The Department of Electrical and Computer Engineering Presents

A DISTINGUISHED SEMINAR

TAJANA ROSING

BRAIN-INSPIRED HYPERDIMENSIONAL COMPUTING AND MACHINE LEARNING ACCELERATION FOR IOT APPLICATIONS

ABSTRACT

We live in a world where technological advances are continually creating more data than what we can cope with. With the emergence of the Internet of Things, devices will generate massive data streams demanding services that pose huge technical challenges due to limited device resources. Sending all the data to the cloud for processing is not scalable, cannot guarantee the real-time response, and is often not desirable due to privacy and security concerns. Much of IoT data processing will need to run at least partly on devices at the edge of the internet. However, running existing machine learning on traditional cores results in high energy consumption and slow processing speed. To achieve real-time performance with high energy efficiency, we need to rethink not only how we accelerate machine learning algorithms in hardware. In the first part of my talk I will discuss some strategies that have allowed our team to significantly accelerate commonly used machine learning algorithms. However, we also need to redesign the algorithms themselves using strategies that more closely model the ultimate efficient learning machine: the human brain. Hyperdimensional computing is one such strategy that is motivated by the observation that the human brain operates on high dimensional representations of data. This, in turn, enables robust and highly efficient implementation of most commonly used learning algorithms in both software and hardware. In the second part of my talk I will discuss the development of an efficient learning platform that leverages hyperdimensional computing models and the design of software and hardware architectures that are multiple orders of magnitude more energy efficient while being just as accurate as the state of the art.

May 6, 2019

WCH 205/206

11:10 a.m. - 12:00 p.m.

BIOGRAPHY

Tajana Šimunić Rosing is a Professor, a holder of the Fratamico Endowed Chair, IEEE Fellow, and a director of System Energy Efficiency Lab at UCSD. Her research interests are in energy efficient computing, cyber-physical and distributed systems. She is leading a number of projects, including efforts funded by DARPA/SRC JUMP CRISP program, with focus on design of accelerators for analysis of big data, a project focused on developing AI systems in support of healthy living, SRC funded project on IoT system reliability and maintainability, and NSF funded project on design and calibration of air-quality sensors and others. She recently headed the effort on SmartCities that was a part of DARPA and industry funded TerraSwarm center. Tajana led the energy efficient datacenters theme in MuSyC center, and a number of large projects funded by both industry and government focused on power and thermal management. Tajana's work on proactive thermal management and ambient-driven thermal modeling was instrumental in laying the groundwork in this field, and has since resulted in a number of industrial implementations of these ideas. Her research on event driven dynamic power management laid the mathematical foundations for the engineering problem, devised a globally optimal solution and more importantly defined the framework for future researchers to approach these kinds of problems in embedded system design. From 1998 until 2005 she was a full time research scientist at HP Labs while also leading research efforts at Stanford University. She finished her PhD in EE in 2001 at Stanford, concurrently with finishing her Masters in Engineering Management. Her PhD topic was dynamic management of power consumption. Prior to pursuing the PhD, she worked as a senior design engineer at Altera Corporation. She has served at a number of Technical Paper Committees, including being an Associate Editor of IEEE Transactions on Mobile Computing, an Associate Editor of IEEE Transactions on Circuits and Systems, and a Guest Editor for the Special Issue of IEEE Transactions on VLSI.

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