An Introduction To
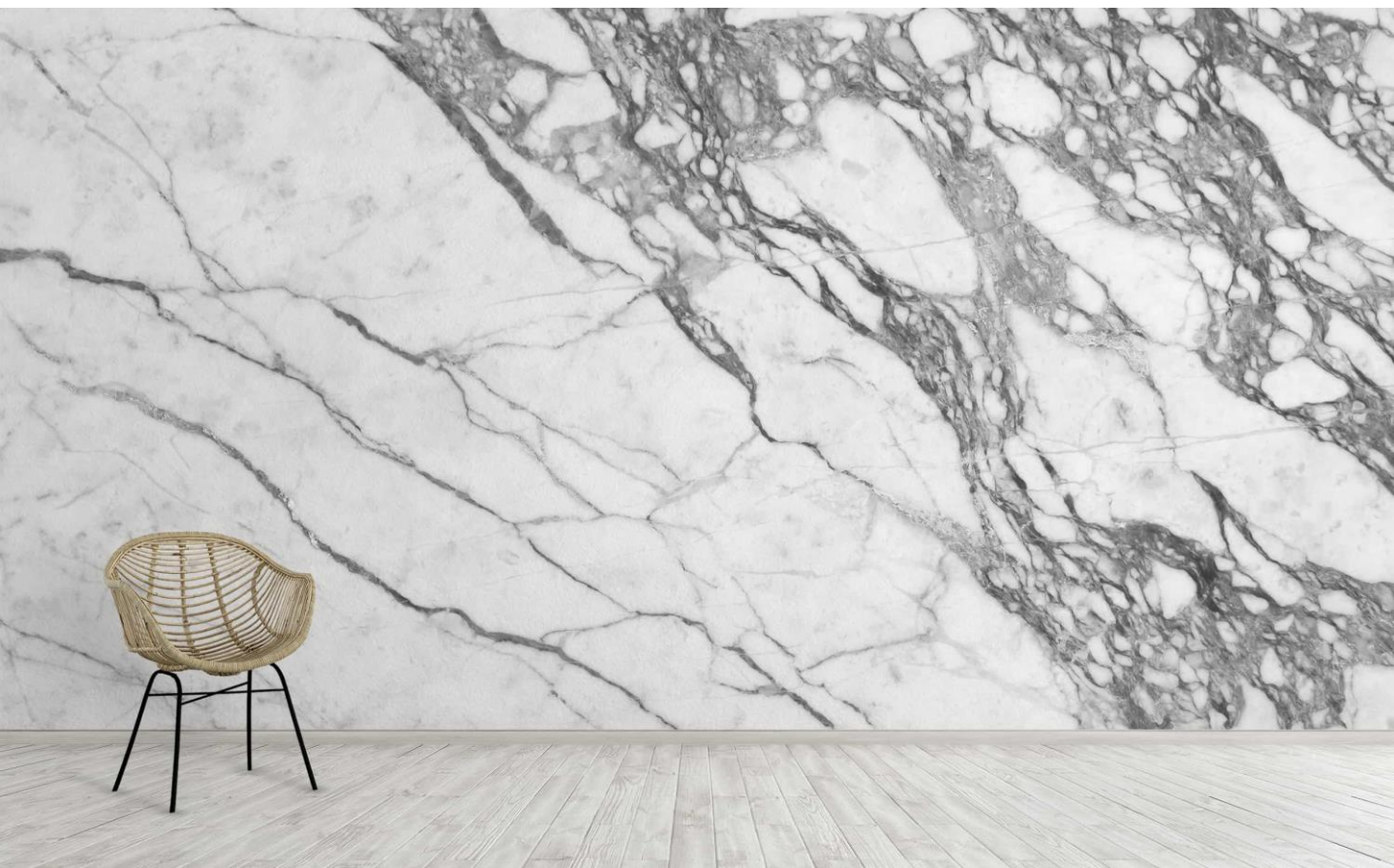# AI Driven Asset Management

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ALPHA

The efficient market hypothesis, which forms the basis of modern finance theory, states that market prices already reflect all information, and therefore it is impossible to predict future prices through information. In fact, the market works very efficiently. However, there are also small but distinct long-standing non-random patterns in the market. Finding an investment strategy that can beat the market is like finding this little non-random patterns in a flood of randomness. This investment strategy is called alpha.

Alpha occurs for various reasons such as market system and regulations, but the biggest source of alpha is the irrational behavior of investors. Behavioral economics is the study of these contents. Finding meaningful patterns by processing large amounts of data has been a common practice in fields such as cryptography, astronomy, bio informatics, and speech recognition. The US hedge fund Renaissance Technologies hired top scholars in mathematics, cryptography, astronomy, bio informatics, and speech recognition who achieved many achievements in their fields to do the same with financial data. As a result, Renaissance Technologies' internal fund is maintaining a CAGR of 66% for more than 30 years.

As the turnover of investment strategy increases, and the larger the asset under management, the higher the transaction cost, the size of the asset under management is also limited. Due to intensifying competition and improvement of methodologies for seeking alpha, the performance and size of individual alphas are getting smaller and smaller. As a result, most successful quant hedge funds currently manage billion dollars in funds by finding and combining a myriad of small alphas. Since a lot of manpower is needed to find a lot of alphas, the number of people employed by these quant hedge funds is rapidly increasing, and the amount of money managed by each researcher is gradually decreasing.

