AI and Optical Sensors

OIDA wrote in the December 2017 OIDA newsletter and last July/August in OSA's Optics & Photonics News about the overlap of artificial intelligence (AI) and optics. It's not very different from human biology: the retina performs some image processing where the image is captured, and the cerebral cortex (the grey matter) does the rest, with the optic nerve and the brain's white matter providing interconnections. In machine intelligence, the optical sensor may perform some AI-centric processing, while optical interconnects carry information to the cloud and within data centers, where much of the higher level processing can be done. The AI-ready optical sensor can reduce the data uploaded to the central processor, just as the retina reduces that load to the brain through the optic nerve.

In machine intelligence, the uploaded information need not be digital, it might be multilevel or even analog. For example, startup Al Storm is developing a local processor that operates on analog data to save on processing speed and power. Meanwhile, Adobe announced a post-process AI-informed algorithm for demosaicing raw digital images that operates after the image is captured. Demosaicing is a way to reconstruct via software an incomplete image that results from the use of color filter arrays in cameras. Adobe claims to have trained its algorithm using over a billion examples.

Illustration by Phil Saunders.
The most intriguing, and speculative, application of optics to AI would be for the elusive optics-enabled processor, analogous to the human cortex. Several companies are aiming for such a solution using integrated photonics, including its use for room-temperature quantum computer circuits. Some examples are PsiQuantum, Lightelligence, Lightmatter (with recent funding from GV, formerly Google Ventures), and newly-launched QuiX.

Meanwhile, AI is getting a lot of attention in the media and government funding agencies. U.S. President Trump signed an executive order launching the American Artificial Intelligence (AI) Initiative on 11 February 2019, but without specifying new funding or how it would put new policies into effect (see here). This new initiative likely pales in comparison to the AI research funded by companies like Alphabet (Google), Amazon, Apple, Facebook, IBM and Microsoft in the U.S. And China may be outspending the U.S., from companies like Alibaba, Baidu and Tencent.

Kai-Fu Lee of Sinovation Ventures says (here) that as the AI field shifts from discovery to implementation, the U.S. and China have two distinct approaches to solving its problems. If the solution lies in its core algorithms, then the advantage goes to the U.S., where it's encouraged to "think different." If the key is in implementation of AI into the field, then the advantage goes to China, where there is less inhibition to imitate successful business models or features, and greater willingness by the government to adapt policies and infrastructure to the new technology.

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