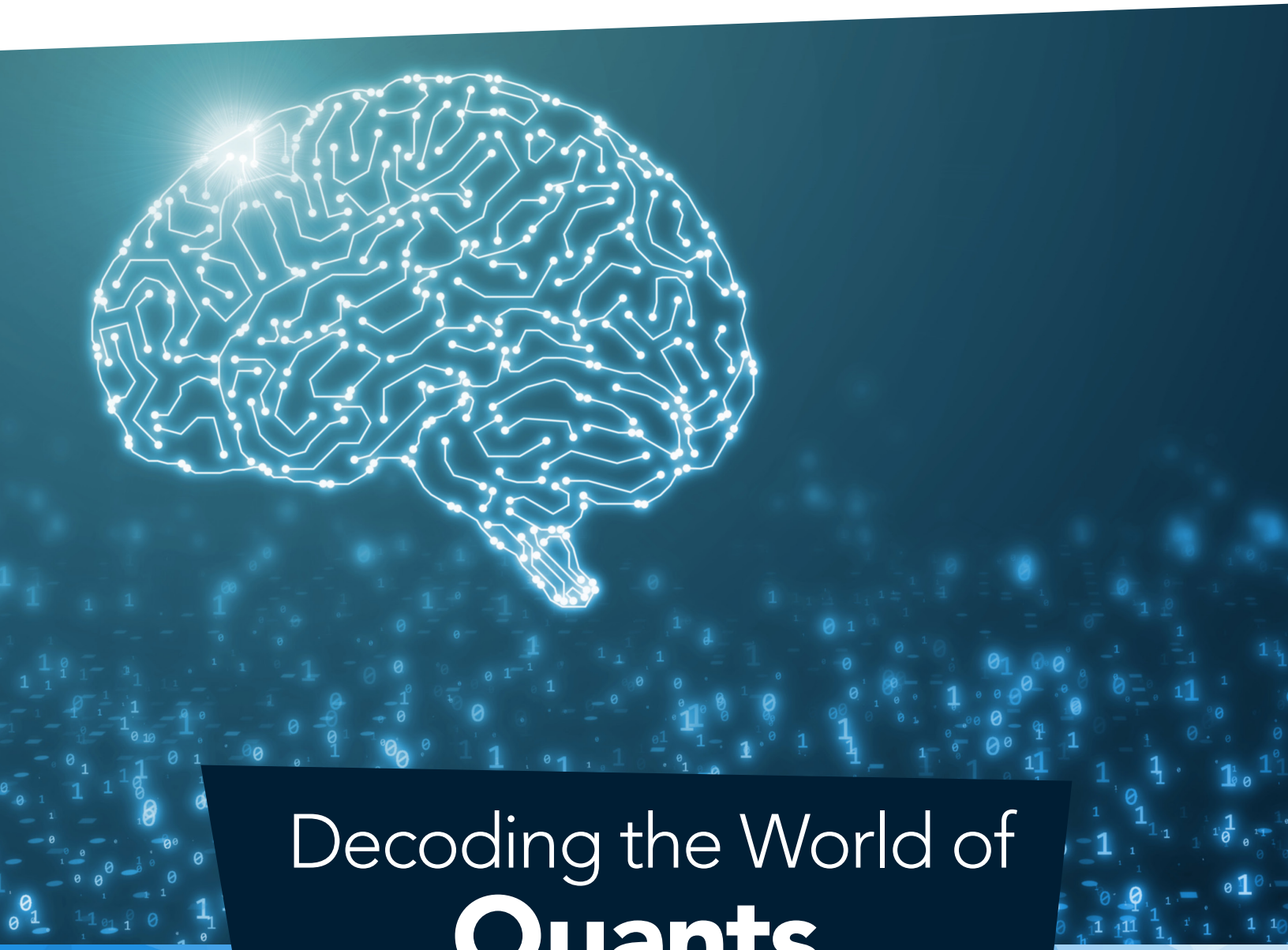
RCM Alternatives



Decoding the World of **Quants, Algorithms, and AI**

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Decoding the World of Quants, Algorithms, and AI

It's hard to listen to a podcast, read a blog post, or pick up the Wall Street Journal (do we still "pick up the paper"?) these days without encountering the word "quant". Be it quantitative finance, quant strategies, quant hedge funds, or job postings for quants.

But what exactly is a quant? Is it a person? Or is it a strategy? Is it the same as algorithmic trading, or quantum computing?

Well, the answers are yes, yes, sort of, and no. We call a person who works in finance (and increasingly in non-finance data related fields like health care or automotive) and models investment strategies using an algorithmic process a 'quant'. We call the investment models they (the quants) develop via this scientific, mathematical approach - quant strategies.

So, in short – a quant is a person who develops investment models known as quant strategies using computerized mathematical algorithms. These quants create an algorithm which can have inputs as simple as price and volume; and as complex as different countries price of production, the number of barrels in storage, recent headlines, interest rates, and more, and has outputs which are when to buy and sell and at what prices. Add in a dash of artificial intelligence via machine learning and you may have enough knowledge to get by at a cocktail party when asked what ***QUANTS*** are all about.

But, the devil is in the details here, and that one question may come in 27 parts or so , to borrow the old *Back to School* line. Because while the concept of what a quant (the person) does is relatively easy to understand, the products that those quants are involved in, and tools the quants use to create their wares starts to get complex in a hurry. We're here to help unbundle this quant cornucopia of terms and characters by highlighting the main areas of quant involvement across the industry:

The many flavors of **everything quant**

There are **quants** that build, test, and look to deploy their models for pay

There are easy-access **quant** menus, of sorts, in risk premia offerings and algo app stores

There are **quant** built/quant fueled robo-advisors

There are automated execution algorithms built by **quants**

There are **quant** hedge funds (who have been around for decades)

Algorithms

Algorithms (or Algos for short) are the tools quants develop to make the lives of traders easier. You can't get very far in one without the other. Quantitative strategies are those employed in a scientific and mathematical way. Like this: when x happens, do y. Algorithms, usually expressed using computer code, define those instructions, essentially doing everything from taking the effort of making the trade off a trader's plate to allowing for the testing of hundreds of years of data. Trading Algos cover a few steps, from the strategy creation, moving into the strategy generation (both order creation and size), then the actual trade execution, and finishing out with position management.

