Life after AI: beyond the functioning of the human brain

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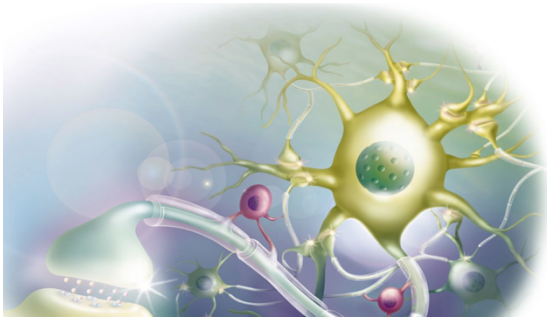
Can AI really be as smart as the human brain?

Each of the 100 billion neurons in the adult human brain commands 7,000 synapses that can fire signals at the rate of a hundred times per second. For a neuron to fire even half as much is already considered a lot, if not too much. Contrast this with today's powerful, quantum class computer chips that easily crunch through quadrillions of bits of data per second, and it seems that the brain simply can't compete.



Nevertheless, even with all this power, the best AI machines today still fail the Turing test; and, no AI can claim to have come close to emulating human cognition. One can cite small wins like AI recently beating human experts at Go, but it cannot be argued that there is an artificial generalized intelligence (AGI). The human Go experts were defeated with computational brute force in a highly constrained problem domain.

As it turns out, the elegance of brain synapses is that less is more. In fact, in brain recording studies of animals learning to respond to certain stimuli, one can see and hear neurons fire excitedly while learning, but quiet down once the target is learned. That is, the brain knows to conserve energy once learning has peaked.

While the young brain starts out with quadrillions of synapses, retaining all those connections into adulthood as our brains are molded with experience seems counterproductive. Imagine the inefficiency in trying to learn everything as if it were the first time, every time. It would be impossible for our species to survive. Inefficient systems do not prevail. The rule of the brain is to simplify.

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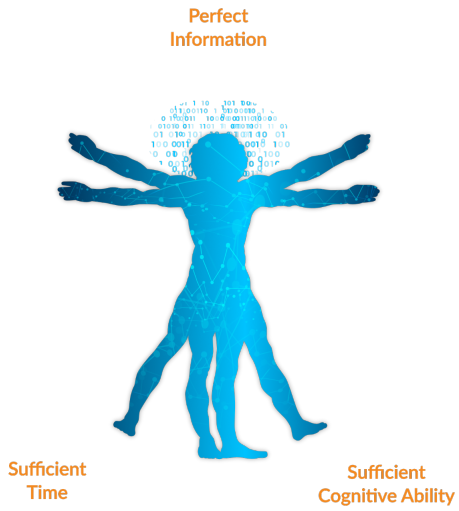
However, to think that the brain has got efficiency down cold is wrong. In fact, the hardwired brain can be highly inefficient. Research shows that the more the brain learns, the harder time it has in generating insights. Hardwired neural connections can become impossible to bypass. In life, there are many situations where not being able to problem-solve or be insightful about the information at hand results in one's demise. So, as it turns out, both looking at everything with a fresh eye all the time and just relying on habits or routines can be dangerously inefficient. So, how does any intelligent system (be it the brain, AGI, or the most convoluted neural net that exists) find that perfectly efficient zone? What does such a zone look like?

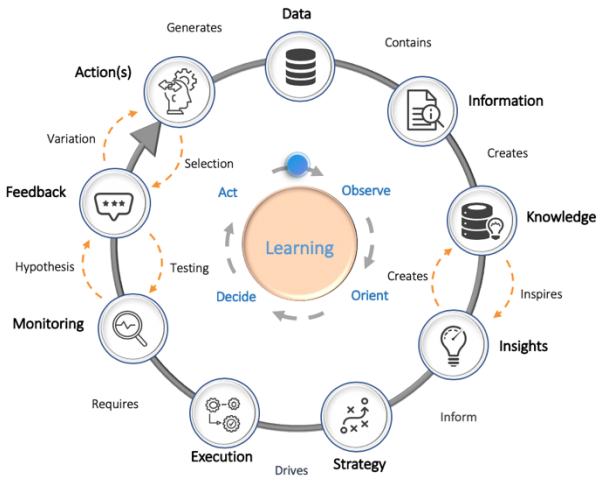


Homo Economicus

In a recent MIT blog by MIT's CEO, Paul Burton ("The return of *homo economicus* and the rise of unbounded rationality"), such a perfectly efficient zone was personified in *homo economicus*, a fictitious, yet aspirational, character who can consistently make optimal decisions instantaneously; an Übermensch, who can see the past, present and future simultaneously, therefore having all insights needed in every decision it had to make.