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AI vs. HUMAN

Both humans and AI can recognize patterns. However, the advantages of the two are somewhat different. Comparing to existing AI technology, human is far superior to AI in comprehensive thinking based on knowledge from various fields, the ability to recognize complex contexts, and imagination. So, it is still difficult for AI to catch up with human capabilities in matters such as the prospect of individual stocks or predicting the future of the industry.

Instead, AI is far superior to humans in the performance and speed of recognizing patterns and making decisions in a given large amount of data. For example, given 1000 stocks and input data, the problem of finding a factor that can meaningfully explain the price of 1000 stocks is more suitable for AI than human.

In addition, order execution (trading), where the optimal order execution strategy is inferred by learning tick data and limit order book data of individual stocks, is also an area where AI shows excellent performance. The artificial neural network works as a universal function approximator that can approximate any function if given enough data, and shows strong performance in these kind of problems.

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AI Enhanced Index

It is true that attempts to predict the direction of individual stock price or indices with AI are currently not showing any noteworthy results. However, attempts to improve portfolio performance with AI are yielding some tangible results.

Quant hedge funds love to find factors that can explain stock movements through cross-sectional analysis and use these factors to construct long-short portfolios. For example, if the volume of news covering an individual stock has a positive effect on future stock prices, you can do well by buying more stocks with high news volume and short shorting stocks with low news volume. . If you find as many of these alphas as possible and apply them simultaneously, your portfolio's performance can be further improved.

The same method is used for enhanced index. Currently, the largest equity index in the financial markets is the S&P 500 Index, which includes large US stocks as the investment universe. Simply put, the S&P 500 Index is an index that invests in the US large-cap stocks in proportion to their market capitalization. If we need to improve the performance of the S&P 500 Index, we need to explore a function other than market capitalization, and AI excels in that search.
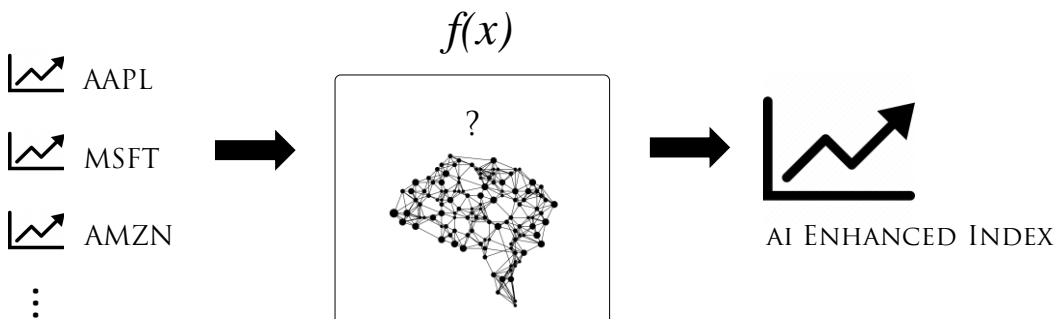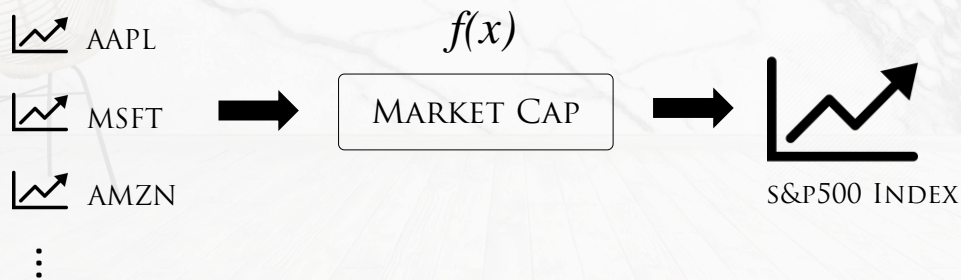
The S&P 500 Index builds its portfolio on a market capitalization weighted basis. It is a method of investing money in proportion to the market capitalization of each stock. To improve the performance of the S&P 500 Index strategy, you need to invest by a function other than market capitalization. For example, you can test investing money to each stocks in the investment universe by a ratio of capital or by a ratio of net income.

By subscribing to data vendor's data service, you can get data of about over 2000 items. This item includes financial data such as equity capital, liabilities, and net income of each stock, and macro data such as interest rates, FX rates, and stock indices. The function we need to find to improve the performance of the S&P 500 Index will take these data as input.

Value weighting is a way of investing money using the function f = {book value / market cap}. Indices that operate in this way (called value weighted index) outperformed the S&P 500 Index for quite some time, but have not succeeded in creating a steady alpha.

Consider finding a function of this simple form without any prior knowledge. {book value / market cap} is a function of the form {A operator B}. There are about 2000 cases in place of A and B, and operators also have at least 20 cases including arithmetic operators. So, to test all index performance of investing money with a simple function of the form {A operator B}, you would need to test 2000*2000*20 = 80 million cases. More complex functions can easily have trillions and even quadrillion of scale cases.

