WHAT I LEARNED THIS WEEK®

December 21, 2017

XIIID | 13D GLOBAL STRATEGY & RESEARCH

If you want to awaken all of humanity, then awaken all of yourself. If you want to eliminate the suffering in the World, then eliminate all that is dark and negative in yourself. Truly, the greatest gift you have to give is that of your own self-transformation.

Lao Tzu

Who takes the child by the hand, takes the mother by the heart.

James Ross

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*Leonardo was **painting [the Mona Lisa] as a universal work for himself and for eternity**…He kept it with him…until he died, sixteen years after he began. Over that period, he added thin layer after layer of little glaze strokes as he perfected it, retouched it, and imbued it with new depths of understanding about humans and nature.*

Walter Isaacson, *Leonardo da Vinci*

Your children are not your children. They are the sons and daughters of Life's longing for itself.

Kahill Gibran, *The Prophet*

We may stop ourselves when going up, never when going down.

Napoleon Bonaparte

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*Nothing fails like success because we don't learn from it. **We learn only from failure.***

Kenneth Boulding

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*The Mona Lisa became the most famous painting in the world…because viewers were able to feel an emotional engagement with her…**Most miraculously, she seems aware—conscious—both of us and of herself.** That is what makes her seem alive, **the most alive of any portrait ever painted.** It is also what makes her unique, **one of human-kinds unsurpassed creations.***

Walter Isaacson, *Leonardo da Vinci*

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*Leonardo was masterful at conveying, moti dell'anima, motions of the soul. "A picture of human figures ought to be done in such a way as that the viewer may easily recognize, by means of their attitudes, the intentions of their minds," he wrote. **The Last Supper is the grandest and most vibrant example of this in the history of art.***

Walter Isaacson, *Leonardo da Vinci*

Not till we are lost…do we begin to find ourselves.

Henry David Thoreau

You raise your voice when you should reinforce your argument.

Samuel Johnson

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*Because of his compassion, a man can become courageous. Because of his economy, a man may become generous. **Because of his humility, a man can become a leader.***

Laozi

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During a space of 15 months, between the autumn of 1978 and spring of 1980, the inflation-adjusted oil price rose more than 120%, illustrating that one cannot ignore social, religious and political upheaval in fragile states. As we wrote in *WILTW* November 23, 2017, there is a very strong link between the direction of the oil price and the CPI, even though commodities have a very small weighting in the CPI's calculation.

During the stagflationary period of the late-1970s, oil prices drove double-digit increases in inflation and a collapse in the bond market. Ironically, during the early 1980s, when long-term bond yields were peaking, setting the stage for the secular bull market in bonds that continued for 35 years, the mantra was that inflation would last forever. Today, the mantra is that inflation will never come back, but bond yields appear to be breaking out from their lows.

7 What can we learn from the way AlphaZero plays Chess? What does it mean for the future of machine learning?

Last week, we highlighted how DeepMind's AlphaZero achieved a superhuman level of play in Chess within 24 hours of "tabula rasa" self-play. AlphaZero—the generalized version of AlphaGo Zero—beat the reigning computer champion—Stockfish—in Chess within four hours of self-play—totaling 28 wins to zero losses with 72 draws.

The conversation within the Chess community about AlphaZero's game of play is revealing. International Chess master, Sagar Shah, underscores: "If you had on Facebook the friend lists that I have, which is all chess players, I can only say posts which say AlphaZero is crazy. You know it's like aliens have come from to Earth. The way it is playing I can't even imagine Chess is being played like this…"

