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Abstract
Photonic neural networks (PNN) are a promising alternative to electronic GPUs to perform machine-learning tasks. The PNNs value proposition originates from i) near-zero energy consumption for vector matrix multiplication once trained, ii) 10-100 ps short interconnect delays, iii) weak required optical nonlinearity to be provided via fJ/bit efficient emerging electrooptic devices. Furthermore, photonic integrated circuits (PIC) offer high data bandwidth at low latency, with competitive footprints and synergies to microelectronics architectures such as foundry access. This talk discusses recent advances in photonic neuromorphic networks and provides a vision for photonic information processors. Details include, 1) a comparison of compute performance technologies with respect to compute efficiency (i.e. MAC/J) and compute speed (i.e. MAC/s), 2) a discussion of photonic neurons, i.e. perceptrons, 3) architectural network implementations, 4) a broadcast-and-weight protocol, 5) nonlinear activation functions provided via electro-optic modulation, and 6) experimental demonstrations of early-stage prototypes. The talk will open up answering why neural networks are of interest, and concludes with an application regime of PNN processors which reside in deep-learning, nonlinear optimization, and real-time processing.