We saw a similar situation in Go game. Go game has about 10^{172} cases. Even the most powerful supercomputer cannot perform adequate searches in this level of search space. So, before AlphaGo, no program could beat a human in Go game. At first, AlphaGo succeeded in reducing the size of the search space through supervised learning by past game data, and AlphaGo Zero through reinforcement learning between AIs without past game data. Now, no human can beat AI in Go game.

Alpha Factory

The problem of finding a weighting function that improves the performance of the index also has a vast search space, but it can be narrowed down in the same way as AlphaGo. Anyone with even a little bit of experience in investing will not operate an index with a weighting function like {Volume + 10000*Interest Rate}. Volume and interest rate have different scales, and it is difficult to find any rationality in operating them by adding the two.

Since AI does not have any common sense and intuition, it must learn through the learning process that there is no need to explore those types of functions. And developing a model that can effectively perform this learning is a major topic of AI asset management.

Qraft Technologies has invested a lot of time in building data and simulation environments that can train these AI models and developing appropriate AI models. Qraft calls an AI system that searches for an appropriate portfolio weighting function "Factor Factory". The functions below are some of the weighting functions found by Factor Factory.

These searched alphas can be used as is, but we can explore another function that combines the alphas in a linear or non-linear way. Because the number of alphas found in Factor Factory is large, this function also has a vast search space, and another AI is needed to narrow it. This AI is called "Strategy Factory". While Factor Factory works as a signal researcher in a quantitative hedge fund, Strategy Factory performs a function similar to that of a portfolio manager.

Alpha Factory

Of course, these weighting functions do not always beat the benchmark index. Alpha has a zero-sum property, and a well working alpha will eventually be found by other market participants. And the alpha everyone knows will end its life as an alpha. So, only a team that succeeds in discovering a new alphas faster than existing alphas disappears can maintain a steady outperformance.

AI is very efficient at finding alpha in given data compared to humans. In addition, AI can explore complex forms of alpha that humans have not been able to explore, and complex and non-intuitive alphas are less likely to be rediscovered by human researchers. This is why we need to apply AI to alpha search.

*For more details about Qraft Alpha Factory, please refer to www.medium.com/qraft

AI Driven ETFs In NYSE

Qraft Technologies has been running a total of four AI driven ETFs listed in NYSE from 2019 to the present through an AI process that applies Alpha Factory technology and is operating without human intervention. It takes only 3 days to develop an AI-enhanced product of a specific index through an AI process in Qraft, and a separate researcher is not required. Qraft's engineers are responsible for developing AI models that can effectively search alphas, and the alphas are automatically discovered and commercialized by the AI system.

AI Driven ETFs In NYSE

The ETF with the largest AUM in the world is SPY (SPDR S&P 500 ETF Trust). State Street's SPY ETF tracks the S&P 500 Index and has about $400 billion in assets under management. The SPY ETF was also the first US ETF to go public in 1993. Blackrock's IVV (AUM $280 billion), which also tracks the S&P 500 Index, is in second place in AUM, and Vanguard's VOO (AUM $230 billion) is also 100% following the S&P 500 Index in fourth place. SPY, IVV, and VOO all track the same S&P 500 Index, and performances are almost identical. ETFs that track 100% of the S&P 500 Index are worth about $1000 billion. If the AI-enhanced S&P 500 ETF consistently outperforms the S&P 500 Index, a significant money move could occur.
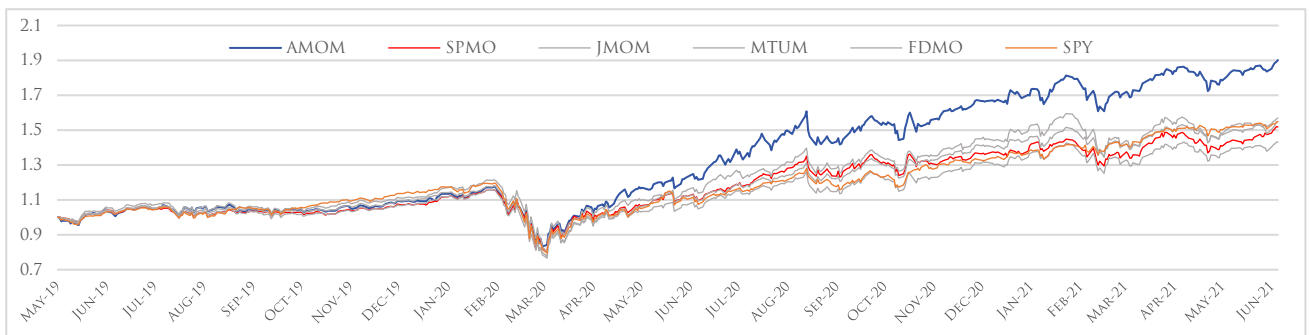
AMOM

Qraft AI Enhanced US Large Cap Momentum ETF

AMOM is an AI-enhanced product of the US large cap momentum index. It is like the AI version of the S&P 500 Momentum Index roughly. It moves the same as the US large cap momentum index, but pursues improved performance. Since inception, AMOM has recorded a cumulative return of 90.17% and an excess return of more than 38%p compared to the S&P 500 Momentum Index.

