

RIDING THE COGNITIVE WAVE

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Many exciting new digital technologies have evolved rapidly this decade—potent mobile devices that perform a myriad of tasks, big data and analytics tools that crunch petabytes of data, and Internet of Things sensors that report continuously on everything from our cars to our coffee pots. So it may surprise you that a far older technology—artificial intelligence (AI)—is poised to become the primary driver of business transformation by 2020.

How can that be, given that AI has occupied the pages of science fiction for at least 75 years and technology labs for more than 50? While it sounds old-hat compared to emerging technologies, AI is beginning to revolutionize the way companies do business.

See “Why Artificial Intelligence is a Big Part of AP’s Future” on page 47.

That is why we see articles every week about what cognitive systems are achieving or can achieve: driving cars without anyone in them over long stretches, beating the world’s best player at a complex game (the Asian game ‘Go’ is the latest), outperforming surgeons at stitching up a pig, and spitting out financial stories faster than even a big newsroom could.

It is also why new multibillion-dollar businesses for services are flourishing—Uber for taxis, Airbnb for booking rooms, and the personal digital assistants of Google, Microsoft, Amazon, and others. For sure, they are capitalizing on a bunch of digital technologies. But it is the modern strain of artificial intelligence, or cognitive technologies if you prefer the more modern nomenclature, which now makes them possible.

To put it succinctly, the cognitive wave is here. The question is whether your company is ready to ride it. That is what this article will try to answer. It will give you an overview of the technology and explain the two biggest challenges to using cognitive tools to transform your business in the years ahead.

THE BASICS: WHAT IS COGNITIVE TECHNOLOGY?

To understand why cognitive technologies will be transformative, you first have to understand what they are and what they can do. Think of cognitive technologies as performing four core tasks:

1. Sense



Until the last few years, computers have been very poor at doing what humans do with ease—scanning the environment around them and understanding the context. The reason is that most computers had neither the capabilities nor the processing power to analyze anything but ‘structured’ data. By structured, I mean the transaction data of a spreadsheet or database with numbers in it. ‘Unstructured’ data is the source food for cognitive systems—the text of a call center’s transcript of a customer conversation, the thousands of online articles published every day, the static images of pictures and moving images of video, and so on. The world is full of digitized data today, and it is doubling every two years, according to IDC.⁷ Between 2013 and 2020, it is predicted to increase ten-fold. But 80% or more of it is unstructured, which is one reason that only an estimated 22% of digital data in 2013 could be analyzed.⁸ But this is changing: cognitive technologies can increasingly assimilate and mine unstructured data in a wide range of formats, extract relevant information from them (e.g.,

⁷ IDC, The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things, April 2014, accessed July 12, 2016, <http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm>

⁸ IDC, The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things, April 2014, accessed July 12, 2016, <http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm>

existence of a person or an animal in a picture, or extracting sentiments from a blob of text), handle multiple overlapping data sources and versions, and perform data integrity and completeness checks, among other tasks. This kind of capability is opening up a complex new world of possibilities.

2. Think



A cognitive system is not useful if it only recognizes data; it must also decide what that data means, and at the speed of light. Cognitive technologies use machine learning and deep learning techniques to analyze the context gleaned during the ‘sense’ phase to understand and characterize normal behavior. This is used to predict future system behavior under expected and anomalous conditions as well as produce actionable insights and recommendations.

3. Act



After the system has arrived at some insights, it needs to drive an automatic reaction that corrects things. If a car manufacturer has trained an onboard system to sense electronic control data from its automobiles and discern when they are heading for mechanical problems, the system must also figure out proactive

actions to correct those problems and improve customer experience. A driverless car is AI on four wheels—an automobile that is continually sensing, thinking, and acting in order to avoid all the hazards of busy roads. Cognitive systems think and act like experts. Unlike a robot, they do not need to be programmed with explicit instructions to perform actions in all possible contexts the system may encounter. Instead, cognitive systems mimic the human brain; they combine self-learned context with reusable patterns to construct procedures to perform complex activities utilizing reusable simple skills.

4. Learn



The best cognitive systems do not stop at acting on some data that they have analyzed. Through technologies such as machine learning, they are able to continuously refine their knowledge and algorithmic models based on the real-world outcomes from them. Like people, cognitive systems need to be designed to learn from experience—the systems’ experience. Most cognitive systems support two methods for continuous learning—explicit training and observational self-learning.

WHY IS IT IMPORTANT NOW? THE PERFECT STORM

A new class of computer systems can now sense, think, act, and learn. Why is that happening now? And where is it all going?

It is happening now because what we are witnessing today is the perfect digital storm. Products, processes, and information systems today are getting hyper-instrumented and hyper-connected. Wireless sensors in devices ranging from mobile phones and cars, to computer printers are reporting on their performance. Extensive networks are connecting everything. Big data and analytics technologies can crunch the data that is being emitted.