This concept of *homo economicus* makes one think of "hyperscalers" in business today. Hyperscalers are defined as organizations equipped with cloud-hosted distributed computers that can work simultaneously to generate answers and create knowledge on just about anything. The usual emphasis is on the architecture and data, but just those two emphases alone would not make a *homo economicus*: It's the way one learns and encodes information. It's the analytics.

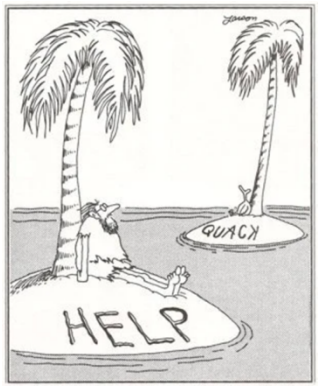
Entities that crack the code to learning faster will win



It's not enough to say that insights come from knowledge, which comes from information, which comes from data. Nor is it enough to Observe, Orient, Decide, and Act on the evolution of data to insights. The key is how an entity learns to learn faster. To be precise, "learning faster" means adapting and being agile to step in and out of high frequency neural firings as needed. It's the elegant interplay between rote, automated systems, and exploratory engines that can formulate useful knowledge quickly for the objective at hand, with an eye oriented to the future for the ultimate goal. In AI-driven analytics, this is the very definition of machine learning (computer algorithms that improve automatically through experience). Can it be that machine learning is what makes *homo economicus* possible? Yes, but not in the way we know machine learning today. In fact, we've got a long way to go, especially if we keep on modeling machine learning on neural networks, or how the brain works, no matter how deep the associations are. If we're not aware, this can lead us not just to a dead end, but to travel the wrong path entirely.

Zen and the art of machine learning

Understanding something without being misled by thought or language or our own notions about how the brain works is tough. Emulating how the brain works has been the target of AI improvements over the years, not because scientists are egocentric, but because it is still the most amazingly complex and intelligent decisioning center that exists. It gives us a good start. Even if one claims that neural activities can never give all the answers, whatever little advancement it bears can still be significant. However, with so much data and technology now accessible to us, caution is key, because we may be at a point where the way we analyze data requires a different lens.



The danger in exploring the art of the possible in the context of AI and the human brain is that we fall into the trap of likening everything to how neurons behave, despite knowing neural activity takes us only so far. If we ask a duck how it would solve world hunger vs. how it explains observer mechanics, we will seemingly get the same answer, because we can only hear it quack. Whether stuck on a problem or an island, its cry for help is the same. In this analogy, of course, we are the duck. It is this kind of conceptual entrapment that produces frivolous-sounding research, like whether robots get tired and need sleep. We can only gauge and envision an entity's sophistication in terms of—well– us.

Enterprise Intelligence hubs as launchpads for next gen AI

In the context of solving business problems, most organizations know the importance of data governance and technological upgrades. The ones with the most

developed data strategy have also figured out that there needs to be a discipline in how insights are derived from their data assets. It's not just about solving one off problems with data science by means of analytics, which may occasionally call for machine learning. It's not just about hiring data scientists. It certainly is not just about continuing the good old same reports, metrics and models as done before. The investment and upgrade in data and technology platforms are a reminder that there is so much more to be discovered than what our current ways of looking at problems today can afford.

Having the right data assets and technology, but with sub-par analytics only increases an organization's AI technical debt, akin to one buying something too sophisticated for how they intend to use it because of their own stubbornness and refusal to learn or take risks. What is the point of having the best in class data management and engineering when no one knows how to employ it?

At MIT, the discipline we overlay on top of data management and engineering is data science by means of an analytics Center of Excellence. On the surface, it sounds like something many digital transformation consulting firms would offer, but the difference is significant: we enable organizations to learn faster by upskilling their data-inclined workforce on data science while solving specific business problems. The key differentiator is not only in ensuring that the organization's AI technical debt is turned into positive ROI, but that the passion for advancing the ways AI is leveraged goes beyond just applying traditional machine learning techniques, or trying the latest methodologies, Kaggle-style.

