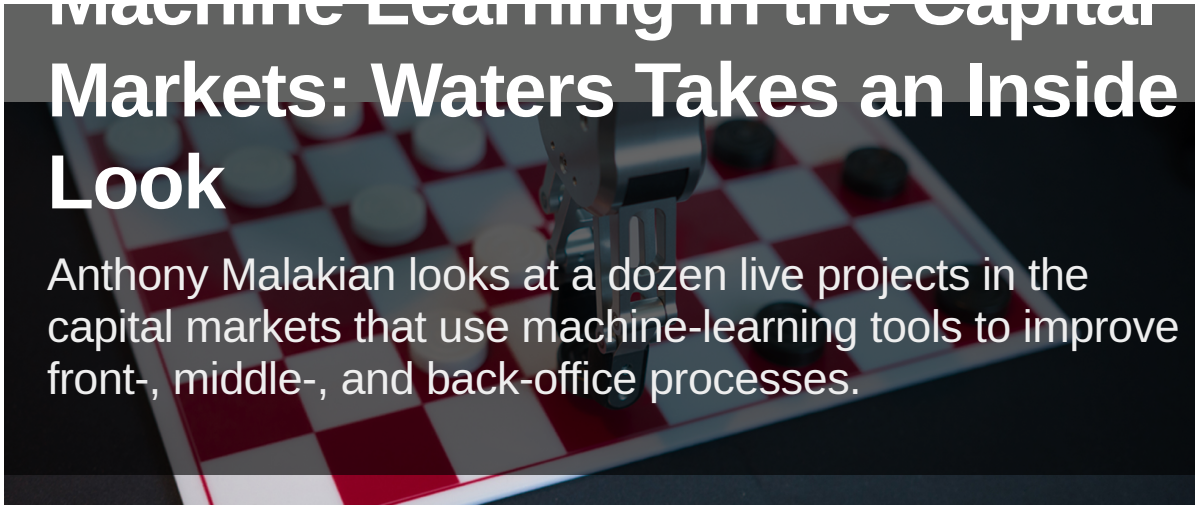

Machine Learning in the Capital Markets: Waters Takes an Inside Look

Anthony Malakian looks at a dozen live projects in the capital markets that use machine-learning tools to improve front-, middle-, and back-office processes.

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While there's a lot of talk about machine-learning technology across the capital markets, much of it is overblown. There's also no question that these tools are set to become increasingly prevalent over the coming years. Anthony Malakian takes stock of where the industry is currently by looking at actual implementations, rather than theoretical discussions.

Desmond Lun spent much of his academic career focused on computational biology. In 2006, after earning his PhD in electrical engineering and computer science from MIT, he became interested in understanding how applying techniques for analyzing big data problems in biology could predict financial market outcomes. Lun began trading, trying out ideas from his own work in computational biology and developing new methods geared toward finance. It took six years to develop the core of the platform that would eventually power his hedge fund, Taaffeite Capital Management, an Australia-based outfit that Lun, who also teaches plant biology and computer science at Rutgers University, created alongside Howard Siow.

Pronounced "tah-fight," the hedge fund is named after a precious gemstone discovered in 1945 by Richard Taaffe. Taaffeite the investment manager was launched in 2014. It was built on a core artificial intelligence (AI) platform that uses Bayesian networks and deep learning. While that might sound complex, Lun insists that these are "very, very general techniques." What matters, he says, comes down to "how you apply them and how you make them work for a specific problem that really determines if it works or not."

Taaffeite sucks in large amounts of widely available data—such as historical prices and exchange-traded instrument volumes—and feeds it into its learning algorithms. The ways in which the algorithms learn, based on specific biological computations, make Taaffeite's strategy proprietary. They use structured datasets that the system learns from and make a very specific prediction, based on which the program decides how to act and how to place trades. "And there's no human intervention," Lun explains.

He says it's important that the system can eke out a small edge at a time. He likens it to using loaded dice at a craps table, knowing the grift is on while the others at the table are none the wiser.

Huge Gains

Take, for example, Brexit. While some got clobbered by the shocking result of the referendum that saw the British people vote to leave the European Union, Taaffeite's lower-leveraged fund returned 20 percent in June and about 30 percent for its higher-leveraged funds. On June 24, the day after the Brexit vote, the hedge fund made about two-thirds of those June gains in a single day, Lun says.

"Our system doesn't know anything about external events—it's reacting on historical prices and volumes. What it was seeing, though, was prices starting to move in an anomalous way. If you looked at European equities compared to equities in other markets, they were being bid up in the run-up to that referendum on the expectation that it would go the other way, and obviously it did not and we made very large gains out of that," he says.

"I think what the system was picking up on was a very, very good asymmetric bet where if Brexit had not happened, we probably would have made small losses or no losses at all," he continues. "But as it happened, we came out with a very, very large, winning bet. That was responsible for about two-thirds of our gains, but even if you take that day out, we still would have had a very, very good month and it's really because of all the uncertainty around that decision—it created a lot of opportunities for anomalous pricing to occur."

