COMPLEX SYSTEMS, COMPUTING AND POWER FRONTIERS

Xin Fu

Ph.D. – University of Florida

Associate Professor, Electrical and Computer Engineering

Principal Investigator, Efficient Computer Systems (ECOMS) Lab

Publications

1. X. Zhang, S. L. Song, C. Xie, J. Wang, W. Zhang, and X. Fu, Enabling Highly Efficient Capsule Networks Processing Through A PIM-Based Architecture Design, International Symposium on High-Performance Computer Architecture, 13 pages, 2020.

2. C. Xie, X. Fu, M. Chen, and S. L. Song, OO-VR: NUMA Friendly Object-Oriented VR Rendering Framework for Future NUMA-Based Multi-GPU Systems, International Symposium on Computer Architecture, 13 pages, 2019.

3. C. Xie, X. Zhang, A. Li, X. Fu, and S. L. Song, PIM-VR: Erasing Motion Anomalies In Highly-Interactive Virtual Reality World With Customized Memory Cube, International Symposium on High-Performance Computer Architecture, 13 pages, 2019.

4. X. Zhang, C. Xie, J. Wang, W. Zhang, and X. Fu, Towards Memory Friendly Long-Short Term Memory Networks (LSTMs) on Mobile GPUs International Symposium on Microarchitecture, 12 pages, 2018.

5. C. Xie, X. Fu, and S. L. Song, Perception-Oriented 3D Rendering Approximation for Modern Graphics Processors, International Symposium on High-Performance Computer Architecture, 13 pages, 2018.

6. C. Xie, S. L. Song, J. Wang, W. Zhang, and X. Fu. Processing-in-Memory Enabled Graphics Processors for 3D Rendering. International Symposium on High-Performance Computer Architecture, 12 pages, 2017.

7. K. Yan, X. Zhang, J. Tan, and X. Fu. Redefining QoS and Customizing Power Management to Satisfy Individual Mobile Users. International Symposium on Microarchitecture, 12 pages, 2016.

8. K. Yan, X. Zhang, and X. Fu. Characterizing, Modeling, and Improving the QoE of Mobile Devices with Low Battery Level. International Symposium on Microarchitecture, 12 pages, 2015.

Dr. Fu is a recipient of several awards including the 2014 NSF Faculty Early CAREER Award, the 2012 Kansas NSF EPSCoR First Award, and the 2009 NSF Computing Innovation Fellow award. As an NSF Computing Innovation Fellow, she joined the Computer Science Department at the University of Illinois at Urbana-Champaign, Urbana from 2009 to 2010. From 2010 to 2014, she was an Assistant Professor in the Department of Electrical Engineering and Computer Science at the University of Kansas, Lawrence. Thereafter, she joined the Electrical and Computer Engineering Department at the University of Houston where she conducts research in areas that include computer architecture, machine learning, high-performance computing, energy-efficient computing, mobile computing, and virtual reality/augmented reality.

VIRTUAL REALITY (VR) USER EXPERIENCE ENHANCEMENT

Driven by the significant performance improvement of computing hardware and the revolution of graphics and display technologies, virtual reality (VR) is now experiencing a rapid growth and debuting into mainstream markets. However, the long reponse time and high energy consumption are still the major obstacles to providing a rich experience to VR users. Dr. Fu's group has developed a set of new technologies to significantly reduce the response time and energy consumption, thus, satisfying VR users. Specifically, Dr. Fu has integrated new memory technology (e.g., hybrid memory cube) into graphics processors to speedup the VR experience and obtain substantial energy savings. Moreover, software and hardware co-optimizations are conducted to amortize the memory pressure during VR rendering, and approximate computing is also explored to reduce the VR rendering time and save energy without diminishing image quality.

REAL-TIME AND IN-SITU MACHINE LEARNING

Neural networks (NN) are being increasingly adopted in various real-world applications (e.g. autonomous vehicles, rescue robots, drones, smart homes, IoT systems) to learn models from the raw data aggregated by edge devices, hence, providing accurate prediction and decision-making. These real-world applications generally have emergent requirements on real-time learning for NNs to keep the models up to date and adapt to the sudden changes in the circumstance that undermines the model accuracy. Dr. Fu's group conducts real-time and in-situ learning for NNs locally on edge devices. Specifically, Dr. Fu has explored hardware-software co-designs to accelerate recurrent NNs (RNNs) from both latency and energy compustion perspectives, and also developed a novel hardware design that is built on the new memory technology (e.g., hybrid memory cube) for highly efficient capsule networks processing.

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