Total Return Stats

| Index	AMOM	SPMO	JMOM	MTUM	FDMO	SPY
Since Inception Return	90.17%	51.82%	57.01%	54.87%	43.17%	54.95%
1M Return	3.52%	5.36%	4.90%	1.35%	2.45%	2.08%
3M Return	9.93%	11.73%	10.90%	9.01%	9.00%	8.09%
6M Return	13.78%	10.40%	11.84%	7.32%	9.36%	15.39%
1Y Return	56.55%	38.65%	43.43%	36.07%	36.49%	44.31%
Since Inception Annualized Return	42.91%	24.66%	27.13%	26.11%	20.54%	26.15%
Since Inception Annualized Alpha	18.25%	0.00%	2.47%	1.45%	-4.12%	1.49%
Since Inception Annualized Sharpe Ratio	1.25	0.87	0.97	0.88	0.80	0.96
Since Inception MDD	(29.26%)	(30.93%)	(34.31%)	(34.08%)	(33.93%)	(33.70%)

Total Return Comparison Since Inception

AMOM

Qraft AI Enhanced US Large Cap Momentum ETF

Since inception, AMOM has shown excess returns of over 38%p and improved Sharpe ratio compared to the S&P 500 Momentum Index. This is the best track record in the US large cap momentum category.

US Large Cap Momentum ETF Comparison

Name	Ticker	Manager	Management Fee (bps)	Total Return(%)	Alpha(%p, After fee)	Sharpe Ratio	Alpha(%p, Before fee)	Annualized Return	Annualized Alpha
QRAFT AI-Enhanced U.S. Large Cap Momentum ETF	AMOM	Qraft Technologies	75	90.17%	38.35%	1.25	39.93%	42.91%	18.25%
iShares Edge MSCI USA Momentum Factor ETF	MTUM	BlackRock	15	54.87%	3.05%	0.88	3.37%	26.11%	1.45%
SPDR S&P500 ETF Trust	SPY	State Street	9	54.95%	3.13%	0.96	3.32%	26.15%	1.49%
JP Morgan US Momentum Factor ETF	JMOM	JP Morgan	12	57.01%	5.19%	0.97	5.44%	27.13%	2.47%
Invesco S&P500 Momentum ETF (Beta ETF)	SPMO	Invesco	13	51.82%	-	0.87	0.27%	24.66%	-
Fidelity Momentum Factor ETF	FDMO	Fidelity	29	43.17%	(8.65%)	0.80	(8.04%)	20.54%	(4.12%)

Alpha Comparison (%p, After Fee)
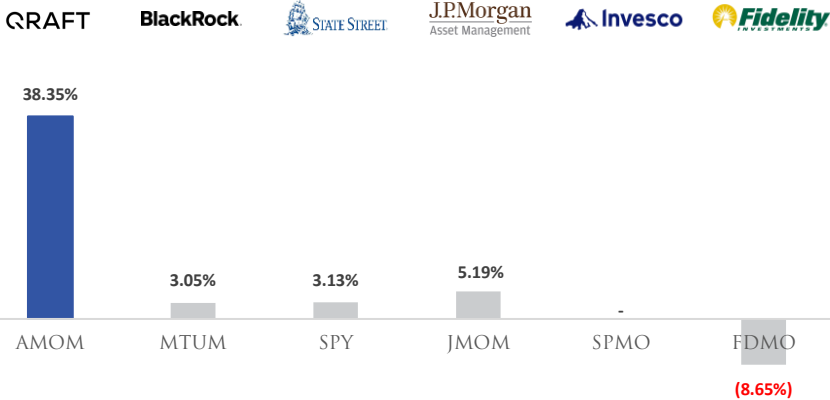
Bar chart values: AMOM 38.35%, MTUM 3.05%, SPY 3.13%, JMOM 5.19%, SPMO -, FDMO (8.65%)

Source Company data, S&P Compustat
Note 1. Updated as of 2021-06-25
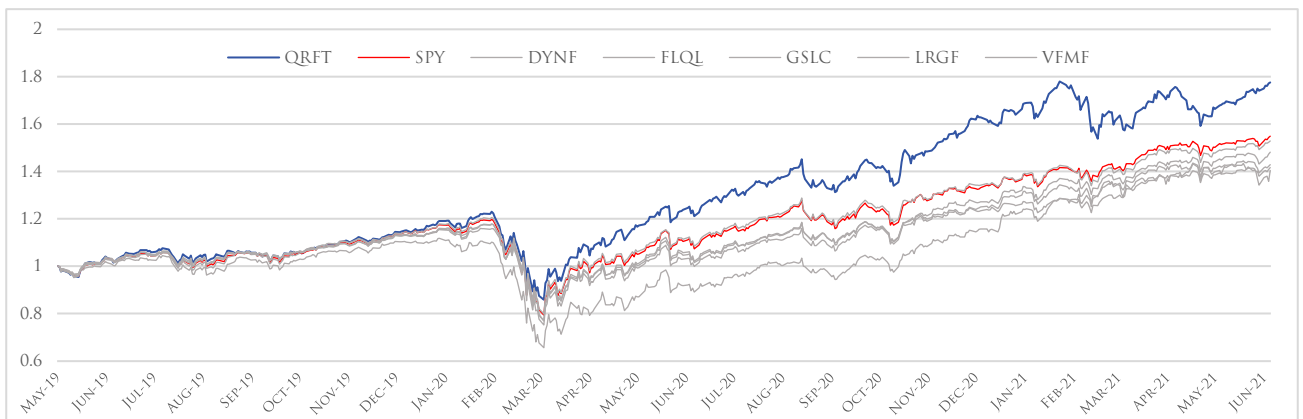2. Rebased at 1.00 as of the inception date