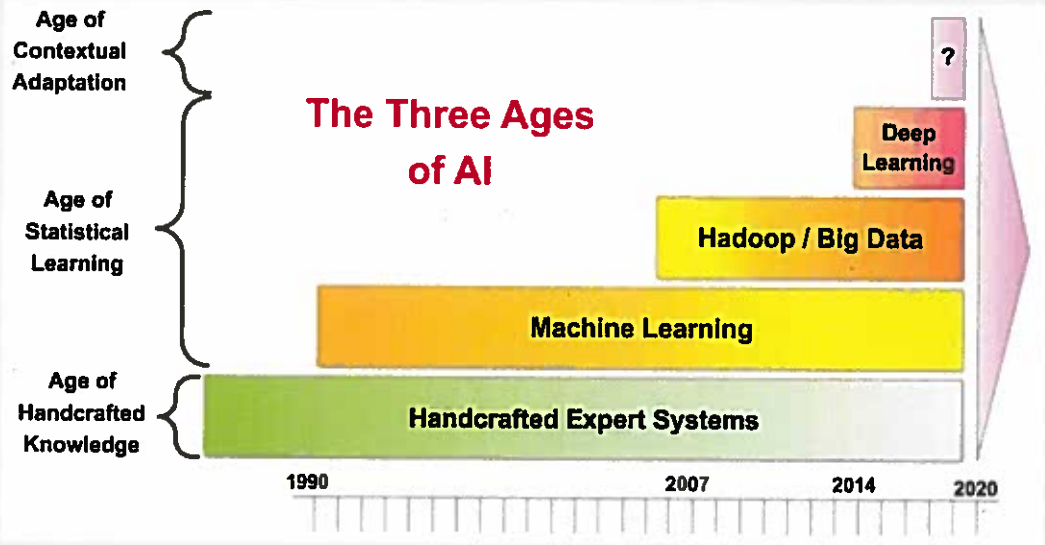
Demis Hassabis of DeepMind explains that AlphaZero sometimes made seemingly crazy sacrifices of high-value pieces. For instance, AlphaZero would offer up a bishop and queen to exploit a positional advantage to gain a victory. In another game, AlphaZero moved its queen into a corner of the board for positional value. As AlphaZero was self-taught, it was not bound by the traditional approach of assigning a value to pieces and trying to minimize losses.

Shah observes that **AlphaZero pursues quality of moves over quantity.** "If you have active pieces it doesn't matter what material you have, you only need activity, and yeah if you miscalculate you will lose but the AlphaZero doesn't do that," notes Shah.

Shah further believes that AlphaZero could completely change the way Chess is being played now. "Everything that is happening in Chess these days depends a lot on computer evaluation…" underscores Shah. "If the engine says this is better top players are more often going for that move…"

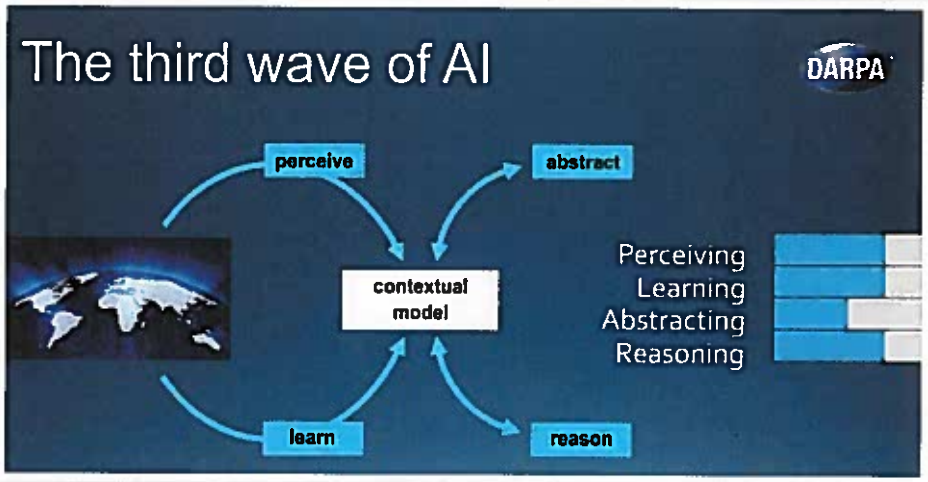
What are the implications for machine learning? AlphaZero is a generalized open-ended deep learning algorithm that can be used in virtually any well-defined sphere—a step towards "General AI" from the current narrow, single purpose AI landscape. Historically, machine learning algorithms have made inferences based on analyzing huge amounts of data. However, deep learning, an extension of machine learning, is an algorithm that can incrementally process the data to learn from it. David Silver of DeepMind notes that **AlphaZero was able to progress much quicker when it had to learn everything on its own,** as the efficiency of the principled algorithm was the most important factor.

AlphaZero will help usher in the third wave of AI—Contextual Adaptation—assisting in closing the AI "semantic gap"—between "Artificial Intuition" and logical/rational machines.



Source: Data Science Central

First and second wave AI systems are strong in reasoning and perceiving, but weak in learning and abstracting. **The third wave—contextual adaptation—will be where AI systems build underlying explanatory models for the real world that include reasoning and abstractive capabilities.** To achieve this, systems may function more similarly to the intuitive human brain. Rather than a fusion of logical components with intuition components, complex logical thinking must be performed by an intuition machine, underscores Carlos Perez, author of the new book *Artificial Intuition*.



