Devices for neuromorphic computing with two dimensional materials

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Research site:
https://sites.google.com/view/roylab/home

Abstract

Advances in machine learning and artificial intelligence have been mainly from the architecture and software levels, with the basic building blocks still being CMOS transistors. This causes the hardware to be bulky and power-hungry. Roy's group is developing neuromorphic devices functioning similar to the neurons and synapses of the human brain, which can serve as the basic building blocks of neural network hardware, making the systems energy-efficient, scalable and compact. In this talk, Roy will discuss her use of semiconducting two-dimensional materials to make artificial neurons and synapses which can perform pattern recognition. The layered structure of 2D materials allows great control over the synaptic characteristics. Having designed both synaptic and neuron devices with 2D materials, she will present the integration of these devices to implement Boolean logic as a first step towards in-memory computing. She will also discuss her efforts in developing optoelectronic synapses using 2D materials which, similar to optic nerves, combine the functions of photodetectors with analog memory. These devices can provide an avenue towards inference tasks at the edge in an era of data deluge.