Temple University
College of Engineering

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ROBUST COMPUTING AGAINST UNRELIABLE HARDWARE

Xun Jiao, Assistant Professor

Electrical and Computer Engineering, Villanova University

Abstract: Recent breakthroughs in microelectronic scaling and artificial intelligence (AI) have brought tremendous capacity and performance advantages that continue to drive new devices and systems from high-performance computing to low-power edge devices. However, as transistor size continues to scale down to deep nanometer, microelectronic circuits are increasingly susceptible to faults/errors such as variation-induced timing errors and radiation-induced soft errors. These errors often manifest as incorrect computations which can ultimately lead to wrong results or degraded services in various applications such as AI. In this presentation, I will discuss our study on robust computing against unreliable hardware. Firstly, I will present our research on modeling microelectronic variation-induced timing errors using machine learning methods. Secondly, I will describe our research on evaluating the impact of hardware errors on AI model quality by developing PyTorch-based error injection tool. Lastly, I will discuss our efforts on improving the computing robustness against hardware errors using software and hardware solutions.

Biography: Dr. Xun Jiao is an assistant professor at the ECE department of Villanova University. He obtained his Ph.D. from UC San Diego in 2018. Dr. Jiao's research interests include resilient computing and AI, approximate computing, and software-hardware codesign. He received 6 paper awards/nominations in conferences such as DATE and EMSOFT. He published 60+ papers in international conferences such as DAC, ICCAD, DATE, and journals such as TCAD, TC, and TNNLS. He is an associate editor of IEEE Trans on CAD, and a TPC member of DAC, ICCAD, ASP-DAC. He served as the general chair of DACPS workshop 2023. His research is sponsored by NSF, NIH, L3Harris, and Nvidia. He is the recipient of 2022 IEEE Philadelphia Section Young Engineer of the Year Award. He has delivered an invited presentation at the U.S. Congressional House.