Contrastive Local Learning Networks in the Lab

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Neural networks in the brain and artificial neural networks (ANNs) in silico are both able to learn complex functionalities. While each artificial neuron is updated based on global information, using a central processor (CPU) and memory, each real neuron in the brain updates itself without external CPU. In this talk I will describe laboratory realizations of such self-learning without use of CPU or memory. Our systems consist of networks of identical variable-resistive elements that self-adjust using a local rule based on the voltage drops they experience under contrastive boundary conditions – with and without enforcing training data labels on output nodes. As such, they have many brain-like advantages over ANNs, such as speed and low power, and enable study of learning as a bottom-up emergent process.

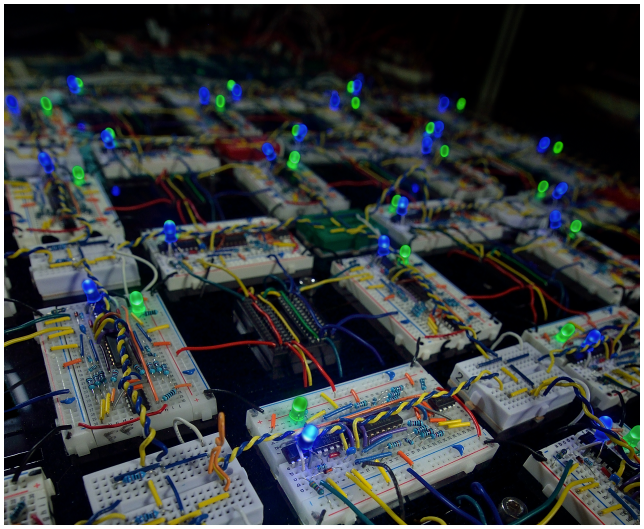

Figure 1: Second generation contrastive local learning network, capable of analog in-memory learning for analog in-memory compute