USC Viterbi
School of Engineering
Ming Hsieh Department of Electrical and Computer Engineering

Seminar

Large-Scale Photonic Circuits for AI Computing and Metrology

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Date: Tuesday, March 26 2024
Time: 2:00pm – 3:30pm
Location: EEB 248

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Meeting ID: 971 7957 6404
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Abstract: The rapid expansion of artificial intelligence (AI), internet of things (IoT) and 5G/6G mobile networks is creating an urgent need for energy-efficient, scalable computing hardware. Optical computing is emerging to enable new computing paradigms with high optical bandwidth, parallel processing, and low-loss data movement. However, the scalability of existing optical accelerators is limited by the electro-optic conversion efficiency, large photonic device footprints, lack of optical nonlinearity, etc. In this talk, I will present our computing approaches to overcomes these bottlenecks with hyperdimensional multiplexing. Our experimental results have realized large-scale AI processing in models with half a million parameters, a full-system energy efficiency at few femtojoule per operation (fJ/OP) and computing density of 6 TOP/($mm^2 \cdot s$). This computing efficiency and density outperform the state-of-the-art digital processors for the first time, with 100 folds improvement. In the last part, I will cover some interferometry techniques based on laser frequency combs for broadband, high-speed precision sensing and metrology at quantum-limited sensitivity.

Biography: Zaijun Chen is a research assistant professor at the Ming Hsieh Department of Electrical and Computer Engineering at USC. He accomplished his Ph.D. degree (summa cum laude) in Prof. Theodor W. Haensch's (Nobel laureate 2005) group at Max-Planck Institute of Quantum Optics (MPQ) in 2019, and postdoc with Prof. Dirk Englund at MIT. He is a recipient of 2023 SPIE best paper award for Machine learning and Artificial intelligence, 2023 Sony faculty Innovation Award, 2023 Optica Foundation Challenge Award, and leading PI in a 2023 DARPA project (NaPSAC). He is an early career editor of *Advanced Photonics*.