Trading Idea Testing

This is the "creation mode", where quants can test what happens when we implement different algos on different pieces of historical data. What if I bought Google the Wednesday before each of its earnings releases? What if I sold Corn futures every time it's 200-day rate of change was a negative number? What if I put bracketed orders 1.5 standard deviations above and below the past 30 days of 30yr bond futures prices 2 minutes 36 seconds before the monthly employment number. Quants code up these ideas into an algorithm and test how they have performed over time.

Trading Signal Generation

Once quants are comfortable with that testing and have decided on the specific type of trading idea they want their algorithm to implement in the market, the next step is running that algorithm on live market data to generate real trading signals. The algorithm will ingest as much price data as you instruct it to, crunch the numbers for your calculating average prices, volume profiles, stochastics, and on and on, and spit out a signal, looking something like 'Buy at a price of 242, with a stop at 236, and profit target of 254' in an overly simplistic example.

Trading Size Generation

Next, is taking the fact that we want to buy at a specific price, and calculating how many we're going to buy. That's where the order size comes in. Trade size generation is done by the algo to let you know how many of each variable to execute on. It looks something like: on this order, buy an amount equal to 0.30% of my trailing 60-day average account equity, divided by the dollar value of the distance between the current price and two standard deviations below the current price. Oh, and by the way, do that for 23 different accounts of 23 different sizes, and then calculate the order size for each account and sum the rounded value to give the total order size.

Trade Order Execution

These orders are tested, generated, sized, and then sent to the exchange for execution, bringing a few new pieces to the puzzle: the quant built and maintained 'pipes' for the trade to travel through - OMS, ORS, and DMA.

Order Management System (OMS): The online system that executes orders trades, commonly through FIX (Financial Information eXchange) protocol, which allows progress tracking for each order throughout the system.

Order Routing System (ORS): This is the transaction process, defining how the order goes from the OMS to the exchange.

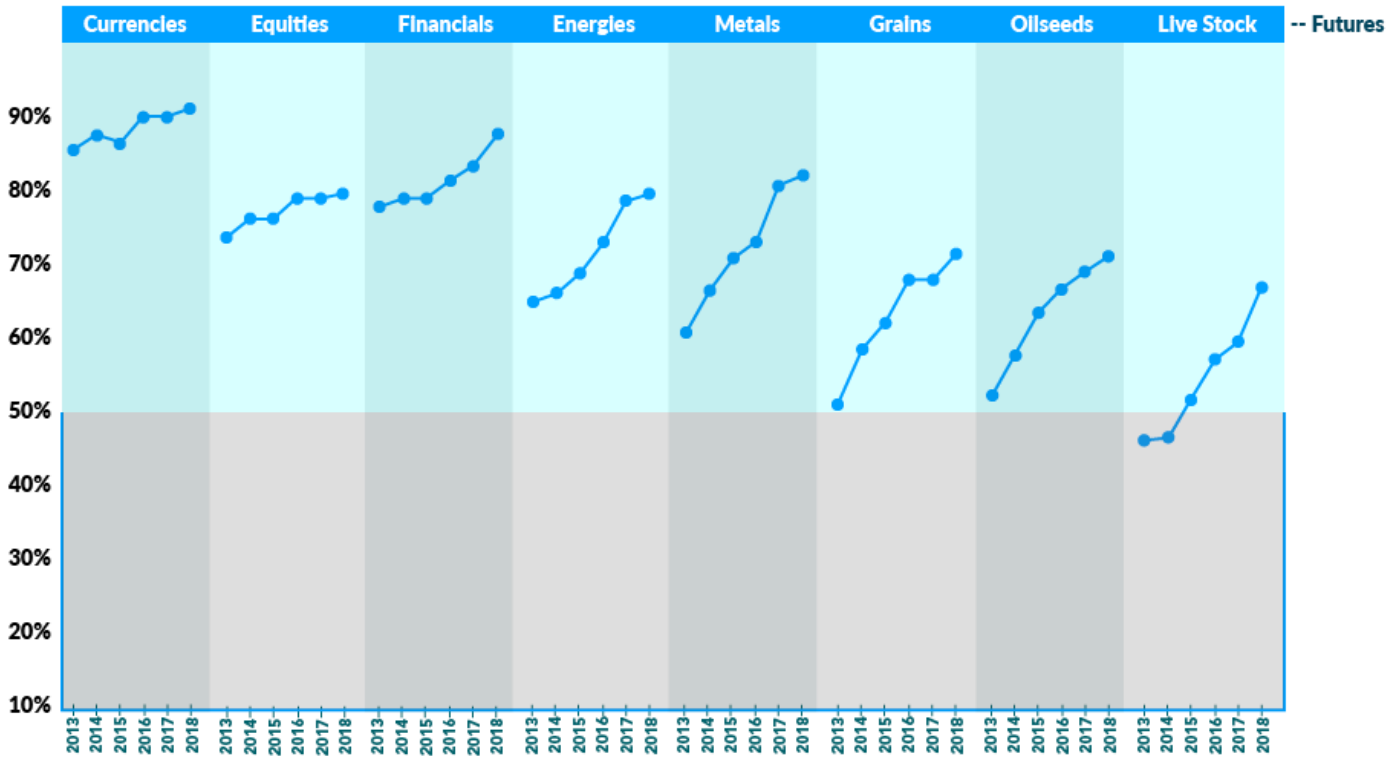
Direct Market Access (DMA): The DMA represents direct connection to the exchanges that complete the order transaction.

But here's the thing, all of the above algo functions have been around for about as long as the personal computer. They aren't all that new or exciting from a technology or computing perspective. It's mostly replacing manual calculations and effort by humans with faster computerized processes. Which brings us to where most of the quant efforts and modern skills are applied these days....trade execution.

Automated order execution algorithms

The reason this matters so much to traders is because if they aren't using an execution algo, they may already be losing out when their model tells them to enter the market, because more than likely, the trader on the other side is a High Frequency Trading firm with a huge speed and information advantage. In analyses from 2018 and 2019, the CFTC examined the state of automated trading on the Chicago Mercantile Exchange (CME) (see Fig. 1 below).

Fig. 1: Automated Orders Shares in Futures



Source: CFTC Trade Capture Report Database

Their initial findings and subsequent updates indicate steadily increasing levels of automated trading (that is, computers actually doing the placing of the trades, not just the generation of trading signals) across the futures landscape, with well over 70% of trades in the most liquid markets (currencies, equities, financials, and energies) being done via automated execution.

