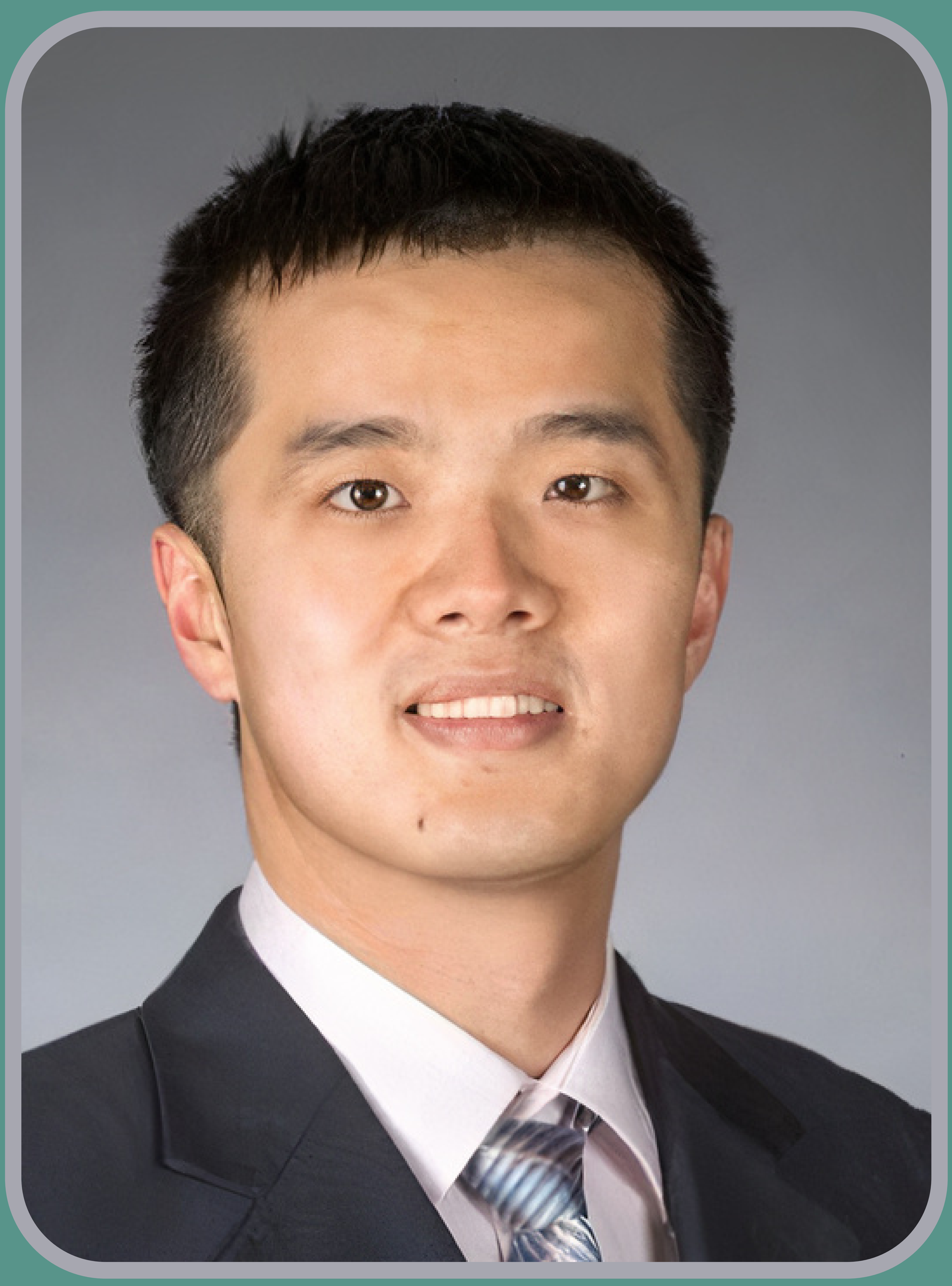
College of Engineering and Computing
Department of Electrical and Computer Engineering
Spring 2022 ECE Distinguished Seminar Series

Hardware-aware Machine Learning for Real-Time Cine Magnetic Resonance Imaging Assisted Cardiac Intervention



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Abstract

Real-time cine Magnetic Resonance Imaging (MRI) has enabled fast and accurate visual guidance in various cardiac interventions, such as aortic valve replacement and electrophysiology for atrial arrhythmias. In these applications, it is strongly desirable to segment the temporal frames on-the-fly, satisfying both throughput and latency requirements. In addition, considering reliability and patient data privacy, the computation is done on local hardware. With limited computing power, most state-of-the-art MRI segmentation methods are used either offline because of their high computation complexity or in real-time but with significant accuracy loss and latency increase, causing visually noticeable lag.

In this talk, I will present our solutions spanning both software and hardware stacks to effectively address this issue. Specifically, I will demonstrate a novel statistical neural network that can handle temporal MRI frames with high efficiency, followed by a hardware-aware neural architecture search that can automatically identify the best neural architectures for the hardware platform. I will conclude my talk with a clinical application demo of these frameworks.

Brief Bio-Sketch

Dr. Yiyu Shi is currently a professor in the Department of Computer Science and Engineering at the University of Notre Dame, the site director of National Science Foundation I/UCRC Alternative and Sustainable Intelligent Computing, and the director of the Sustainable Computing Lab (SCL). He is also a visiting scientist at Boston Children's Hospital, the primary pediatric program of Harvard Medical School. He received his B.S. in Electronic Engineering from Tsinghua University, Beijing, China in 2005, the M.S and Ph.D. degree in Electrical Engineering from the University of California, Los Angeles in 2007 and 2009 respectively.

His current research interests focus on hardware intelligence and biomedical applications. In recognition of his research, more than a dozen of his papers have been nominated for or awarded as the best paper in top journals and conferences, including the 2021 IEEE Trans on CAD Donald O Pederson Best Paper Award. He was also the recipient of IBM Invention Achievement Award, NSF CAREER Award, IEEE Region 5 Outstanding Individual Achievement Award, IEEE Computer Society TCVLSI Mid-Career Research Achievement Award, Facebook Research Award, among others. He is the deputy editor-in-chief of IEEE VLSI CAS Newsletter, and an associate editor of various IEEE and ACM journals.

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