

Research Statement

Yuyang Wang

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In the dynamic landscape of distributed computing, the exponential growth in traffic demands within data centers and high-performance computing systems has been distinctive, fueled by a deluge of data-intensive workloads. This trend is prominently exemplified by the rapid expansion of machine learning, big data analytics, and most notably, deep learning (DL)–driven artificial intelligence (AI) applications. The recent advent of large language models, which has revolutionized natural language processing and creative content generation, is propelling the broad adoption of ever-larger models and datasets, marking a significant milestone toward the era of data ubiquity. The continued scaling of these applications has pushed the limits of computational hardware, notably via increased parallelism and specialization. Yet, this rapid progress has outpaced the evolution of the underlying communication infrastructure, rendering chip-to-chip data movement a formidable barrier impeding performance and energy efficiency. This communication bottleneck has become the grand challenge to the quest of upscaling the computing systems toward exascale. Tackling this burgeoning challenge, my research seeks **transformative connectivity solutions** harnessing the potential of integrated silicon photonics.

Research Foundation

My interdisciplinary research vision is positioned at the intersection of electronics/photonics, devices/systems, and design/applications. It necessitates a collaborative synthesis across various subdomains, which I conceptualize along two orthogonal dimensions, as depicted in Fig. 1.

References