I think, therefore I am – man or machine?

How humans and machines are forging a new age of understanding

Many products and services that we use every day – from search-engine advertising apps to "smart" cars and mobile phones – are beginning to demonstrate aspects of artificial intelligence. Most consist of purpose-built, narrowly focused applications, specific to a particular service. They use a few of the core capabilities of cognitive computing. Some use text mining. Others use image recognition with machine learning. Most are limited to the application for which they were conceived.

Cognitive systems, in contrast, combine five core capabilities:

1. They create deeper human engagement

Cognitive systems create more fully human interactions with people — based on the mode, form and quality each person prefers. They reason through the sum total of all available structured and unstructured data to find what really matters in engaging a person. By continuously learning, these engagements deliver greater and greater value, and become more natural, anticipatory and emotionally appropriate.

2. They scale and elevate expertise

In every industry, knowledge is expanding at a rate faster than any professional can keep up with. Cognitive systems are designed to help organisations keep pace. These systems master the language of professions – the language of medicine, or sales, or cuisine. They can both understand and teach complex expertise. This reduces the time required for a professional to become an expert. And because these systems are taught by leading practitioners – whether in customer service, oncology diagnosis, case law or any other field – they make available to broad populations the know-how of the best.

3. They infuse products and services with cognition

Cognition enables new classes of products and services to sense, reason and learn about their users and the world around them. This allows for continuous improvement and adaptation, and for augmentation of their capabilities to deliver uses not previously imagined. We see this happening already with cars, medical devices, appliances and even toys. The Internet of Things is dramatically expanding the universe of digital products and services – and where code and data go, cognition can now follow.

4. They enable cognitive processes and operations

Business processes infused with cognitive capabilities capitalise on the phenomenon of data, from internal and external sources. This gives them heightened awareness of workflows, context and environment, leading to continuous learning, better forecasting and increased operational effectiveness — along with decision-making at the speed of today's data. This is good news in a world where, for example, an average billion dollar company spends almost 1,000 person hours per week managing its suppliers.

5. They enhance exploration and discovery

Ultimately, the most powerful tool that cognitive businesses will possess is far better "headlights" into an increasingly volatile and complex future. And the ability to see ahead is becoming more important as leaders in all industries are compelled to place big bets – on drug development, on complex financial modelling, on materials science innovation, on launching a start-up. By applying cognitive technologies to vast amounts of data, leaders can uncover patterns, opportunities and actionable hypotheses that would be virtually impossible to discover using traditional research or programmable systems alone.

A holistic approach

If cognitive computing is to fulfil its true potential, the underlying platform must be flexible enough to work for any company, in any industry – across all industries. To do that requires a holistic approach to research and development, with the goal of creating a robust platform with a range of capabilities to support diverse applications from an ecosystem of developers.

This platform must encompass machine learning, reasoning, natural language processing, speech and vision, human-computer interaction, dialogue and narrative generation, and much more. Many of these capabilities require specialised infrastructure that leverages high-performance computing, specialised hardware architectures and even new computing paradigms. Each grows from its own scientific or academic field. But these technologies must be developed in concert, with hardware, software, cloud platforms and applications that are built expressly to work together in support of cognitive solutions.

How Watson can help

With IBM Watson's rapid evolution, we are getting a glimpse of what's possible. One example is a cognitive medical imaging application that analyses X-rays, MRIs and ultrasound images. It processes the natural language of medical journals, textbooks and articles. It uses machine learning to correct and improve its understanding. And it develops deep knowledge representations and reasoning that can help surface possible diagnoses. To do this requires specialized graphic processing units to support the large scale of data and human domain expertise to guide its learning and interpret its results.

The power of this new model can be applied to any domain. Oil and gas companies can combine seismic imaging data with analyses of hundreds of thousands of papers and reports, current events, economic data and weather forecasts to create risk and reward scenarios for exploratory drilling. Or, by analysing test scores, attendance and information about student behaviour on digital learning platforms, schools can create longitudinal student records and personalised education plans.

In one of the most promising near-term applications of cognitive computing, IBM is working with more than a dozen leading cancer institutes to accelerate the ability of clinicians to identify and personalise treatment options for patients.

The choices we make

The cognitive era is the next step in the application of science to understand nature and improve the human condition. In that sense, it is a new chapter of a familiar story. The controversy surrounding artificial intelligence is merely the latest example of the age-old debate between those who believe in progress and those who fear it. Within the scientific community – as opposed to the media and popular entertainment – the verdict is in. There is broad agreement on the importance of pursuing a cognitive future, along with recognition of the need to develop the technology responsibly.

"Technology creates possibilities and potential, but ultimately, the future we get will depend on the choices we make. Technology is not destiny. We shape our destiny."

Erik Brynjolfsson, MIT

Specifically, we must continue to shape the effect of cognitive computing on work and employment. Like all technology, cognitive computing will change the nature of work done by people. It will help us perform some tasks faster and more accurately. It will make many processes cheaper and more efficient. It will also do some things better than humans, which has been the case since the dawn of civilisation. What has always happened is that higher value is found in new skills, and humans and our institutions adapt and evolve.

Equally important is the need for societal controls and safeguards. Again, such concerns are not unique to intelligent systems. Questions about security attach themselves to every transformational technology, from cars to pharmaceuticals to mobile phones. These issues are already urgent, and will remain so as cognitive technologies develop. They are fuelled especially by today's radical democratisation of technology. And the answer lies not in attempting to limit that democratisation. Rather, we must embrace it while designing cognitive systems with privacy, security and human control integrated into their very fabric.

Next-generation genius

In the end, all technology revolutions are propelled not just by discovery, but also by business and societal need. We pursue these new possibilities not because we can, but because we must.

As with every revolutionary technology, our initial understanding will be limited – both by the world's complexity and by our own deeply ingrained biases and heuristics. However, for all these limitations, progress is imperative. Indeed, we pay a significant price for not knowing: not knowing what's wrong with a patient; not knowing which part of the population wants to buy a product; not knowing where to find critical natural resources; not knowing where the risks lie in every investor's portfolio.

"Computers will never rob man of his initiative or replace the need for his creative thinking. By freeing man from the more menial or repetitive forms of thinking, computers will actually increase the opportunities for the full use of human reason."

Thomas Watson Jr., former Chairman and CEO

At IBM, we believe that many of the perennial problems of the world can be solved – and that cognitive computing is the tool that will help us accomplish this ambitious goal.

The much-hyped drama of "man versus machine" is a distraction from that, and it rests on an exciting but misguided fiction. Cognitive systems are not our competitor, nor will they become so. Neither the science nor the economics support such fears. Cognitive systems, as they actually exist, are a tool to deepen the relationship that really matters – the relationship between humans and the world.

In so doing, we will pave the way for the next generation of human cognition, in which we think and reason in new and powerful ways. It's true that cognitive systems are machines that are inspired by the human brain. But it's also true that these machines will inspire the human brain, increase our capacity for reason and rewire the ways in which we learn. In the 21st century, knowing all the answers won't distinguish someone's intelligence – rather, the ability to ask better questions will be the mark of true genius.

Got you thinking?

Read more about advances in cognitive computing and how IBM is driving positive change.