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# IS THE COMPUTER A GOOD MODEL FOR THE BRAIN?

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Wish you could be as smart as a computer? Well, computer engineers wish they could build a machine as smart as you, or even your dog. Okay, so there are certain tasks that computers are obviously better at then we are. For example, quick, what's the square root of 7.13? Now, while all of you were trying to cheat by opening up a calculator app, could've been calculated the answer to 1000 decimal places. But can that same computer take a picture of me and recognize what it's looking at? With dedicated facial recognition software, written by humans, I must add, it probably can. But that requires a lot of work on the front end to make it happen. You see, when it comes to recognizing visual images, or a style of a piece of music, the natural architecture of a human or even an animal brain is at a huge advantage. So, what if we could make computers think more like brains? Now, the computer is based on von Neumann architecture. That's where you have a CPU and a separate memory bank. That CPU performs operations based on binary data. That's essentially an electrical on or off switch, and it can really only do one of those at a time until an entire program is fulfilled. Now, your brain is also an information unit, but it works in a very different way. It's all based on the neuron. Neurons can communicate with other neurons through electrical and chemicals signals, and you have a web of around 80 to 100 billion neurons in your brain. They are constantly making and breaking and reinforcing connections as you form new ideas. So, it's true that your brain executes individual computations at a rate much slower than the computer chip, but your brain actually has some enormous advantages. For one thing, it's massively parallel. See, a traditional computer has to solve operations one at a time, while your brain can be working on millions at the same time. It also is really energy-efficient. And finally, your brain is naturally designed to learn, or, in computer terms, to reprogram itself. As it does work, it redesigns itself to do work better. Let's check this out. In 2012, researchers with the Google Brain Project created a neural network of 16.000 processors. Then they fed it 10 million random, unlabeled Youtube thumbnail images and the computer learned to recognize cats! Of course, it did! Essentially, it had to invent the concept of a cat, which is pretty much what a human naturalist would have to do if he went to an alien world and saw alien life forms.

Computers are also good at storing and retrieving information. Assuming the computer and its components remain undamaged and uncorrupted, you should be able to retrieve information years after storing it in a computer with no loss of data. Computers don't forget facts or exaggerate.

In 1997, world chess champion Garry Kasparov played a series of six games in a rematch against the supercomputer Deep Blue. The year before, Kasparov defeated Deep Blue, winning three games to one (with two draws) against the supercomputer. During the rematch, Kasparov won the first game but then began to struggle. When it was all over, Deep Blue claimed the victory with two wins against one with three draws.

In 2011, IBM's computer Watson competed against Ken Jennings and Brad Rutter on the "Jeopardy!" game show (a home of America's Favorite *Quiz Show).* Backed by more than 2,800 processor cores and a library's worth of information, the computer defeated the two human opponents. Watson showed that with the right processing power and programming, a computer could learn to interpret natural language and respond appropriately. It marked a leap in the field of artificial intelligence. Today, IBM is turning Watson's power to solving problems in the medical field and beyond.

Were these losses signs that computers had become smarter than people? It's true that computers can perform calculations at a blistering pace. But, on the other hand, measuring how fast humans can think isn't easy. In fact, professor Chris Westbury estimates the brain may be capable of 20 million billion calculations per second. Westbury bases this estimation on the number of neurons in an average brain and how quickly they can send signals to each other.

Computers aren't good at everything. One reason for that is because humans are very good at adapting to changing situations. Computers traditionally have trouble responding to, for example, a player switching his or her style in the middle of a match. As long as computers rely on sets of pre-installed instructions to perform tasks, they can't be said to be more intelligent than humans. Even IBM's Watson can only respond to input – it can't spontaneously pull up information or think in the way we humans do. Only when computers can adapt and perform tasks outside their initial programming they will be truly intelligent. Until that time, computers are just very sophisticated calculators. One more example, while a supercomputer like the Sequoia can analyze problems and reach a solution faster than humans, it can't adapt and learn the way humans can. Our brains are capable of analyzing new and unfamiliar situations in a way that computers can't. We can draw upon our past experiences and make inferences about the new situation. We can experiment with different approaches until we find the best way to move forward. Computers aren't capable of doing that – you have to tell a computer what to do.

Humans are also very good at recognizing patterns. While we're making progress in machine pattern recognition, it's mostly on a superficial level. For example, some digital cameras can recognize specific faces and automatically tag photos of those people as you take pictures. But humans can recognize complex patterns and adapt to them – computers still have trouble doing that.

Humans are better at learning through observation and experimentation. There are computers and software that mimic this ability. But in general, it's difficult to build a computer or program that lets a machine learn through experience. Most are limited to a specific set of parameters. Humans are capable of learning multiple disciplines.

Other elements of the brain have remained elusive to computer scientists. Things like emotion, self-awareness, ambition and self-preservation all rest within our brains. Computers don't experience these concepts. While we can create programs that mimic the human responses to stimuli like heat or pressure, machines don't actually feel anything.

Even though a computer isn't a good model for the brain on its own, that hasn't stopped computer scientists and neurologists from trying to build an electronic brain simulation. Scientists working on the Blue Brain project are trying to build a computer model of the human brain. The goal is to reverse engineer the brain so that we can further our understanding of how it works. A working simulation could provide neurologists with information on how to treat various illnesses and conditions.

I'm torn on the subject of artificial intelligence. On the one hand, we live in the age of technological innovation and we're seeing enormous leaps in computational ability every year. On the other, thinking is hard. It's probably only a matter of time before machines are actually thinking in a way that's analogous to our own processes. But it's still hard for me to imagine. As the scientists point out, there are easier ways to create human intelligence – you just make more humans. But even so, the simulated brain will be a much closer fit to the gray matter in our skulls than a traditional computer. In short term, these brain-inspired computers may help us with everything from energy efficiency to sensory input to big data, but in the long term, that’s where things get really interesting. Maybe we’ll no longer have to program computers. Maybe we’ll just have to teach them. Alternatively, we may come to a point where human and machine intelligence merge, leaving the entire question moot.