

KEYNOTE/PLENARY

Title:

Beyond Electronics: Harnessing Light to Accelerate AI Workloads

Speaker:

Prof. Haibo Zhang

Associate Professor, School of Computer Science and Engineering, UNSW Sydney

Abstract

The rapid evolution of AI, particularly driven by the large language models and their widespread adoption across diverse domains, has led to an exponential surge in AI computational workloads. As deep learning models and training datasets continue to grow in scale and complexity, these workloads have become increasingly compute-intensive, memory-bound, and energy-hungry. While electronic accelerators such as GPUs and TPUs have significantly improved the computational throughput, their performance and energy efficiency are increasingly constrained by the slowing of Moore's Law and the end of Dennard scaling.

Photonic computing and communication, which use light rather than electricity for computation and data transfer in the optical domain, have emerged as a compelling alternative to traditional electronic platforms. This keynote will explore how photonic technologies can address key bottlenecks in handling AI workloads from two complementary perspectives: (1) photonic computing, which enables fast and energy efficient execution multiply-and-accumulate (MAC) and matrix multiplication operations that are at the heart of AI workloads; and (2) photonic communication, which leverages on-chip and chip-to-chip optical interconnects to overcome the memory bandwidth limitations and support scalable AI training and inference. By aligning device-level photonic capabilities with system-level architectural design, this talk will outline a forward-looking roadmap toward energy-efficient and high-performance photonic computing architectures to support next-generation AI workloads, positioning photonic technologies not as a replacement, but as a critical enabler for the next era of high-performance computing.

Biography



Dr Haibo Zhang is an Associate Professor in the School of Computer Science and Engineering, UNSW Sydney. His research spans photonic computing and communication, embedded systems, computer networks, and applied machine learning. Dr Zhang has authored over 150 peer-reviewed publications, including many in prestigious venues such as ACM SIGCOMM, IEEE INFOCOM, and IEEE/ACM Transactions. He has received two conference Best Paper Awards and has served as Program Chair or Co-Chair for 17 international conferences, including ITNAC 2016. He is currently leading pioneering research in ultra-fast, energy-efficient and scalable photonic computing. In 2024, he led the development a photonic computing testbed at ANU to support experimental research in this emerging field. More information about his work is available at: <https://haibo Zhang-web.github.io>