These automated counterparties (read: computers) can process more data and react more quickly than a human trader placing manual orders. While a manual trader attempts to work an order after receiving a signal to trade, automated order placing systems are rapidly calculating things such as implied and hidden liquidity, comparing the day's volume and price patterns to historic norms, and placing orders which may learn from and react to the patterns of simpler order flow. With futures markets becoming dominated by automated trading, the other side of your trades are increasingly taken by someone bigger, faster, and smarter. Execution algorithms can help reduce the amount being given up to the market makers, short-term opportunists, and high-frequency traders utilizing these automated order placement methods.

That just scratches the surface of how these execution algos work, with individual algos like TWAP, POV, or synthetic iceberg just some of the many algos designed for how each trader wants to manage their execution. They can want the computer to execute a trade more evenly, by using something more similar to an average price, or desire something more complicated like a synthetic iceberg.

What's a synthetic iceberg order, much less an iceberg? Per a blog post by algo provider RCM-X, the point of an iceberg order type has always been to hide your flow from the rest of the market, allowing you to fly under the radar of the massive trading firms looking to prey on naïve order flow. You know, like the old adage of 90% of an iceberg's mass being underwater, hidden from view.

That sounds great, and many people use iceberg orders for just those reasons. But after the CME changed its order book from Market by Price (MBP) to Market by Order (MBO), native iceberg orders can be easily found by anyone who knows what to look for (and experienced traders and big shops are particularly good at this game of hide and seek).

Synthetic icebergs however, are the trading world's way of combating the Market by Order (MBO) predicament. They're better than exchange native ones, plain and simple. But it's not that black and white, because even synthetic icebergs aren't all created the same. Take the newly revised and enhanced iceberg-like algo, PROWLER, by the quants at RCM-X. With several adjustable parameters, PROWLER is an execution algorithm that submerges the iceberg, hiding it from contra-trading participants while allowing you to capture as much alpha as possible. PROWLER includes all of the basics when it comes to iceberg orders, such as Min & Max show for order sizes and IOC orders to take the liquidity in the book. But PROWLER goes far beyond the limits of your typical iceberg, by randomizing the order size, delaying the placing of child orders, and providing sniping, designed to avoid detection. (To learn more about execution algos, download our "Execution: the Cost You Can Manage" whitepaper. To learn more about RCM-X, visit their website.)

If you're feeling right about now that the algorithm has some rather humanlike properties, essentially watching the other market participants actions via the order book, and then reacting to them as needed to get an order done per the parameters you've set – you're on the cusp of understanding where and how artificial intelligence and machine learning start to fit into the puzzle.

Artificial Intelligence

One of the best follows on non-financial Twitter is Salesforce.com's Chief Digital Evangelist: Vala Ashsfar. He comes up with inspiring lists highlighting what it means to be a good mentor, what money can't buy (happy home, manners, etc.), and companies founded by immigrants (Apple, Google, Amazon to name a few). Not to mention his mesmerizing videos of things like how chicken wire is made, machines sorting parts, and harvesting olives. But the meat of his feed deals with the ever-expanding use of new technologies, and especially AI's future role:

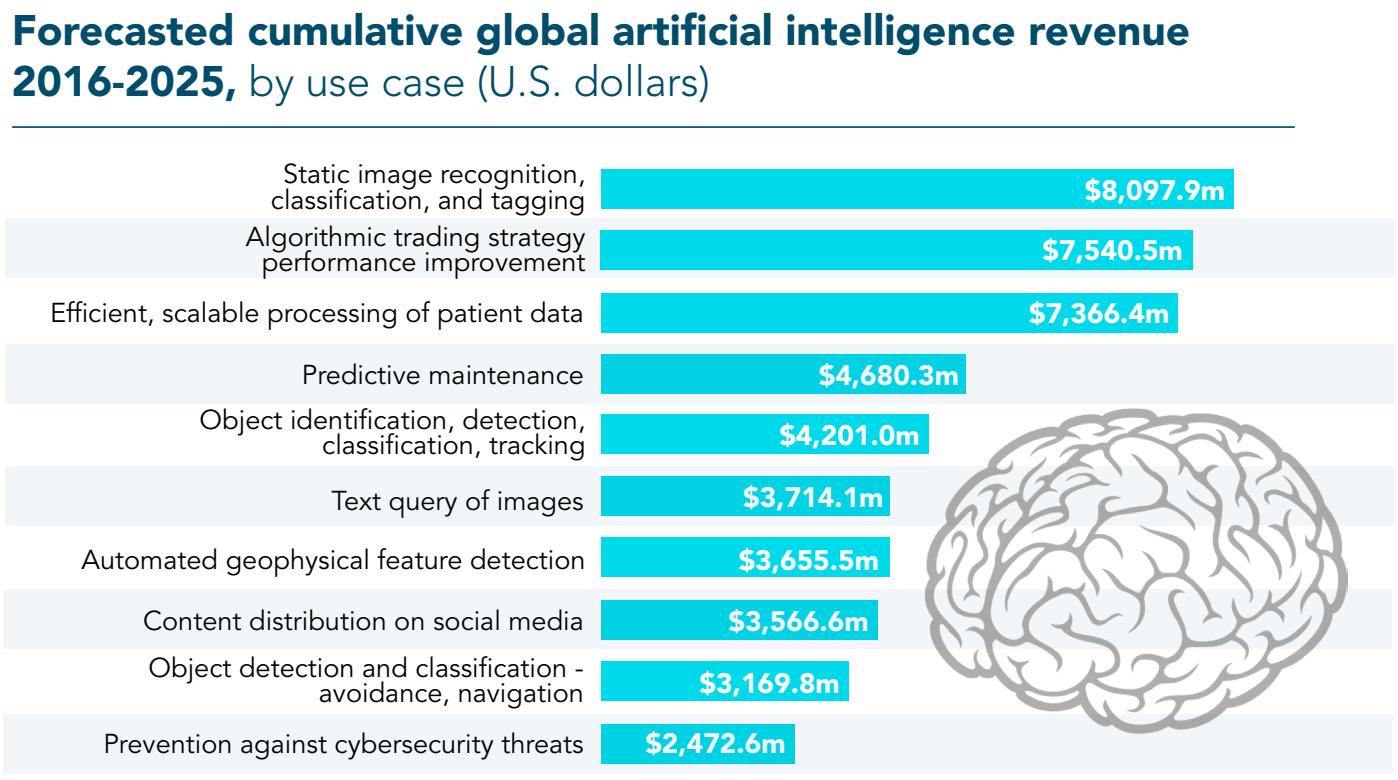
> *Artificial intelligence (AI) has moved way past the buzz. Companies are adopting AI — and fast. The numbers don't lie. According to the Accenture Technology Vision 2018 forecast, four out of five executives (81%) believe that within the next two years, AI will work next to humans in their organizations, as a co-worker, collaborator, and trusted advisor. The most common application of AI for business will use machine or deep learning to automatically analyze big data: 3 AI Trend Sales Can't Ignore - Vala Afshar*

But this technological revolution is not just for automated driving and making sure the website you're on shows you the pink socks you may be interested in. This has BIG implications in the world of investments. It turns our quants can't get around to do the really heavy lifting they need/want to do without the use of artificial intelligence (AI).