QRFT

Qraft AI Enhanced US Large Cap ETF

QRFT is an AI-enhanced product of the US large stock index. If you think of it as an AI version of the S&P 500 Index, it's roughly right. It moves the same as the US large cap index, but pursues improved performance. Since inception, QRFT has recorded a cumulative return of 77.62% and an excess return of more than 20%p compared to the S&P 500 Index.

TOTAL RETURN STATS

Index	QRFT	SPY	DYNF	FLQL	GSLC	LRGF	VFMF
Since Inception Return	77.62%	54.95%	48.15%	41.66%	52.86%	42.84%	40.41%
1M Return	5.19%	2.08%	1.47%	1.84%	2.33%	0.10%	(1.16%)
3M Return	11.10%	8.09%	7.51%	6.71%	8.24%	4.95%	4.52%
6M Return	9.76%	15.39%	16.41%	14.26%	13.26%	14.03%	21.31%
1Y Return	46.69%	44.31%	45.21%	39.47%	40.93%	42.86%	57.63%
Since Inception Annualized Return	36.94%	26.15%	22.91%	19.83%	25.15%	20.39%	19.23%
Since Inception Annualized Alpha	10.79%	0.00%	-3.24%	-6.32%	-0.99%	-5.76%	-6.92%
Since Inception Annualized Sharpe Ratio	1.20	0.96	0.88	0.81	0.94	0.78	0.70
Since Inception MDD	(30.19%)	(33.70%)	(34.72%)	(33.63%)	(33.69%)	(36.03%)	(41.33%)

TOTAL RETURN COMPARISON SINCE INCEPTION

Source Company data, S&P Compustat
Note 1. Updated as of 2021-06-25
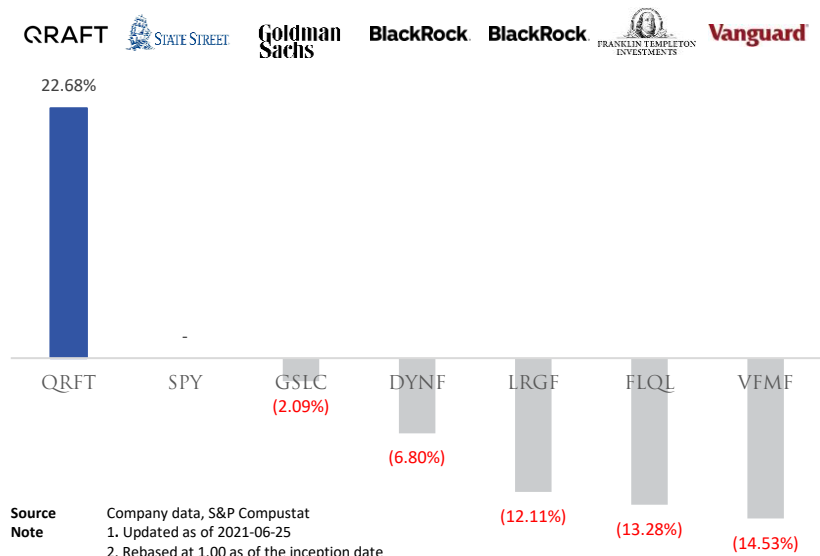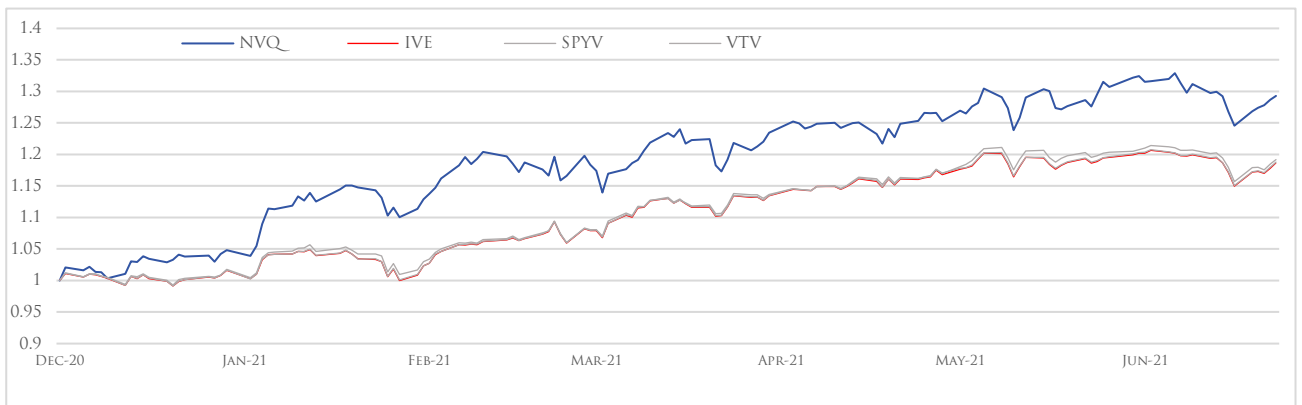2. Rebased at 1.00 as of the inception date

