MRSEC SEMINAR SERIES

Unconventional Computing with Memristive Devices and Arrays

Memristive devices have become a promising candidate for unconventional computing. In this talk, I will present some of our recent work on unconventional computing experimentally implemented by using memristive devices or crossbar arrays. Using traditional non-volatile memristors with 64 stable analog resistance levels, we have built a dot-product engine based on a 128 x 64 1T1R crossbar array. Accurate image compression and filtering have been demonstrated with such analog computing accelerator. In addition, we have demonstrated efficient and self-adaptive *in-situ* learning in a two-layer neural networks using such memristive arrays, which is expected to significantly improve the speed and energy efficiency of deep neural networks.

Using newly developed diffusive memristors with diffusion dynamics that is critical for neuromorphic functions, we have developed artificial synapses and neurons to more faithfully emulate their biocounterparts and more efficiently perform spiking neural network functions. We have further integrated these artificial synapses and neurons into a small neural network, with which pattern classification and unsupervised learning have been demonstrated. Moreover, the diffusive memristors can be used as true random number generators for cybersecurity applications and artificial nociceptors for robotics applications.

Dr. J. Joshua Yang is a professor in the Department of Electrical and Computer Engineering at the University of Massachusetts, Amherst. He spent eight years at HP Labs leading the memristive materials and devices team before joining UMass in 2015. His current research interests are Nanoelectronics and Nanoionics, especially for energy and computing applications, where he authored and co-authored over 120 papers in peer-reviewed academic journals, and holds 83 granted and over 70 pending US Patents. He obtained his B.A. degree in mechanical engineering from Southeast University in China and PhD from the University of Wisconsin – Madison in Material Science Program in 2007.



J. Joshua Yang Dept. of Electrical and Computer Engineering University of Massachusetts, Amherst Friday, May 4, 2018 Cook Hall, Rm. 2058, 11:00a.m.-12:00p.m.



