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INTEGRATED FUTURE(S)

FASTER AND SMARTER, PLEASE

Quantum and neuromorphic computing as means, not ends

Welcome to Integrated Future(s), IF.

IF is a weekly newsletter about the future of emerging technology and the impact on science, medicine and society. We'll look at how artificial intelligence, blockchain, quantum and neuromorphic computing, robotics, nanotech, neurotech and more – along with other things not yet identified – will integrate with each other and with the technological infrastructure of science in our society. This is known as ***technoscience***.

This week we'll explore the basics of quantum computing along with the foundations of the lesser known neuromorphic computing. These are the future rails on which our integrated systems will ride.

We'll begin to consider how their power may impact and accelerate an array of other tools, while also considering how advances in neuroscience may provide feed forward advancement in tech and *vice versa*.

Please remember that the map is not the territory.

- Sean

QUANTUM COMPUTING 101

https://uwaterloo.ca/institute-for-quantum-computing/quantum-computing-101#Quantum-tech-years-away

Quantum Supremacy! Quantum Entanglement! Quantum Strangeness?!? We see headlines about advances in quantum computing and quantum science in general, but often times there is just a cursory explanation of the basics. What is quantum computing, why is it important, who is working with it, when is it coming and how do I find out more? This is as friendly an explainer as I've found from the good folks at University of Waterloo. Understanding the basics of quantum computing will allow us all to follow developments and get a better sense of what it may bring, and what it won't, to the overall advances of integrated technology in our lives, our science, and our society.

THESE ARE BUT TOOLS

The technology and its applications that have and will integrate into our lives, our science and our society are tools. Though they may be based on complex concepts, they are not magic and are simply the next generation of things we use towards a goal or purpose like a hammering rock or a sharpened bone. They are also not imbued with ethics or intent, that is for us to determine, though there may be complexities as to when/how/by whom these inputs are determined. It is why we (as many of us as is reasonable and possible) should be aware of these developments before they are ready off-the-shelf, implanted in our brains and/or ubiquitous in our daily lives. That's one of the goals of IF.

NEUROMORPHIC COMPUTING

https://www.nist.gov/programs-projects/neuromorphic-computing

This projects/programs description from our friends at NIST is as good an intro into neuromorphic computing as you'll get. The concept stems from the recognition that the brain contains multitudes of tricks and efficiencies we have yet to tap (or sometimes even understand) in our advances towards better, cheaper, faster computing. And AI.

BRAIN COMPLEXITY

https://twitter.com/Technoscience6/status/1214162534023991296

Just how deep does this untapped brain complexity go? 10^{40}? Maybe. Here's my thread on that topic. All back of the envelope, but I was pleased to find out I hadn't quite violated the Bekenstein bound.

SCIENTISTS UNCOVER A NEVER-BEFORE-SEEN TYPE OF SIGNAL OCCURRING IN THE HUMAN BRAIN

https://www.sciencealert.com/a-newly-discovered-signal-in-neurons-hints-at-the-power-of-the-human-brain

The evidence is growing that there is more complexity at work in the brain than we know. Here is one recent development (*Science* article through the link). Each neuron may potentially be a computer.

HOW BIG DATA AND HIGH-PERFORMANCE COMPUTING DRIVE BRAIN SCIENCE

https://www.sciencedirect.com/science/article/pii/S1672022919301561?via%3Dihub

Shanyu Che, Zhipeng He, Xinyin Han, et alia

Here is a review that covers the state of brain science via the impact of advanced computing across several major consortium efforts. This is where that feed forward aspect comes in. The more we advance computing the more we will know about the brain. The more we know about the brain, the faster we can advance computing. *Ad infinitum*?

SYNAPTIC WEIGHTING IN SINGLE FLUX QUANTUM NEUROMORPHIC COMPUTING

https://www.sciencedirect.com/science/article/pii/S1672022919301561?via%3Dihub

Schneider ML, Donnelly CA, Haygood IW, et alia

Here is an example of the integration of neuromorphic computing concepts with quantum circuitry. Not IF. Now.

That's it for this week. Next week we'll take a look at AI, brains, and cognitive bias; the good, the bad, and the novel. Share as you like. Questions and comments to seanmanion@sciencedistributed.com. Thanks for reading.

Sean T Manion PhD is a technoscientist with a focus on blockchain and other emerging tech, neuroscientist, former federal researcher/admin and bureauscientist. He is a Chief Editor at Frontiers' Blockchain for Science, a Fellow of the British Blockchain Association and co-author of the book Blockchain for Medical Research: Accelerating Trust in Healthcare with Yaël Bizouati-Kennedy (CRC Press, April 2020). He is currently performing the duties of self-appointed strategic planner for science.

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