> *"...AI and finance are made for one another, one could even go further and call them "soul mates." Machine Learning and different techniques created new systems to spot patterns which the human brain is not capable of, and since finance is quantitative, to start with, it's laborious not to notice traction. Financial corporations have conjointly endowed heavily in AI in the past, and many others are starting to investigate and implement the financial applications of machine learning (ML) and deep learning to their operations. The conjunction of Artificial Intelligence and Stock Trading, for instance, [has] unfortunately been mostly restricted to giant corporations. Luckily, this reality is changing as AI becomes more mainstream." - Data Driven Investor*

Here's another piece shared by Mr. Ashfar showing the forecasted revenue over the 10 years ending in 2025. Notice that second largest "use case" is $7.5 Billion worth of revenue coming out of Algorithmic trading strategy performance improvement via AI. (See Fig. 2 below)

Fig. 2: The Future of AI



Source: Tractica.com

Now, that's a bit of an odd thing to be up there amongst the others. But not because it won't be huge. But because its unlikely hedge funds spend that much on third party solutions for doing such. They typically bring that sort of development in house, for fear of someone else discovering the golden goose on their dime.

Here's some detail on how one of the world's largest fund managers, MAN AHL, tiptoed their way into trading via artificial intelligence (via Bloomberg):

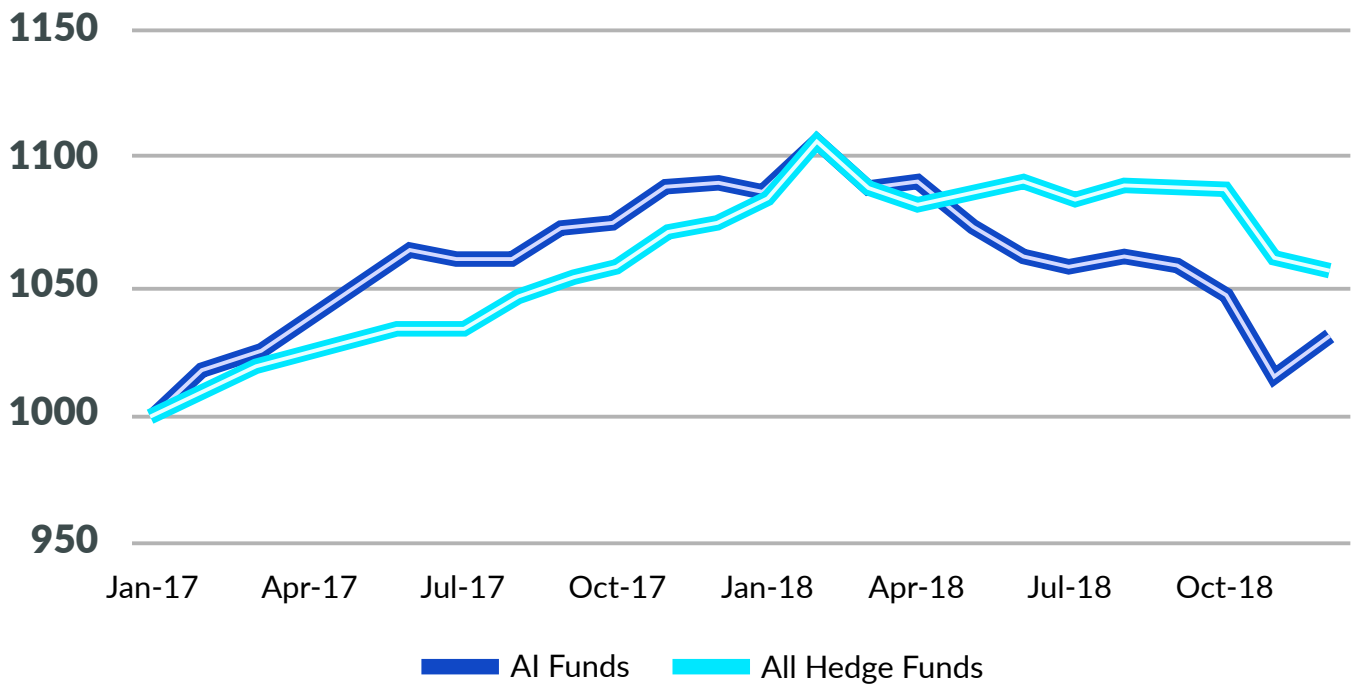
> *The program stayed in quarantine until 2014, when a senior portfolio manager with a Ph.D. in mathematical logic named Nick Granger decided it was time to take it out of testing. He gave the AI system a small amount of money from a portfolio he was managing—then more, then more again. At each step, the program was profitable. "It withstood everything we threw at it," says Granger, who has a bookish demeanor, with short blond hair, squinty eyes, and rectangular dark-rimmed glasses. "We couldn't break it."*
>
> *Over time, Granger built up the firm's confidence in the technology. By 2015, artificial intelligence was contributing roughly half the profits in one of Man's biggest funds, the AHL Dimension Programme that now manages $5.1 billion, even though AI had control over only a small proportion of overall assets.*
>
> *The firm has gone from viewing AI with skepticism to making it a cornerstone strategy. Among the company's biggest expenditures now is computer equipment—along with hiring engineers to keep up with the technological change and the ensuing growth. AI is now not only out of the nuclear bunker but on a pedestal. "It went from a total isolation to 'OK, you are allowed to sit at dinner with the rest of us, but don't talk' to the point where it's become a part of the family," Ellis says.*

But not every firm has the time and resources to adapt their entire investment structure to machine learning and artificial intelligence. Even MAN admits that they were weary of it and didn't speak of it to clients until it started to perform. But if the current trajectory stays the ways it is, we might soon see a day where every firm, every coder, every household has a quant. That's the take from a paper last year titled, The Intelligent Investor in an Era of Autonomous Learning, by Jeffrey Tarrant, CEO and Founder of New York-based investment firm MOV37, which detailed the rapid arc of AI capabilities, saying it will bring about the third wave of investment management, per knect365.com