QRAFT

QRFT

Qraft AI Enhanced US Large Cap ETF

While all other ETFs in the same US large cap multi factor category have failed to beat the S&P 500 Index, QRFT has been showing more than 20%p excess return and improved Sharpe ratio compared to the S&P 500 Index since inception. QRFT is currently the best performing ETF in the US large cap multi factor category in terms of cumulative return and Sharpe ratio.

US Large Cap Multi Factor ETF Comparison

Name	Ticker	Manager	Management Fee (bps)	Total Return(%)	Alpha(%p, After fee)	Sharpe Ratio	Alpha(%p, Before fee)	Annualized Return	Annualized Alpha
Qraft AI Enhanced US Large Cap ETF	QRFT	Qraft Technologies	75	77.62%	22.68%	1.20	24.25%	36.94%	10.79%
SPDR S&P500 ETF Trust (Beta ETF)	SPY	State Street	9	54.95%	-	0.96	0.19%	26.15%	-
Goldman Sachs ActiveBeta US Large Cap Equity	GSLC	Goldman Sachs	9	52.86%	(2.09%)	0.94	(1.90%)	25.15%	(0.99%)
Blackrock US Equity Factor Rotation ETF	DYNF	Blackrock	30	48.15%	(6.80%)	0.88	(6.61%)	22.91%	(3.24%)
iShares Edge MSCI Multifactor USA ETF	LRGF	Blackrock	20	42.84%	(12.11%)	0.78	(11.69%)	20.39%	(5.76%)
Franklin LibertyQ US Equity ETF	FLQL	Franklin Templeton	15	41.66%	(13.28%)	0.81	(12.91%)	19.83%	(6.32%)
Vanguard US Multifactor ETF	VFMF	Vanguard	18	40.41%	(14.53%)	0.70	(14.15%)	19.23%	(6.92%)

Alpha Comparison (%p, After Fee)

Source Company data, S&P Compustat
Note 1. Updated as of 2021-06-25
2. Rebased at 1.00 as of the inception date

HDIV

Qraft AI Enhanced US High Dividend ETF

HDIV is an ETF that invests in US high-dividend stocks. AI decides how to allocate money to high dividend stocks, and seeks a balance between high dividend and price return, unlike some high dividend ETFs that underperform in terms of total return by simply increasing the dividend rate. HDIV has the highest Sharpe ratio among US high-dividend ETFs since inception.

TOTAL RETURN STATS

Index	HDIV	SPYD	VYM	FDVV	DVY	HDV
Since Inception Return	32.69%	27.93%	31.25%	35.96%	33.41%	19.93%
1M Return	(1.20%)	(1.03%)	(0.88%)	0.52%	(1.70%)	(0.09%)
3M Return	5.48%	5.71%	3.82%	6.27%	3.63%	1.94%
6M Return	17.50%	27.96%	17.44%	20.23%	25.68%	13.26%
1Y Return	43.47%	59.77%	41.35%	48.02%	57.20%	27.83%
Since Inception Annualized Return	24.60%	21.02%	23.51%	27.06%	25.15%	15.00%
Since Inception Annualized Alpha	3.58%	0.00%	2.49%	6.04%	4.13%	-6.02%
Since Inception Annualized Sharpe Ratio	0.94	0.67	0.83	0.90	0.79	0.60
Since Inception MDD	(28.32%)	(40.03%)	(29.91%)	(34.56%)	(35.86%)	(31.10%)

TOTAL RETURN COMPARISON SINCE INCEPTION
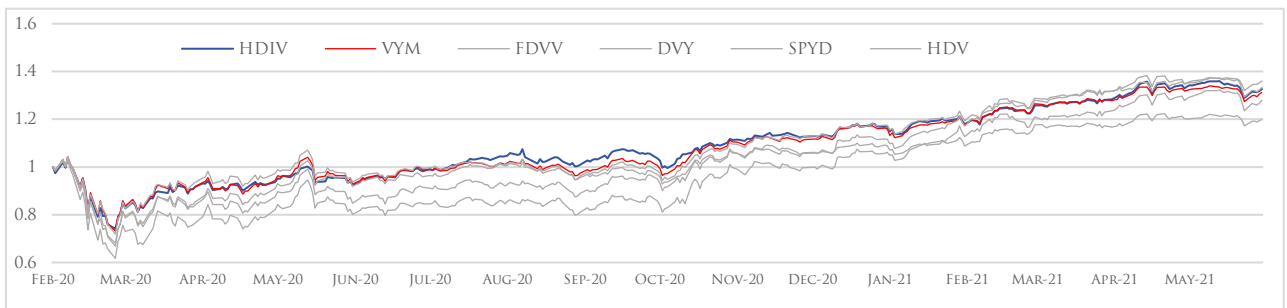
Source Company data, S&P Compustat
Note 1. Updated as of 2021-06-25
2. Rebased at 1.00 as of the inception date

