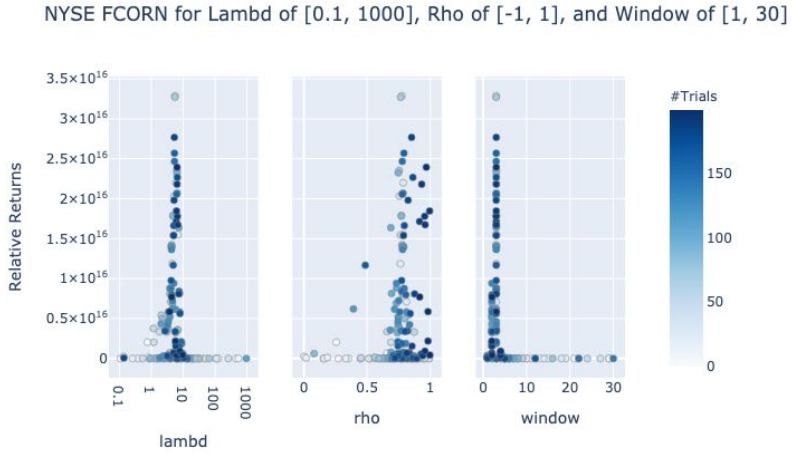




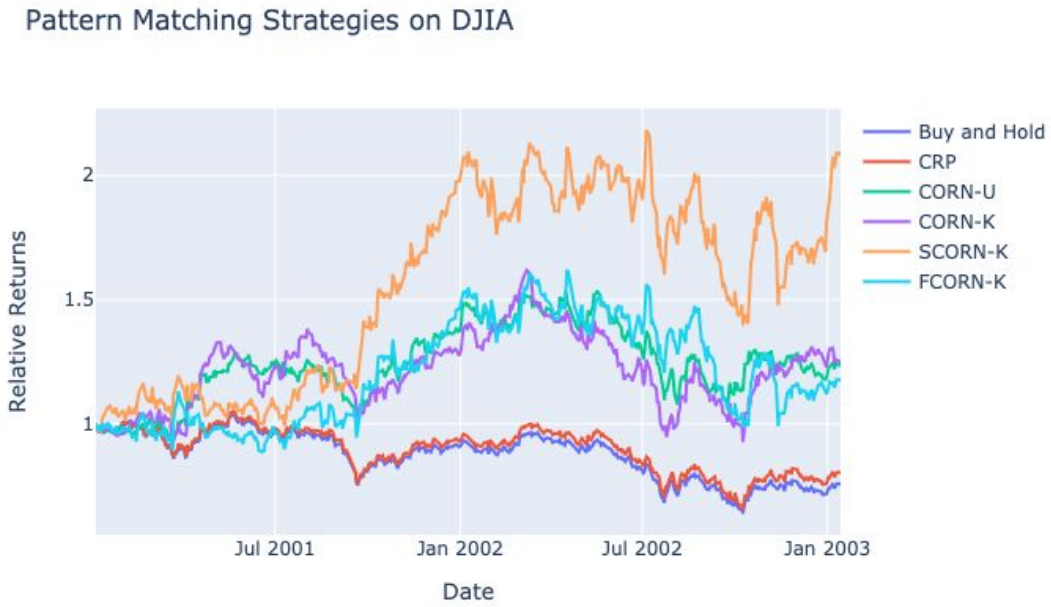
Functional CORN-K

- Dynamically changing weights on all historical periods.





Results: DJIA 2001 ~ 2003



Results: US Equity 2011 ~ 2020

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MlFinLab Module

```
In [301]: import mlfinlab

In [302]: model = CORN(window=2, rho=0)

In [303]: model.allocate(us_equity, verbose=True)
Progress: |████████████████████████████████████████| 100.0% Complete

In [304]: model.all_weights.tail()
```

Out[304]:

Date	AAPL	ABT	AMGN	AMZN	AXP	BAC	BRK-A	C	CAT	CMCSA	...	PG	PM	QCOM	SLB	T	UPS	USB	WFC	WMT	XOM
2020-04-21	0.000000	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.020534	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-04-22	0.000000	0.0	1.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.000000	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-04-23	0.489216	0.0	0.0	0.510784	0.0	0.0	0.0	0.0	0.0	0.000000	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-04-24	0.000000	0.0	1.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.000000	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-04-27	0.000000	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.000000	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

5 rows × 44 columns

```
In [305]: model.portfolio_return
```

Out[305]:

Date	Returns
2011-01-03	1.000000
2011-01-04	1.002099
2011-01-05	1.007820
2011-01-06	1.014134
2011-01-07	1.016917
...	...
2020-04-21	12.518541
2020-04-22	12.439334
2020-04-23	12.512422
2020-04-24	12.716396
2020-04-27	13.050817

2344 rows × 1 columns

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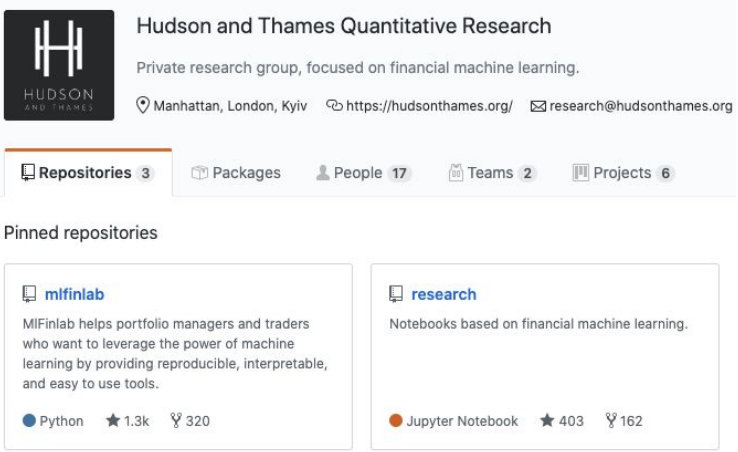
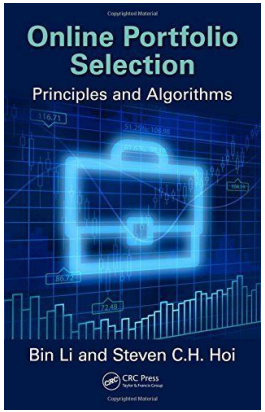
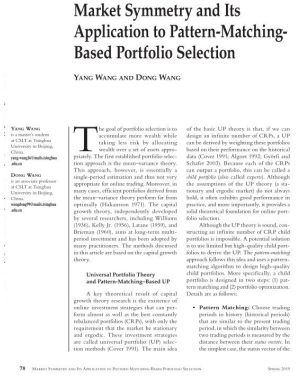
Additional Resources






Market Symmetry and Its Application to Pattern-Matching-Based Portfolio Selection

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Thank You