> *The idea behind Autonomous Learning Investment Strategies (ALIS) is that the coming together of man, machine and data science is set to create the 'third wave' of investment management. The first wave was fundamental discretionary investors, says Tarrant. The second wave was systematic quantitative managers who used hypothesis-driven programming and structured financial data. The third wave is ALIS managers who use machine learning, which is typically data (rather than hypothesis) driven using unstructured and non-financial data.*

But is the promise of AI more than the delivery? The recent performance of AI funds vs traditional hedge funds in Fig. 3 below may say so. It's one thing to have computers design their own quantitative strategies by analyzing reams of data. It's quite another for those strategies to deliver on a walk forward basis. Typically, these AI strategies are working on probabilities, and will identify a model as "good" if it has a positive expectancy. That can mean it makes an average of $1 per trade and averages a winning percentage of 50.5%. That is a long term winner, but isn't likely to get many real humans out of bed.

Fig. 3: EurekaHedge Hedge Fund Indices



Quant hedge funds

So once your room full of quants has come up with some amazing looking quantitative models, thrown in a dash of AI, coded thousands of algorithms for their implementation, and you've flipped through your golden rolodex for a few 10s of millions of dollars, you have yourself a quant hedge fund.

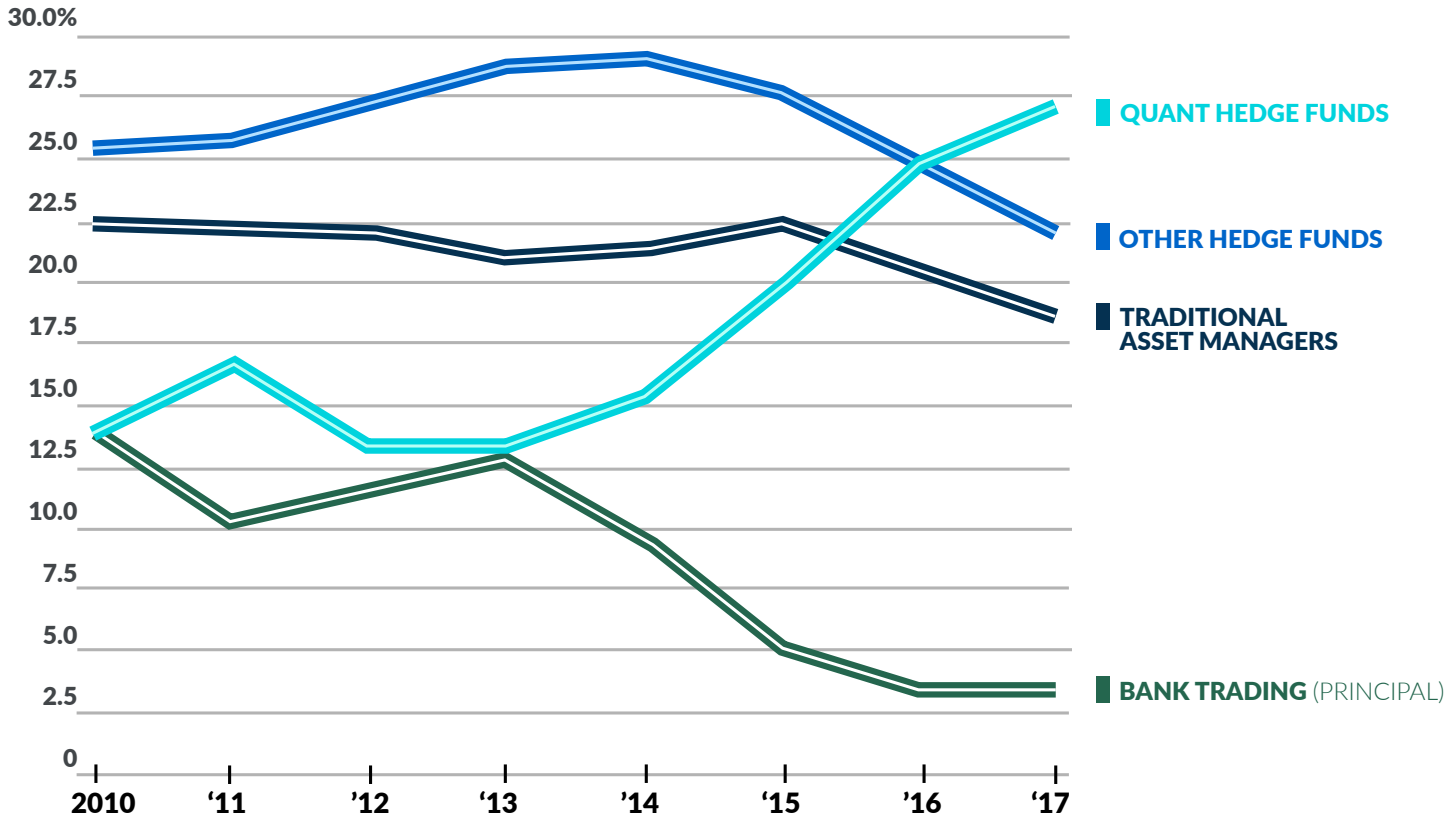
HFR estimates that quant hedge funds will surpass $1 Trillion in asset this year. That's a large number to think about, but quant hedge funds are increasingly including more hedge fund styles than not. Last year, The Wall Street Journal published a chart claiming "Quant Hedge Funds" are responsible for 27% of all U.S. stock trading, well ahead of "other hedge funds" and traditional asset managers.

Quant hedge funds might just now be getting attention in the equity world, but they've been around for decades in the futures space. Futures focused hedge funds have been doing automated, model-based, algorithmic trading for decades; using computers to crunch price data, generate signals, monitor risk levels, and exit trades. Some might even say they invented it.

We're talking quants who've been trading currencies, grains, foreign bonds, and WTI, going both long short these strategies making returns since the 1980's. And it wasn't just Ph.D. students in the back of a room. It's people like Boston Red Sox Owner, John W. Henry.