QRAFT

NVQ

Qraft AI Enhanced US Next Value ETF

The value factor has been underperforming in the last decade. There are many opinions about the failure of the value factor that has worked well for decades, but the research that has attracted a lot of attention is not only the tangible assets that were important in the manufacturing-based industry in the past, but also the intangible assets that are becoming important with the change to the digital and knowledge-based industrial structure. It was a study that the value factor still works if the company value is newly defined by quantifying them together. NVQ ETF searches for an appropriate proxy function of intangible assets with AI considering items such as intellectual property rights, advertising expenses, R&D expenses, patents, and the situation of each sector and company, and combines the inferred intangible assets with tangible assets and compare it to market capitalization. NVQ has returned 29.25% over the past six months since inception, outperforming IVE that tracks the S&P500 Value Index and other value ETFs as well as the S&P 500 Index by more than 10%p.

TOTAL RETURN STATS

Index	NVQ	IVE	SPYV	VTV
Since Inception Return	29.25%	18.65%	18.78%	19.19%
1M Return	(1.70%)	(0.65%)	(0.59%)	(0.82%)
3M Return	6.12%	4.58%	4.68%	4.76%
6M Return	24.33%	18.00%	18.07%	18.42%
1Y Return				-
Since Inception Annualized Return	51.82%	33.04%	33.28%	34.00%
Since Inception Annualized Alpha	18.78%	0.00%	0.24%	0.95%
Since Inception Annualized Sharpe Ratio	0.94	0.67	0.83	0.90
Since Inception MDD	(28.32%)	(40.03%)	(29.91%)	(34.56%)

TOTAL RETURN COMPARISON SINCE INCEPTION

Qraft's AI ETF lineup has been highlighted by major financial media, not only for its technology, but also for its outstanding performance proven in the real market. Driven by market interest and performance in AI, Qraft's AI ETF story is featured in the Wall Street Journal, Barron's, and MarketWatch as a main article.

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Qraft launched its fund in December, while Principal's started trading last month. With more than 2,000 ETFs in the U.S. alone, funds face stiff competition in enticing investors. Funds usually take as much as five years to reach $100 million in assets—the threshold they need to meet to stay in business, analysts say. Many funds fail to reach that mark and eventually shut down. One reliable way of appealing to investors is by posting eye-popping returns.

Qraft's $5.6 million ETF relies on artificial intelligence to screen for value stocks based on intangible assets such as intellectual property, and it tries to predict which will have the best performance over the next month. The AI's monthly 100 top picks have recently included GameStop and AMC.

"Our AI model is based on increased probability," said Francis Geeseok, a managing director at Qraft. "So we're betting on that probability."

Just like human fund managers, AI-powered funds can also struggle with timing. Qraft's AI traded in and out of GameStop over February, March and April, exposing the fund to losses while missing out on some gains, according to FactSet. In June, the fund added AMC to its roster and held on to GameStop.

Shares of the Qraft fund are up 19% so far this year, versus 11% for the S&P 500.

UPCOMING EVENTS

Jun 24 2021 — 11:00 AM - 5:00 PM EDT — Global Food Forum

Jun 30 2021 — 1:00 PM - 1:45 PM EDT — WSJ Pro Cybersecurity Webinar: Aligning IT and Cybersecurity

Jun 30 2021 — 7:00 PM - 7:45 PM EDT — WSJ+ Live: Daniel Kahneman and His Co-Authors on the Crisis of 'Noise'

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News

Qraft AI Enhanced ETFs

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This Robot-Run ETF Favors a Meme Stock Over Tesla and Amazon. Here's What Else It Bought.

By Jack Denton   Updated June 9, 2021 11:50 am ET / Original June 9, 2021 9:15 am ET

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It has had some success with Tesla and Amazon in the past but this exchange-traded fund controlled by artificial intelligence thinks a certain meme stock will outperform the tech giants in the month ahead.

Booting technology-stock favorites from its portfolio in June, the Qraft AI-Enhanced U.S. Large Cap Momentum

Pedestrians walk by a GameStop store on Mar. 10, 2021 in San Francisco, California.

MarketWatch

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This robot-run fund thinks GameStop's stock will soar in June, and predicts a fall for Tesla and Amazon

- As GameStop readies earnings, here's one area in which WallStreetBets can declare victory
- As AMC stock surges, SEC says it's watching memes for signs of misconduct
- Newest meme stock darling Clover Health is popping. Is the SEC watching?
- Why I'm still rage-buying meme stocks: Barron's on MarketWatch

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- Infrastructure talks fizzle out between Biden and group of Senate Republicans
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News

Qraft AI Enhanced ETFs

Market Neutral Strategies
With Qraft AI Enhanced ETFs

The four AI driven ETF lineup of Qraft pursues excess returns compared to benchmark indices through AI. If this alpha works well, you can pursue an absolute return strategy that hedges the market exposure by buying Qraft's AI driven ETF and short S&P 500 index futures. This strategy is recording an absolute return of about 10% per annum during the actual operation in the market (May 2019~Jun 2021).

