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Neuromorphic Computing

Humans are the smartest species and we soon realized that evolution is a □ar better inventor than us, and natural selection has highlighted the best o□ its inventions. So, we started mimicking the nature around us.

Biomimicry
A lot o□ our inventions are inspired by nature.
Classics such as the echolocation used by sonars or the velcro in your laptop bag. Or the recent ones like, the earthquake-resistant water cube architecture at the Beijing Olympics, the Burj Khali□a which is inspired by a desert □lower, or the 50-□oot-long king□isher beak o the bullet train.
The applications o□ Biomimicry are endless. But is that all we can learn □rom nature?

Neuromorphics
Let's mimic the brain. Because, why not?
A Brain smart enough to know its own existence is de□initely one o□ the most power□ul creations o□ evolution. It's been a □antasy □or long enough to upload the brain onto a computer. Except □or this time, we managed to do it.
In December 2017, Scientists completed the brain mapping o□ an earthworm known as C. elegans. They built a Connectom which is a so□tware program with all o□ worm's 1000 cells, 302 neurons as well as their □unctions completely mapped.
They basically built a digital brain o□ the earthworm, then uploaded it to a robot, le□t it in a small to see what happens next.
Now comes the interesting part. The robot mimicked the behavior o□ the earthworm, navigated the room, turned back when it saw a wall, and so.
But you may say what's new in this, we have had robots capable o□ navigation and avoiding walls □or a long time. How is this di□ferent?
The di□ference is, we didn't program it to avoid walls; we didn't program it to navigate the room. All we did was digitalize the worm's brain. All o□ this was actually done by the digital brain itsel□ and this was all just so□tware with a □ew sensors.

Neuromorphic Computing
Arti□icial intelligence so□tware has increasingly begun to imitate the brain. Algorithms such as Google’s automatic image-classi□ication use networks o□ arti□icial neurons to per□orm complex tasks. But because the traditional computer hardware was not designed to run

brain-like algorithms, these machine-learning models require much more computing power than the human brain does.
“There must be a better way to do this because nature h\as □igured out a better way to do this,” says Michael Schneider, a physicist at the NIST.
Interestingly, this year at CES, Intel showcased its research in neuromorphic computing. The Tech Giant has developed a □irst o□ its kind sel□-learning neuromorphic chip code-named as Loihi, which uses an asynchronous Spiking Neural Network. The chip is based on a new computing paradigm inspired by how neurons work in a human brain and scrape o□f the traditional computing architecture consisting o□ CPU and memory. The chip gets smarter over time and does not need to be trained in the traditional way with a huge data set.

The key di□ference between neuromorphic and traditional computing is that they process data in an analog, rather than a digital □ashion. This means that instead o□ sending in□ormation in a series o□ 0/1, they vary the intensity o□ these signals, just like our brain’s synapses do. This means that more in□ormation can be coded into each signal by varying the intensity, drastically reducing the amount o□ power needed.
This makes the chip up to 1,000 times more energy-e□ficient than general purpose computing required to train any neural network. The chip serves as hardware counterpart to the Deep Neural Networks and is meant to make computations □aster.

The di□ference between classical systems and neuromorphic ones is just like the di□ference between Morse code and speech. The □ormer encodes data using just dots, and dashes, making meanings easy to understand but the message is lengthy to communicate. Speech, however, can be di□ficult to interpret but each individual utterance holds much more data. Thus, the latter is very e□ficient.

Thus, Neuromorphic Computing is the new power wave in the □ield o□ Arti□icial Intelligence and it can probably compute □aster than the human brain.