Source: John Launchbury, Director I20, DARPA

AlphaZero helps to bridge the "semantic gap" as an intuitive-based algorithm. Originally designed to play the highly-intuitive game GO, AlphaZero dismantled its Chess opponent based on logic, notes Perez. AlphaZero's willingness to sacrifice pieces to gain a positional advantage set up its opponent into what is known in Chess as a "zugzwang,"—where every move that one makes leads to a worse outcome. AlphaZero played a game which maximized creativeness against its logical opponent that was unable to see beyond short term gains.

The implications of general purpose deep learning algorithms such as AlphaZero that can be applied to virtually any definable challenge are staggering. Key applications for third wave systems include self-driving machines, artistic machines—creating synergy with humans in their work (see *WILTW* June 22, 2017), reading human minds and predicting behavior, as well as machines that teach.

Numerous real-world use applications will be impacted by third wave systems, including gesture recognition, speech synthesis, and predicting clinical events. For instance, using geo-referenced crime reports and satellite images for three U.S. cities, researchers showed how deep learning can analyze image features to consistently explain up to 82% of the variation in neighborhood crime rates.

Hassabis foresees AlphaZero-related algorithms helping to tackle some of the hardest problems in science, ranging from drug discovery and designing new materials to improving our understanding of climate change. To this end, DeepMind is working with the Cancer Research UK Centre at Imperial College to improve detection of breast cancer. Advances in early detection and treatment have improved survival rates, but breast cancer still claims the lives of 500,000 people worldwide every year.

Deep learning is sweeping through the $6.5 trillion healthcare industry. Earlier this year, of the 800 research studies submitted to the Medical Image Computing and Computer Assisted Interventions Society, 60% focused on machine learning, of which 80% used deep learning, notes Abdul Hamid Halabi of Nvidia. One case explores how deep learning can analyze images to help robots perform minimally invasive surgery. In another example, startup Arterys uses deep learning to measure blood flow through a patient's heart ventricles—reducing the process time to 15 seconds from 45 minutes. Recurrent Neural Networks (RNN) will also be able to forecast future disease diagnosis and medication prescription—assessing the entire history of patients, making continuous predictions based on patients' historical data.

A primary risk is that advanced third wave AI systems will accelerate the global technology arms race, as nation-states seek military advantages. Imagine if an advanced AlphaZero-related algorithm were asked the best way to take down America's grid or to produce the effects of an EMP attack without having to actually explode a nuclear device over the U.S.? In *WILTW* October 5, 2017, we warned that China, Russia and the U.S. are running neck-and-neck in an AI military arms race.

Perez underscores:

> *The western world is unaware of the profound effect of AlphaGo's mastery of the game of Go has had on the psyche of the population of China, Japan and*

Korea. We are unfamiliar with the game of Go, so DeepMind's accomplishment isn't as relevant to us. These countries have now made it a national priority to sprint ahead in the development of Deep Learning Technology.

Last week, China announced a new three-year plan to rule AI—accelerating its timeline from 2030 to 2020. The new plan represents the top leadership's vision for a new Chinese economy in the age of AI, notes the *MIT Technology Review*. For instance, China aims to mass-produce neural-network processing chips, robots for disabled people, and machine learning systems to help radiologists read x-ray scans.

Recognizing China's advances, Google also announced last week that it is opening a facility in Beijing to help the company conduct AI research. While President Trump tightens immigration policies in America, Frank Chen of Andreessen Horowitz notes that China is implementing its "thousand talents" program to attract immigrants and ex-patriots to come to China and pay them to conduct deep learning and AI research.

Third wave AI systems could also be harnessed by criminals and terrorists for asymmetrical advantage (see *WILTW* August 30, 2012), whether the tool is autonomous weapons or fake news on steroids. For instance, hackers could exploit AI by gradually teaching a security system that unusual behavior is normal.

It is still early in the evolution of third wave AI systems. However, recent rapid advances have exceeded even the most optimistic expectations. **The pace of change is accelerating, and we plan for an expansive update in 2018.** Peter Thiel summarizes the equation: "What keeps me awake at night though is that Deep Learning could in fact be the 'Last Invention of Man.'"

8 Anxiety, despair, and rage—the discontents of a broken generation.

As Freud once told us, these feelings are intolerable. And, yet today, they are increasingly ubiquitous. The majority of millennials, the largest generation in America's history, are consumed with anxiety, habituated to despair and brimming with rage. The incessant self-absorption on social media that has