So all the technical elements of the perfect storm—the digital technologies that can guide what people need to do—are in place. Entrepreneurs like Elon Musk (the connected, self-driving electric car), Travis Kalanick (Uber), and Brian Chesky and Joe Gebbia (Airbnb) are the ones turning those perfect storm elements into viable new businesses that are giving entrenched industries a run for their money.

Uber does not own taxis or taxi drivers (they are contractors). Yet its latest round of fund raising valued it at more than \$60 billion. In 2014, its revenues in its home San Francisco market alone were more than three times what taxis were generating in the city.⁹ Clearly, consumers are using Uber much more than taxis, for its convenience and other reasons.

Clearly, Uber has seized the perfect storm of digital technologies, and it is reshaping a century-old industry.

Is your industry next? And, if so, is your company prepared?

⁹ Business Insider, Uber CEO Reveals Mind-Boggling New Statistic That Skeptics Should Put In Their Pipes And Smoke, January 19, 2015, accessed July 12, 2016, <http://www.businessinsider.com/uber-revenue-san-francisco-2015-1>

PREPARING FOR THE STORM

To be able to lead this cognitive wave, companies will have to overcome several challenges. They are many and disparate, but you could group them into two broad categories—technical challenges, and people and safety challenges.

Let us start with the technical ones. Oddly enough, ‘technical’ does not mean ‘technology.’ It is really about knowledge and how to codify it so you can train an AI system to do the task you want it to do, whether it is to drive a car, perform a surgery, monitor and protect a household when the family is away (or even at home), and much more.

No matter how much sophisticated technology is in a cognitive system and how well it can sense, think, act, and learn about some issue it will not be useful unless it can also collect and sense the right digital data, think and act

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on that data, and then perfect its learning for the future.

Take the self-driving automobile. Its developers, whether they are at Tesla or Toyota, must understand the physics of a car, the physics of braking, the physics of other objects such as other cars, trucks, deer and people, that share the road with it, the physics of weather and every part of the internal and external physical environment that enables the car to operate without colliding into something. To cite one narrow slice of this, how much braking should be applied in bad conditions such as rain or snow? Does it depend on the weight of the car? (yes). The height of the car? (yes). The speed of the car? (yes). The road conditions? (yes).

And that, in turn, means the developers of the self-driving car need to capture that knowledge coherently. That is not the topic that most people talk about when discussing AI and cognitive technologies. They are largely discussing the technology pieces—the natural language software, the image-recognition technologies, and so on. That is all necessary, but not sufficient.

You need to capture the domain knowledge necessary to train a car to drive as expertly and hopefully better than the most skillful drivers. That is a huge barrier, and it takes a huge amount of effort to overcome it.

The second challenge involves the people and safety issues. The people issues are probably the most perplexing. What new jobs might arise in that firm given that the 'doers of work' can be liberated from those manual jobs and become 'creators and curators of knowledge'? TCS conducted a major study this

What happens to a company that can automate 60% of its workforce through AI systems?

year of what more than 800 mostly big companies are doing with AI. One big finding was that the companies getting the greatest value from the technology in terms of revenue and cost improvements can envision the technology both automating more jobs and creating additional new jobs, as compared to the companies realizing less value from AI.

Cognitive systems are about to unleash huge changes in big companies, which I boil down to automating the work of the 'doers' and liberating them to take on the new jobs of creation and curation of knowledge. But that, of course, poses big questions for companies—how do they determine which jobs can be automated? How do they determine what the new jobs will be? And then how do they retrain and redeploy people for those new jobs? It figures to be a massive job and skill shift that will keep many chief HR officers awake at night. History, however, does indicate that this problem is solvable.

A 2015 Deloitte study found that during the past 144 years, new technologies have created more jobs than they have destroyed.¹⁰

As for the safety issues, how do we make products and processes powered by cognitive systems safe for people and for companies? Consider the self-driving car example again. When you design and develop the autonomous vehicle to avoid an accident, if the choice is between the driver suffering in a crash or another car or pedestrian suffering, which one does the system choose? It is a huge ethical (and probably legal) dilemma.

The other safety issue is one we have heard about for decades: computer security. How do we build cognitive systems that cannot be hacked, or at least easily hacked? In our study, this turned out to be the biggest challenge for the 800+ companies we surveyed, and it is not likely to go away.

JUMPING ON THE WAVE

Experienced surfers know how to time the waves just right. The same will hold true with companies and cognitive systems. But it is becoming more evident by the day that most large companies, across most industries, need to climb on top of that board now because the perfect conditions are here. It is time to begin exploring and investing seriously and strategically in harnessing the power of cognitive systems to reimagine your business.

¹⁰ Deloitte, Technology and people: The great job-creating machine, August 2015, accessed on July 26, 2016, <http://www2.deloitte.com/uk/en/pages/finance/articles/technology-and-people.html>