UCF DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

# Spring 2016 Seminar Series

## MEMORY SYSTEM OPTIMIZATIONS FOR ENERGY AND BANDWIDTH EFFICIENT DATA MOVEMENT

THURSDAY, MARCH 24, 2016

11:00 AM – HEC 113

Since the early 2000s, power has been the central problem that limits the performance of computer systems, from datacenters to smartphones and wearable devices. Data movement is the primary contributor to power dissipation in nanometer ICs. Consider, for instance, the energy cost of performing a double precision addition on a graphics processing unit (GPU) implemented at the 22nm technology node: the energy required to fetch the two operands from memory is 50x greater than the energy required to move the operands from the edge of the GPU chip to its center, which itself is another 10x higher than the cost of the actual addition. This gap between the energy cost of data movement and computation is expected to widen in future computers. Thus, minimizing data movement is a first order design constraint for future computer systems.

In this talk, I will examine the first fully programmable DDRx controller that enables application specific optimizations for more energy and bandwidth efficient data movement between the processor and main memory. I will then present the memristive Boltzmann machine, a novel hardware accelerator that leverages in situ computation with RRAM technology to eliminate unnecessary data movement on combinatorial optimization and deep learning workloads. I will also overview a new data exchange mechanism using synchronized counters that enables energy efficient data movement in large last level caches.


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Mahdi Nazm Bojnordi is a Ph.D. candidate in the Department of Electrical and Computer Engineering at the University of Rochester under the supervision of Professor Engin Ipek. He received his M.Sc. in Electrical and Computer Engineering in 2006 from the University of Tehran, and his B.Sc. in Computer Science and Engineering from Shiraz University in 2003. His research is in computer architecture, with an emphasis on energy efficient computing. His graduate research has been recognized by an IEEE Micro Top Picks award in 2013, a Samsung Best Paper Award in 2013, and a Distinguished Paper Award at HPCA 2016.