**ALTERNATIVES**

# Science Fiction to Science Fact: The Rise of the Machines

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The rapid expansion of artificial intelligence (AI) has generated a lot of excitement, but also some (perhaps justified) paranoia. Will computers replace—or even overtake—human beings? Mat Gulley, executive vice president and head of alternatives at Franklin Templeton Investments, and Ryan Biggs, research analyst at Franklin Equity Group, explore the ramifications of "the rise of the machines" in the realm of asset management. They say the full implications of the new machine age will likely take decades to fully play out, but will likely be staggering.

Mat Gulley, CFA
Executive Vice President
Head of Alternatives and Co-Head IM Data Science, Fintech & Rapid Development
Franklin Templeton Investments

Ryan Biggs, CFA
Research Analyst
Franklin Equity Group

We have been anticipating their arrival for decades. As far back as 1958 the *New York Times* wrote a story about a machine developed at Cornell University called the Perceptron. The device was said to be "the embryo of an electronic computer … expected to walk, talk, see, write, reproduce itself and be conscious of its own existence." In 1958!? That would have been an astonishing achievement in a time even before the microwave oven graced our kitchen countertops.

For the past half century, humanity has been eagerly anticipating the age of artificial intelligence (AI); imagining it in Hollywood and reporting on its progress in the media. Perhaps at times our optimism has gotten ahead of itself. Not any longer. This time, the machines are not just coming—they are already here.

**AI Is Real**

Exponential growth in computer processing speeds, advances in big data, open-source software and cloud computing have all converged over the last decade to move AI from the realm of science fiction to science fact.

**THE RISE OF THE MACHINES**

In 2011, IBM's "Watson" computer wowed the world, beating champion Ken Jennings on the trivia game show *Jeopardy!* Jennings had previously won *Jeopardy!* 74 times in a row against human competition. Watson beat him on its first try.

In May 2016, Google's DeepMind computer beat world-class player Lee Se-dol in the game of Go. Go is an ancient Chinese board game long considered to be impossible for computers to play at a high level due to the presumed human intuition required. After losing to the machine, Se-dol was so impressed by one particular gambit that he described its play as "beautiful" and something he'd never seen a human do.

Today a human is no longer the world chess champion, but neither is a computer. Today the best chess-playing entity is a collaborative team of humans and machines. A team of humans and computers working together can beat any computer or any human working alone. In other words, racing with the machines beats racing against them.

Then in November 2016, DeepMind and the University of Oxford collaborated to create a computer that could actually read lips like the fictional HAL 9000 computer in Stanley Kubrick's sci-fi classic film, *2001: A Space Odyssey*. There are many potential applications, including improved hearing aids, silent dictation in public spaces, speech recognition in noisy environments—or preventing humans from unplugging you, as the scene below from the movie depicts.

**Dave Bowman:** Open the pod bay doors, HAL.
**HAL:** I'm sorry, Dave. I'm afraid I can't do that.
**Dave Bowman:** What's the problem?
**HAL:** I think you know what the problem is just as well as I do. I know that you and Frank were planning to disconnect me, and I'm afraid that's something I cannot allow to happen.
**Dave Bowman:** [feigning ignorance] Where the hell did you get that idea, HAL?
**HAL:** Dave, although you took very thorough precautions in the pod against my hearing you, I could see your lips move.
**Dave Bowman:** Alright, HAL. I'll go in through the emergency airlock.
**HAL:** Without your space helmet, Dave? You're going to find that rather difficult.
**Dave Bowman:** HAL, I won't argue with you anymore! Open the doors!
**HAL:** Dave, this conversation can serve no purpose anymore. Goodbye.

*2001: A Space Odyssey. Dir. Stanley Kubrick Metro-Goldwyn-Mayer, 1968 [film]*

**AI Is All Around Us**

AI is all around us today, often influencing our reality and decision making in imperceptible yet impactful ways.

For example, Netflix and Facebook employ AI technology as part of their pattern- and behavioral-recognition programs. When Netflix recommends movies you may like, they've been curated by AI. When Facebook suggests friends to tag in a photo—also AI.

Indeed, Facebook's remarkable facial recognition technology is perhaps more capable than the human brain. It easily identifies people in limited light and often from awkward perspectives.

The speed with which self-driving car technology has emerged is also an indication of the presence of true AI. A colleague of ours uses autonomous driving technology to commute between Palm Beach and Ft. Lauderdale, Florida, a distance of roughly 50 miles. He describes how the car actually performs better in higher traffic because it has more data to compare, and with each drive and software download it learns more and improves further.

This new machine age can be dated to 15 years ago when Garry Kasparov, the world chess champion, played chess and lost to IBM's supercomputer Deep Blue. Today a simple chess program running on a cell phone can often beat human grandmasters. Recently, when asked what strategy he uses against computer competition, Dutch grandmaster Hein Donner said "a hammer."

Siri, Alexa, and Microsoft's Cortana are also examples of AI (although some might actually call it primitive) that we interact with daily. The corporate tech giants (Google, IBM, Intel, and Apple) have been climbing over each other to gobble up private AI companies.