Live: Equal-weighted 4 AI Driven ETFs Long + 100% S&P500 Futures Short

Equity Curve (Log, Live)
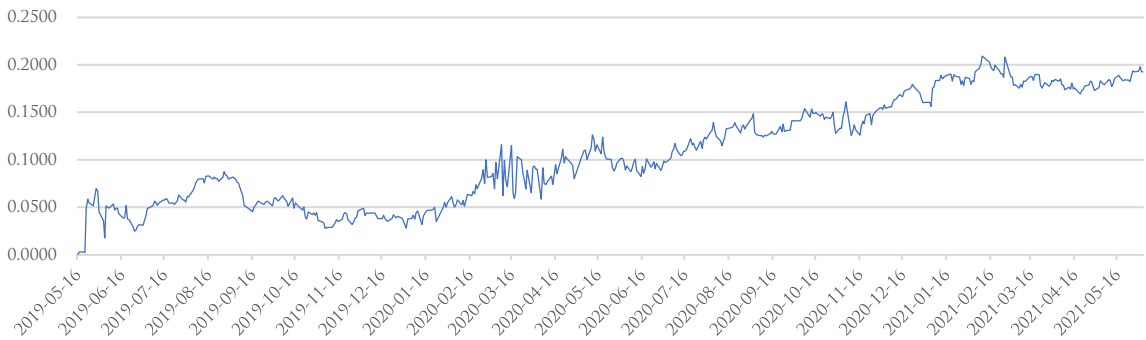
Backtest: Equal-weighted 4 AI Driven ETFs Long + 100% S&P500 Futures Short

Equity Curve (Log, Backtest)

QRAFT

AXE

AI Driven Equity Execution System

Once the portfolio is fixed, it is necessary to trade it on the real market. The larger the portfolio size and the higher the turnover rate, the more important the role of order execution (trading) is to buy and sell in installments appropriately in the market to minimize market shock and lower transaction costs. Qraft developed an AI order execution system based on deep reinforcement learning and commercialized it under the brand AXE. Currently, institutions such as the National Pension Service (South Korea) are using the AXE system to reduce transaction costs. The AXE system, which searches for an optimal order execution strategy optimized for each stock by learning tick data and LOB data of individual stocks by AI, shows 2-3bps superior order execution performance compared to VWAP in actual trading. Considering that the best professional traders are showing order execution performance that inferior to VWAP by 8bps, AI will soon make a big difference in the trading industry. Qraft has completed the AI-driven asset management process leading to KIRIN (financial data and simulation platform), Alpha Factory (searching excess return strategy), and AXE (order execution), and used it as a real reference, including the outstanding performance of ETFs listed on the NYSE, in the market. proving it.

AI Driven Asset Management Process
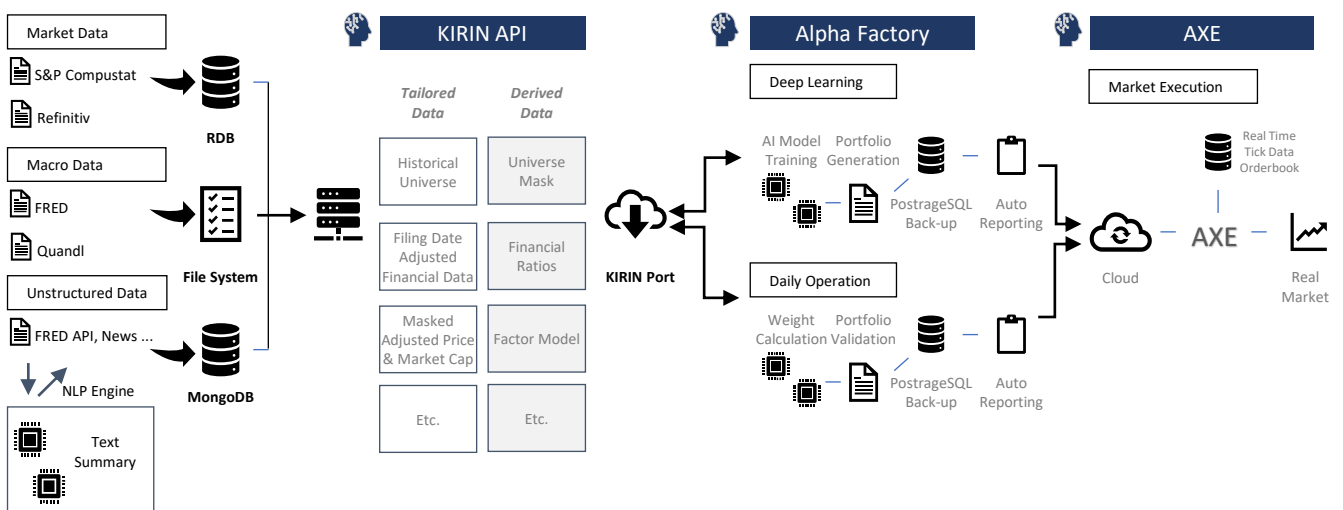
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QRAFT