A Leap

There's a lot of hype surrounding the machine-learning space. Vendors throw around the term "machine learning" like they throw around the term "industry leader" when describing their organization or technology/services. This feature

makes an impartial assessment of machine learning's proliferation in the capital markets using specific examples.

Artificial intelligence—which combines everything from machine learning to robotics, deep learning, natural-language processing and virtual reality—is the most intriguing technological development facing the industry today. For all the talk of blockchain, the hype is already withering on the vine, in many ways. But AI implementations—and spending—are tangible.

According to consultancy Preqin, 40 percent of hedge funds launched in 2016 were considered systematic and favored computer models and algorithms over human analysts, though that's a loose analysis as it doesn't necessarily mean that machines are making all the investment decisions, as is the case with Taaffeite. Consultancy Opimas estimates that this year, financial firms will spend over $1.5 billion on AI-related technologies—including machine learning—and that will jump 75 percent to $2.8 billion in 2021. And the MIT Technology Review website stated that machine learning, specifically, has created a "tremendous resurgence" in overall AI endeavors, across all disciplines and sectors, and predicted that financial data was the next frontier to be conquered.

Machine learning has been around since the 1950s; the techniques being used aren't necessarily creating this rapid advancement in the industry. It has more to do with a combination of outside effects, according to Michael Kollo, deputy global head of research for AXA Rosenberg. First, there's the issue of big data—there is a ton of data available that can be analyzed and broken down, all attainable on the cheap. And alternative datasets are becoming increasingly valuable for trading houses.

Additionally, the ability to cheaply store that information has also vastly improved, in large part thanks to the advancement of public cloud providers like Amazon, Google, Microsoft and IBM. But perhaps most importantly, computing power has increased exponentially over the last decade, so gaining insights from these machines no longer takes months of computational analysis. "One thing that's not going away is that whether we call it machine learning, AI, deep learning, or whatever else, processing power is only going one way. The allure of finding patterns because you can examine every permutation of every possible pattern within your dataset is only going to get greater," Kollo says.

A Snapshot

To benchmark machine learning's progress in the capital markets, here are just a few of the more interesting use-cases that we've seen during 2017:

• In June, **IBM launched its Watson Financial Services Solutions unit**, which addresses everything from anti-money laundering/know-your-customer (AML/KYC) needs to fraud monitoring and surveillance. IBM, being one of the leaders in AI advancement with solutions already in place in the healthcare and security sectors, is now taking aim at finance's regtech space. "What we're doing with cognitive technology is automating how we assist that person with that secondary-alert triage. We can provide them with an augmented view of that alert," Alistair Rennie, general manager of IBM Watson financial services solutions, told *Waters* at the time of the launch. "We've trained the system to look for that alert and look at the surrounding data—what did we do in comparable cases and is there outside data that can help fill in a hole?—and then based on the pattern, it can provide a dashboard and a proposed recommendation to the person who is going to make that ultimate decision. So it lays out its evidence and its hypothesis and then the person responsible for making that determination can complete the triage of the alert."

• Nasdaq has been wading into the AI waters for a while now. In July, the exchange operator decided to make a bigger splash by **acquiring London-based regtech firm Sybenetix**, which uses machine learning to predict people's behavior in order to flag suspicious activities. "What we've come to learn by working more closely with the buy side is that there is a growing market demand [for these platforms]," Valerie Bannert-Thurner, senior vice president and head of risk and surveillance technology solutions at Nasdaq, told *Waters* after the acquisition. "We see a lot of different buy-side firms across the board realizing that strong compliance is a key competitive advantage and a differentiator."

• At a conference hosted by *Waters*' sibling publication, *Risk*, in July, BlackRock's Stefano Pasquali, who heads up the firm's liquidity research unit, told the audience that the firm is using machine-learning techniques **to better calculate the cost of liquidating fund positions in the case of redemptions**. Right now, BlackRock is in the process of feeding internal trade data into its market liquidity model. Depending on the insights gained, it will tweak the system from there. "Liquidity is multi-dimensional and is impacted by so many features. It is highly non-linear. So this is a typical use-case for neural networks," he said, adding that BlackRock will also use machine learning to assess the probability of large net-flows out of its funds.

• High-frequency trading (HFT) shop Hull Investments **uses machine-learning algorithms to power its market-timing strategy**, where it adjusts the equity exposure depending on return forecasts, where the strategy is anywhere from 150 percent long to 50 percent short. “I think the biggest thing is we’ve had so many different techniques—everything from neural networks to random forests—that the biggest benefit recently has been in the combination of models, or an ensemble of models,” Blair Hull, founder of Hull Investments, told *Waters* in an earlier interview. “So you don’t just have one model—you have multiple models that you use. That’s the biggest advancement that’s come in recent years.”