These alternative investment managers combine all the different aspects of the quant space together. They source their own quants to build the models (vs the crowdsourcing platforms mentioned next), hiring talented programmers and applied math types. They design their own infrastructure for testing the quant

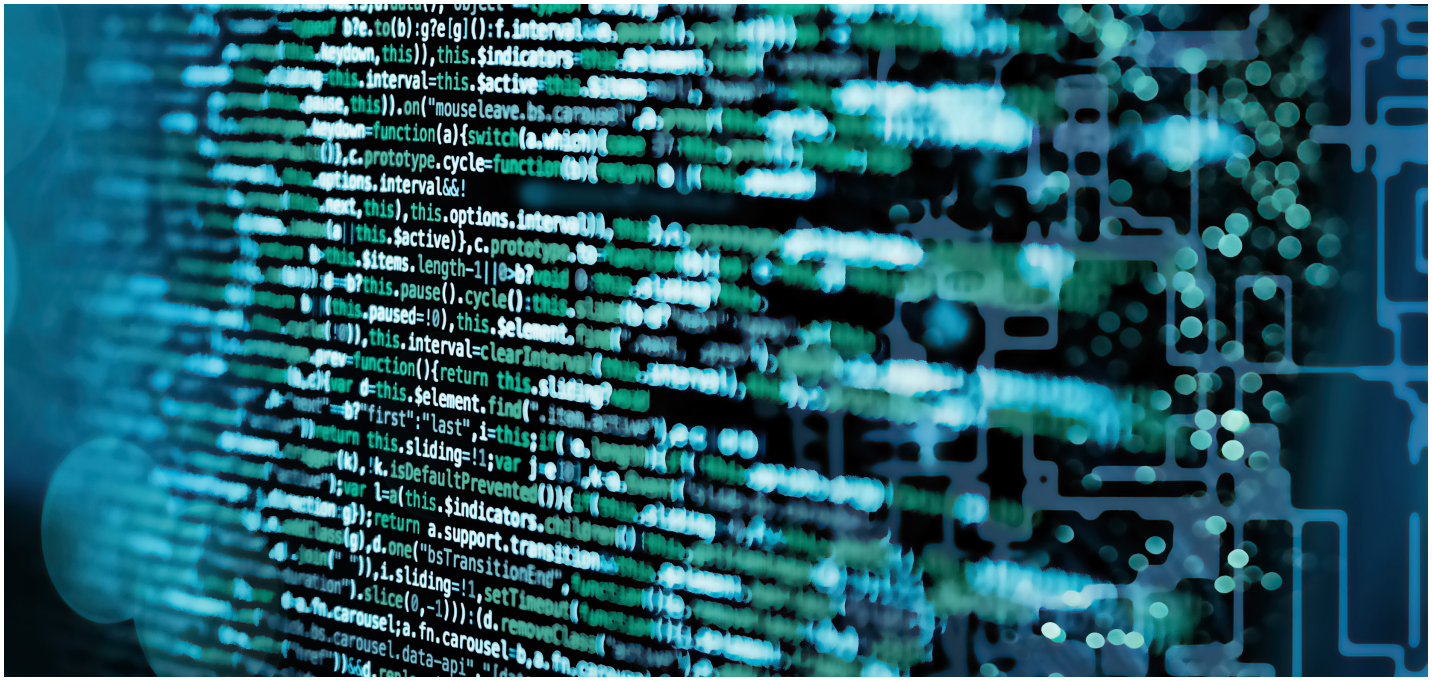
Fig. 4: Share of stock trading by type of investor



Source: Tabb Group & The Wall Street Journal

models, implementing them, and researching new ones (versus the algo app stores we look at later in this piece), and they do all the risk management, portfolio creation, market selection, rebalancing, and so forth (versus the robo-advisors who automatically do this piece for investors). They are the top of the quant food chain, knowing and using each component part that FinTech companies have since broken out.

We've spent our entire career finding just these types of apex predators, researching what makes them tick and how they find alpha in the markets, as well as educating investors on how they act differently than your typical stock market investment. See here for more on that, or jump right to our database to find programs that match your risk and reward characteristics. There's emerging manager talent, long standing success stories that pre-date the above names but haven't had the same distribution (asset raising prowess), and niche strategies focusing on single sectors of the market.



Quant design and distribution platforms

These days, you have to be more than just a quant. That was the advice coming from RCM's Managing Director Jeff Malec when he sat down with a handful of UCLA grad students in the Anderson School of Management Masters in Financial Engineering program. Having a quant on staff and building algorithms are really just the table stakes or price of admission these days. Those getting jobs and seeing their models in portfolios are the ones who also have some social skills and a bit of the entrepreneurial spirit. As we've talked about in previous quant posts, there's sort of an arms race for quant talent to help build the next generation of algos and machine learning and what not, and the entrepreneurial sort is embracing modern technology to make sure they stand out from the crowd. They're heading to one of many quant platforms which let all the talent compete against each other for the rights to have their models traded with real money! Just like Shark Tank, investing in an idea, or the American Idol winner getting a record deal – except happening far, far away from the cameras, and instead being waged on server racks.

Hackernoon and Wired compiled some of the top players in the game : (below)

QuantConnect

QuantConnect, is another platform that provides an IDE to both backtest and live-trade algorithmically. Their platform was built using C#, and users have the options to test algorithms in multiple languages, including both C# and Python. QuantConnect also embraces a great community from all over the world, and provides access to equities, futures, forex and crypto trading. They offer live-trading integration with various names such as InteractiveBrokers, OANDA, and GDAX.

Cloud9trader

Launched in 2017, cloud9trader lets developers profit from algorithms by trading via a broker. The price data stored on its system allows a program's performance to be tested again real-world factors before live trading begins.

QuantRocket

QuantRocket is a platform that offers both backtesting and live trading with InteractiveBrokers, with live trading capabilities on forex as well as US equities. It's specifically designed for trading with InteractiveBrokers, and sets itself apart with its flexibility. QuantRocket supports multiple engines—its own Moonshot, as well as third party engines chosen by the user. While QuantRocket doesn't have a traditional IDE, it is integrated well with Jupyter to produce something similar. One thing to keep in mind is that QuantRocket is not free. Pricing plans start at 19.99/month USD, with annual options.

Numerai

Founded by mathematician Richard Craib in 2015, San Francisco-based Numerai attracts data scientists who develop algorithmic models using artificial intelligence. The platform helps users predict movements in the stock market and offers them the chance to win money by competing in tournaments.

Quantiacs

Founded in 2014, California-based Quantiacs gives developers a place to connect algorithms to capital from institutional investors. It supplies the data needed to test the platforms and matches hedge funds and developers. It also allows algorithm creators to share in the profits when investors use their code.