AI startups have raised more than US$2 billion in venture capital funding in 2017, according to PwC.[1]

The bottom line is that AI is not just theory any longer, it is practice. The machines have risen.

## How do the Machines Think?

We've heard colleagues often reference the so-called "black box" quantitative trading systems as a form of AI. In our view, this is a mischaracterization. While many of those systems are no doubt highly complex and represent significant aspects of machine learning, they are not the type of transformative AI we are interested in exploring here.

The AI machines we are discussing are the so-called "deep learning" systems, systems that we believe are the most disruptive technological advancements since the Industrial Revolution starting in the late 1700s.

These systems are built on something called "artificial neural networks." Ironically, the Cornell University folks in the 1960s may have been on to something. Their "Perceptron Machine" was designed in the same way (albeit in a much more primitive sense, using cable wires versus microscopic transistors).

Artificial neural networks are systems of hardware and software patterned after the operation of neurons in the human brain. In other words, they are computers that mimic, or think, in the same way biological neurons do—extracting rules and patterns from sets of data.

For example, show a neural network enough pictures of cats, and eventually it will be able to tell you if a picture it has never seen before is a cat or not.

The machines use a combination of training and inference to literally "learn" in the same way a young child would. This learning is possible today because of the ever-increasing power, speed and miniaturization of computers. The deep learning machines can simulate billions of neurons while processing huge quantities of information from the internet and other data sources.

So how is this distinct from black-box trading technologies? The quants and their trading algorithms are based on logic and transparency. While highly complex, they can always be deconstructed. Alternatively, the neural networks by definition cannot be unpacked. The path these machines take when deriving an answer is far too complex to be mapped linearly. It is like the human brain—billions and billions of matrixed steps—virtually unknowable.

## Augmented Intelligence: the Future of Active Asset Management

The rapid expansion of AI in recent years has of course spawned prophets of doom. They worry that the computers will become more clever than their human masters, and perhaps even displace us someday. Such worries, while not entirely without reason, are in our view not realistic at this point.

For now and for the foreseeable future, we believe deep-learning machines will remain pattern-recognition engines that offer humanity a sort of augmented intelligence, but not an autonomous one.

Even at its most advanced, today's AI technology still requires human intervention in some form, either as a final decision or in the creation and modification of its software or hardware.

Most experts agree that the future role of AI in terms of industry—specifically as it pertains to asset management—will be as something experts call "augmented intelligence."

As opposed to any existential risk, it appears the version of AI taking hold will offer humans the opportunity to enhance their capabilities, versus relinquish them.

An example of augmented intelligence at work in investment management has been nicely encapsulated by David Zweig's recent article in the *Wall Street Journal*, "How to Be Your Own Quant."

Zweig relays how UBS (an investment bank) was unable, despite its best efforts, to develop computer models that could beat the skill of their own human analysts in creating successful earnings forecasts.[2]

However, by reframing the situation from competition to cooperation between human and machine, they were able to use the technology to counter a very human frailty: inconsistency.

Zweig observes that "human judgment is inconsistent. People are good at knowing what matters, but not very good at always looking at it the same way."

UBS therefore developed an augmented intelligence approach through which human analysts were involved in advising the AI quant team on which earnings variables were the most useful. The AI quant team then incorporated those into the model. This process improved the consistency and overall performance of the forecasts.

As Zweig summarized in his article, augmented intelligence allows you to "…couple your human judgment about what works with a computer-like discipline of applying it."[3]

Computers will likely act as a wingman in the investment process—providing an objective, data-driven feedback loop that a human would simply not be able to produce. Given how much data is involved in every aspect of the asset management business, there is easily enough information available for multiple forms of AI to be applied. Thus, the number of decisions that rely on human judgment are reduced to the ones where there is a competitive advantage.

### The Future Is Now

Like the first two industrial revolutions, the full implications of the new machine age are likely to take several decades to fully play out, but they will likely be staggering.

As far as the economic future we're creating, we can only speculate as to what it will look like. The one thing we are certain of is that it will be vastly different.

Will we find a place among the machines? If someday there are robots that do everything and do it better, where does that leave us? A future of blissful human-robot collaboration? Or perhaps something a little darker?

For the foreseeable future, humans will be better at many aspects of economic production than the machines. As has happened with technological advances in the past, different parts of labor will be leveraged by AI and humanity will adapt accordingly.

Historically transformative technology has made those people who've had parts of their jobs automated more valuable and more productive, not less.

Ultimately we are talking about a world with vastly more power to solve all sorts of problems, and vastly less need for us to work on the things that monopolize our time currently. Most routine drudgery could be eliminated. Shame on us if we don't seize this opportunity to do great things.

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**What Are the Risks?**

**All investments involve risks, including possible loss of principal. The value of investments can go down as well as up, and investors may not get back the full amount invested.** The technology industry can be significantly affected by obsolescence of existing technology, short product cycles, falling prices and profits, competition from new market entrants as well as general economic conditions.

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1. Source: Financial Services Institute, PwC, "Top Financial Services Issues of 2017," December 2016,

2. Source: *Wall Street Journal*, "How to be Your Own Quant," May 26, 2017.

3. Ibid.