• The US Securities and Exchange Commission (SEC) began using machine learning to augment its risk assessment processes back in 2008. The regulator has moved on to modeling and using it to measure the probability of words within and across documents to find unique topics and insights, and to create alerts. Both topic modeling and text analysis are now used widely in the agency to point to possible anomalous transactions, noted Scott Bauguess, SEC acting director for the division of economic and risk analysis, and acting chief economist, **during his keynote speech at the CyberRisk North America event in June**. “The underlying science is remarkable and this data-driven approach makes it easier to apply to SEC procedures,” Bauguess said. “Regulators can use artificial intelligence and machine learning to understand behavior, and we have been integrating them into the risk programs of the SEC.”

• London-based hedge fund group Man GLG appointed William Ferreira to the newly created role of head of machine learning, where he will be responsible for developing the firm’s machine-learning capabilities, providing its portfolio managers with tools and techniques through which to support their analysis and decision-making processes. “We believe that machine-learning techniques present an opportunity for discretionary investment managers, providing them with analytical tools to complement, and further enhance, their decision-making processes,” noted Teun Johnston, CEO of Man GLG, **in a statement**. “We are continually seeking to develop our offering for our clients and, as the amount of data available continues to expand, these techniques can supplement existing rigorous quantitative and qualitative analysis.”

• Saxo Bank has been **working with machine-learning techniques for several years now**. In a previous interview with *Waters*, Saxo’s CEO, Kim Fournais, said that the bank recently started working on a component that will help it to better personalize users’ trading and investment experiences using machine learning. “It will understand your behavior, your interests, what kind of

news you are interested in, what kind of instruments you have traded, and what kind of risk profile you have," he said.

• Trumid, an all-to-all electronic trading platform for corporate bonds, **uses machine learning to power its Likelihood-to-Trade (LTS) score**, developed by its Trumid Labs unit. Its proprietarily built machine-learning model incorporates real-time information entered into the dark pool by users, and analyzes the past performance of similar bonds. The list uses that information to provide a view into possible trading opportunities. Trumid asks its users to "follow" either subsets of bonds or individual bonds. That list can be thousands of bonds long, depending on the user. LTS' machine-learning model—which serves as a dynamic list-sorting tool—then takes that user "follow" list and creates a list of bonds that have the highest probability to trade at that moment. "It decreases the amount of time they need to hunt around for what they can get done on the Trumid market center platform and it potentially increases the probability that they get a trade done," Jason Quinn, who leads new product design for Trumid, told *Waters* in a previous interview.

• UBS is deploying Arago's AI platform Hiro **to support its UBS Global Production Services unit**, with the aim of automating processes across the entire IT stack. "The implementation of Hiro is a key step towards a new kind of process automation based on artificial intelligence," noted Stephan Murer, chief technology officer at UBS, in a statement. "After a short trial phase we became convinced of the benefits that Arago's problem-solving artificial intelligence delivers to its clients."

• State Street's Quantextual platform is a research aggregation tool that **uses machine-learning techniques to ingest, digest, and tag research reports**. JR Lowry, global head of information and advisory solutions at State Street, as well as EMEA head of State Street Global Exchange, told *Inside Data Management* that the platform is geared toward portfolio managers and chief information officers to better allow them to get a handle on the many research reports populating the market.

"[W]e're trying to use the machine learning part of that application to help with some of the content tagging, so that you can more quickly zero in on what would be most relevant for you," he said. And much like how Amazon or Netflix draw your attention to products you might like, in time Quantextual will also make suggestions "based on your express interest and usage of tool."

• Misys has unveiled a new platform, dubbed FusionCapital Detect, which uses machine-learning algos to **tackle validation errors in the trading workflow**. Peter Farley, senior strategist for capital markets at Misys, told *Waters* that the solution aims to limit transaction errors, cut down on labor costs and reduce reputational risk.

"We ran a beta test with a big regional bank, looking at areas where mistakes can cost more, such as structured products and derivatives," he said. "We found that the cost of these errors in the validation process is around 20 percent of the transactions."

Enough Fiction

At its core, machine learning is both understandably defined and complex. It's easy to understand its basic premise—a computer/algorithm learns without being explicitly programmed to execute on a specific function. What's not so clear, however, is how those algos develop their own functions. This creates misconceptions and unrealistic expectations.

Take Google, for example. Its Google Brain deep-learning research unit taught two neural networks—named Alice and Bob—how to encrypt and send messages to one another that a third neural network, Eve, could not understand. Poor Eve. There were as many negative articles written about this experiment as positive. Then there is Facebook's chatbot neural networks that created a language to more efficiently communicate with one another. There were rampant (false) reports that the engineers had to kill the project for fear of a computer takeover.

The imagination runs wild with associations of the evil Skynet computer network from *The Terminator* when you hear these stories, but right now it is facile to invoke the name of a fictional company from an Arnold Schwarzenegger film. In finance, machine learning is still on the ground floor compared to what Google and Facebook are working on, and they're still just scratching the surface of the technology's potential. Rest assured, however, that sooner or later machine learning will be used for most everything—in small parts and large—from the front office to the back office.