Quantopian

Founded in 2011 by John Fawcett and Jean Bredeche, Boston-based Quantopian provides a platform for developers to test algorithms for free. Successful applicants earn royalties when their algorithm is used. The company is managing funds for investors and is planning to make a product for institutions. Live-trading was discontinued in September 2017, but still provide a large range of historical data. They also have a serious community of developers, and post an ongoing DAILY contest with 10 winners awarded each day for a total of $5000 per month in prize money (*updated from the previously written as "periodically hold contests"). Quantopian provides capital to the winning algorithm.

The idea is that with more and more people able (both from a talent perspective and prevalence of the needed technology perspective) to build market trading algorithms, it's much easier to have the quants come to you with their ideas, rather than taking the risk of bringing in a couple into your department and hoping for the best. Here's one example of a developer being attracted to these DIY Quant companies.

> *"Towards the end of 2014, Nagai encountered Quantopian, a Boston-based company that enables so-called retail traders – private individuals rather than institutions – to build, test and submit trading algorithms of their own invention. To submit an algorithm, it was necessary to understand the common programming language Python. Nagai set about learning and, within a month, had submitted his first algorithm. Since then, he has submitted around a dozen, coming second in the Quantopian Open on one occasion with an algorithm that had a healthy 16.87% annual return.*
>
> *Although he doesn't think it will happen soon, Nagai's long-term aim is to be able to live well on the profits. He's confident that his continuing study of the strategies pursued by the experts will pay dividends. "If you can study it, you can apply it," he explains."*

It gives these developers the opportunity to let the money speak for themselves (and making money off it), rather than cold calling hedge funds hoping to get a position, and for some, provide just as good (if not better) tools than they would be working on at a hedge fund or bank, developing the models. Here's Quantopian's CEO, John Fawcett:

> *"We have an interface and if you write to our spec, we can test it. We can trade it with your account and we can license it from you and trade it with our account. Providing that standardization increases people's productivity and opens up opportunities for them."*
>
> *Fawcett stresses that users who have submitted more than 400,000 algorithms retain copyright over their material.*
>
> *According to Fawcett, Quantopian has 100,000 users in 180 countries and claims Quantopian is "institutional quality". The institution is, effectively, in the browser. "If quants look at it and feel that it's as good, if not better than the tool set they have internally, that platform has really been the beacon to attract our community," he says."*

These cloud sourced platforms are allowing mass algorithm creation at a far greater pace, and far smaller cost, than the groups setting them up would otherwise have access to. The question now is whether there will be a "winner take all" effect here like in the rest of the tech space (see Apple, Google, Amazon), or whether each hedge fund wishing to crowd source algo creation will need to build out a similar platform. Our guess is you'll see a little bit of both, with these early adapters becoming the main players – but other large hedge funds creating smaller, focused 'contests' via such platforms to meet certain specific needs. The big threat to these types of platforms is the technology itself. How far are we from AI platforms which can create millions of algorithms from which the hedge funds can select, removing the aspiring human quant from the equation. This is a fascinating space that bears watching.

"Algo App Stores"

In the age of Uber, Instacart, and GrubHub, you have to bring the goods to the people. Why use recipes.com when you can get the food cooked and delivered to you. Along those lines, there are some groups that are bypassing the whole 'build the algo' part and offering up a menu of already built algos. We're talking a slick interface for browsing through hundreds of already built algos and connections to the exchanges for live trading of them for your account. We liken it to an algo app store, where investors can link their brokerage accounts and turn on and off algos as they see fit, building portfolios of multiple algos, upping the number of contracts/ shares traded, and so forth.

This is particularly appealing to the younger crowd who don't want to take the time to make small talk with a broker, and that are used to well thought out interfaces, allowing them to do what they want (versus…say, filling out a form and faxing it in). We've become quite used to algorithms delivering personal alpha (saving us time, money, hassle) in our everyday lives via Netflix recommendations, Waze directions, and Uber rides - and it's only natural for investors to increasingly accept algorithms for generating alpha in their investment lives as well. The algo store platforms show users

trading algorithms similar to how Kayak.com shows you hotels or Cars.com lets you browse new cars. All the stats are updated every day depending on market action – including the model's backtested, forward tested, and stress tested performance. Check out one of the leading 'algo app store' sites: AutomatedTrading.com, which is one of many sites built using the iSystems backend technology.

The institutional investor corollary to the algo app store is the risk premia menu at your prime broker, allowing investors the ability to add short volatility, the carry trade, momentum, and more with a few clicks of a button. Risk premia offerings are allowing investors to order algorithmic trading strategies a la carte, having hired quants to break out the different return drivers from an overall systematic trading strategy.

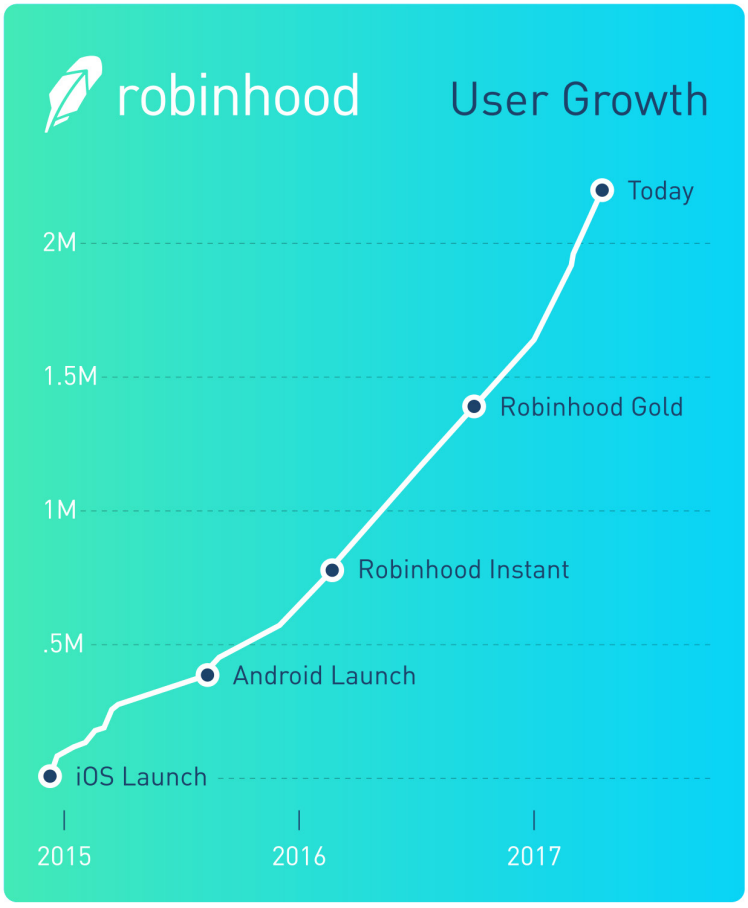
Robo-Advisors (Quants in FinTech clothing)

And where does FinTech fit into this whole thing? FinTech is essentially a buzzword we're all using to make technological replacement of humans sound friendlier, and revolutionary. The definition being "computer programs and other technology used to support or enable banking and financial services." [cough..] [algos] [cough...] So FinTech to consumers is really what algos have been to traders this whole time – a digitized way to lower costs, increase efficiency, and make your life easier.

