University of Rochester
Department of Electrical and Computer Engineering Colloquia

Energy-Efficient Approximate Computing

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12:00 PM – 1:00 PM

Computer Studies Building (CSB) 209

Abstract: Minimizing energy consumption is a key objective in modern computing circuits and systems. Approximate computing is an emerging paradigm where circuits are deliberately designed such that their results are approximate. By giving up some arithmetic accuracy, it is possible to design circuits with dramatically lower power dissipation and smaller silicon footprint. Using approximate circuits is attractive for emerging classes of applications that are inherently tolerant to errors, which include signal processing, computer vision, machine learning, and cognitive systems. In this talk, I will first describe new methods to design approximate circuits for basic arithmetic building blocks, such as adders, multipliers and dividers. Our circuits use a novel mechanism to dynamically zoom in on the most relevant bits in input operands and approximate the remaining bits. I will show how our approximate arithmetic circuits can provide dramatic reductions in power consumption with negligible reduction in accuracy. I will then describe new automated methods to synthesize arbitrary approximate circuit accelerators. Our techniques enable designers to automatically discover large number of approximate circuits from their original circuit, by mutating the original circuit in intelligent ways and retaining the most promising mutants. I will focus on the application of approximate accelerators for deep neural networks, which recently emerged as a major success story in machine learning and artificial intelligence. I will describe how our techniques drastically simplify the underlying computation requirements for deep learning accelerators in terms of circuit area cost and power consumption without compromising accuracy. Finally, I will overview future directions for approximate systems.

Bio: Sherief Reda is an Associate Professor of Engineering and Computer Science at Brown University. He joined the Computer Engineering group at Brown in 2006 after receiving his Ph.D. in computer science and engineering from University of California, San Diego. His research interests are in the areas of energy-efficient computing, thermal-power sensing and management, and low-power design techniques. Professor Reda received a number of research awards and acknowledgments, including five best paper nominations (DATE 2002, ICCAD 2005, ASPDAC 2008, ISLPED 2010 and ICCAD 2015), two best paper awards (DATE 2002 and ISLPED 2010), and a NSF CAREER award. He is a senior member of IEEE.

Pizza and soda provided.