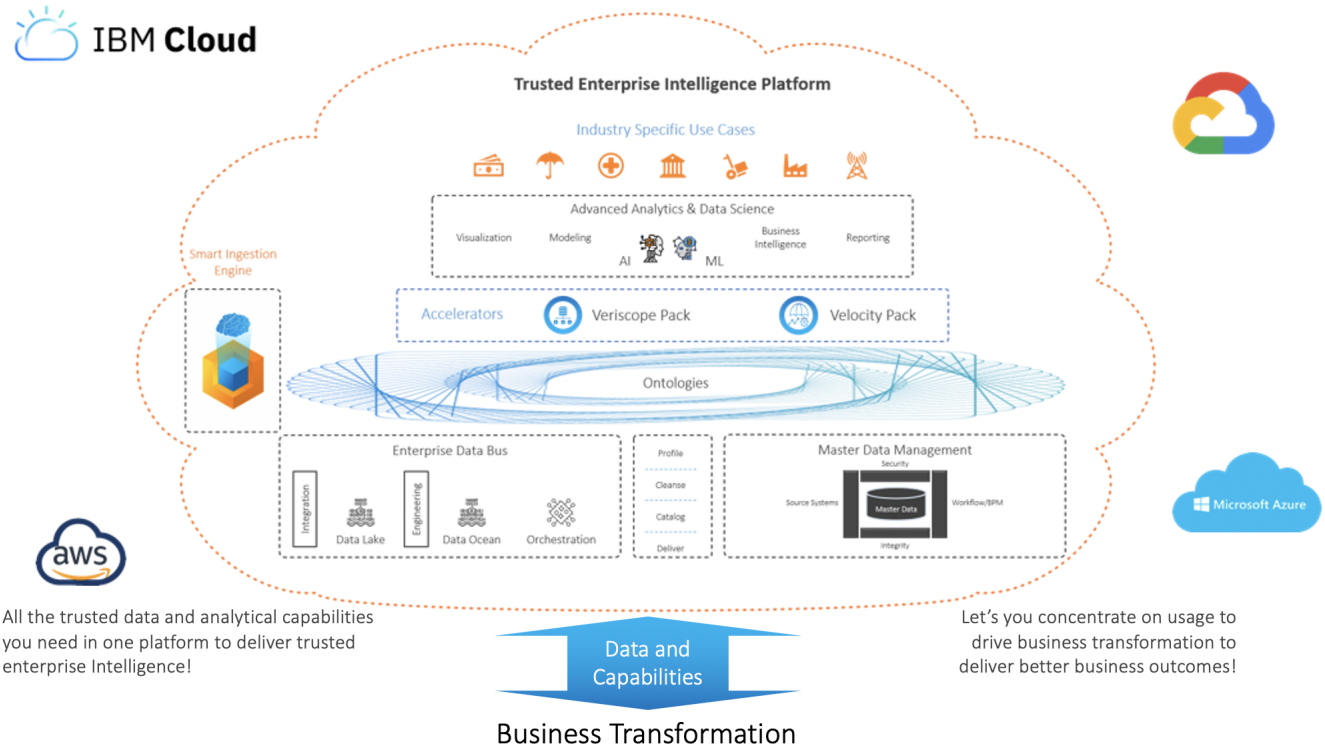
While we do work with neural net-based methodologies, we must stay aware that anything modeled after the human brain puts too much emphasis on efficiency, and such emphasis inhibits plasticity. In the contemporary context of big data and richer technology, the game changer is in how we analyze data and derive insights. Now that access to information and the technology to intercept it have stepped up to the plate, the way we look at information has to change to achieve the *homo economicus* level of performance. It's not just about seeing how much AI can emulate brain sciences, it's about facilitating machine learning that goes beyond how the brain works.

One of our areas of focus in advancing combinatorial AI and neural networks is knowledge graphs (or the graphical representation of multiple data points and dimensions). With human cognition driving seed ontologies (or the initial set of assumptions used in extracting insights from data), the way edges or connections are drawn in knowledge graphs allows for different methodologies beyond neural networks. While the typical metrics on knowledge graphs today are focused on speed and accuracy of information retrieval, they are point-in-time measurements. There is a far more interesting and useful metric: completeness.

Just as *homo economicus* can make decisions off of insights from past, present and future simultaneously, completeness measures the validity of knowledge graphs across dimensions. When we get to a point in AI research where the full picture of an event is revealed immediately, therefore leaving nothing unknown, whether it's business decisioning or life decisions, we too, shall be complete. It's not just augmented intelligence, you see. It's a homecoming.

We Architect Enterprise Intelligence

At Mastech InfoTrellis we work to expose the entire corpus of enterprise data and leverage it with state of the art techniques from Data Science to accelerate enterprise learning. We would love to talk with you about it.



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Dr. Maria Singson is Vice President & General Manager of Data Science at Mastech Infotrellis. She has founded startups in analytics, retail and the fashion industries, and has served as Leader of Innovation Analytics at Dun & Bradstreet and Chief Science Officer at Genpact. She also teaches AI readiness and machine learning at Rutgers Business School for Executive Education. Her Ph.D. is in Cognitive Sciences. She has been influential in her views on AI and the human brain throughout all of her analytical services.

About

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