One of the most successful implementations of FinTech to date has been the robo-advisor. Sure, there's now platforms for building your own investment algo, for testing it, and for implementing it. And platforms for those who just want to pick algos. But what about the people who don't even want to go as far as finding the algo that's right for them? Isn't it just easier if someone picks it for you? That's the premise behind the robo-advisor names like Betterment, Wealthfront, Personal Capital, and more.

Ask any millennial with a few extra sheckles, and chances are they're invested in a robo-advisor. The business model is based on some quant strategies for managing client's money, applied in scale across 10s of thousands of clients. Gone are the days of your advisor giving you that stock recommendation on the golf course. Robo-advisors have backtested, automated algorithms for investing client's money, rebalancing those investments, and even tax harvesting. They are 'quants' in innovator/fintech/startup company clothing, right down to the social impact part where they are trying to make financial tools and strategies previously only available to the top 1% available to the masses.

Enter Robinhood, one of the most successful FinTech companies to date based on their slick user interface, no commission trades, and innovation of letting people by fractional shares (who's got $1,500 to shell out for 1 share of Google, anyway).



How do you let hundreds of people buy a fraction of a share of a stock that's smallest increment is 1 share? You get a room full of quants to figure out how to build an algorithm to match user demand for said shares with the inventory of shares available to the brokerage, and connect the user interface and brokerage backend to the exchanges and prime brokers for execution of the aggregated orders. All in the name of doing good – by helping those who can't buy a full share themselves.

A new-comer to the game doing more good than that is a Chicago startup named Rapunzl. Rapunzl functions similarly to Robinhood in that it allows those without million dollar bank accounts to trade stocks via their mobile devices, but is targeted to youths. They are quants trying to bring the world of investing to young people so they are better prepared for the investment world when the time comes. Rapunzl is a free mobile application that educates users about the stock market by allowing them to simulate investment portfolios in a community of peers. RCM (and their subsidiary, RCM-X) have been able to provide industry expertise, office space, and have facilitated several introductions to respected figures in financial services in an effort to help Rapunzl create a meaningful impact in the lives of America's youth.

Rapunzl simulates $10,000 stock portfolios in real-time and allows users to engage with a community of their peers by interacting with their friends' portfolios, viewing trading history, and driving dialogue amongst users. Rapunzl also offers scholarship competitions which increases engagement and allows students to crowdsource investment strategies from top investors.

Will Quants eventually take-away the Quant Advantage?

A couple of decades ago, the question was whether people could learn how to trade or whether people were born to trade. Did you have to have the magic touch, or could a quantitative scientific approach be taken to make a trader. It was one of the first trading algorithms and cradle for the birth of quants in the investment space, and it was called the Turtle Trade (read about that here), proving that people can learn to trade with a quantitative set of rules. The next step was coding those rules into computers, essentially teaching them how to trade. Now, firms are using machine learning to adapt to the market in ways humans can't. Is it working? There are still those that are skeptical.

> *"Regardless of what method you use in quantitative finance—be it machine learning or traditional quant methods—there are an infinite number of ways to fail," says Martin Froehler, a former quant with Superfund Asset Management GmbH in Switzerland who went on to found Quantiacs. Machine learning models are no "superweapon," he says. In his experience, ninety percent of live machine learning tests fail.*
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> *But Froehler's fund benefits from machine learning, too. Based in Silicon Valley, Quantiacs attempts to crowdsource the quant model, and many of the quants feeding the fund are using machine learning technologies. Among other things, they're making use of deep neural networks, complex mathematical systems for recognizing patterns in vast amounts of data. In other words, the Third Wave is not just about using one new technique. It's about combining techniques, from machine learning to crowdsourcing to the blockchain."*

There's no doubt quants and AI will have to continue to grow and learn, and that it will take more than just turning your data over to the AI powered algorithm and then sitting back and watching the cash roll in. There's just as much chance that the AI comes up with something putrid as great, and perhaps an even greater chance of curve fitting or otherwise inferring a relationship that doesn't or shouldn't be there. Here's Ben Hunt at Epsilon Theory espousing on the dangers of current AI approaches:

> *... I see why we want this artificial intelligence system, it's the next level. It's the Giant Brain, replacing the Big Brain of all those computers that DE Shaw and Two Sigma and RenTech are using to figure out markets and mint money, which replaced the Little Brain of us humans scurrying around in the pits. AI is going to pierce through all the noise and find us the signal. It's going to identify the pattern. It's going to tell us the answer.*
>
> *We think of markets as a clockwork machine, as an intricate collection of gears upon gears. We believe that if only we examine the clockwork closely enough, we can identify some hidden gear or unbeknownst gear movement that will let us predict the clockwork's movement and make a lot of money.*
>
> *[But]...the market is not a clockwork machine. The market is a bonfire.about "human funds."*

If markets are a bonfire instead of a machine, will we ever be able to figure out its inner workings to the point where AI will create repeatable Alpha? What's more, Quantinsti imagines a future where AI fueled algorithms will "self-learn" and adapt to different market environments on the fly. If everyone in the future has this ability, does anyone have it? They say a million monkeys on a million typewriters can accidentally produce Shakespeare. But will a million self-learning algos on a million servers come up with the same trade? Will they all go Joshua on us and find out the best way to win is not to play?

The future has more unknowns than knowns, to be sure. But one thing is for certain - whether it's building algos, offering algos for use, replacing costly humans with algos, doing advanced trade execution with algos, or managing billions of dollars in alternative investments via quant strategies – quants are here to stay. So much so, that the reference to automation, computerized trading, algos, and even 'quants' will likely fade into obscurity as that will just be how investments are done. The outlier will be whatever is opposite the quants in a few years' time – where we might see articles talking about "human funds."

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