

Radio Frequency Neural Networks

Tingjun Chen

Duke University

E-mail address: tingjun.chen@duke.edu

Abstract:

Modern edge devices, including cameras, drones, and Internet-of-Things nodes, increasingly rely on machine learning to support intelligent applications. However, running machine learning models directly on resource-constrained edge devices often requires substantial memory and computational power, making real-time inference difficult with conventional digital computing architectures. In this talk, I will present WISE, a computing architecture for wireless edge networks that enables radio-frequency neural networks. WISE introduces two key ideas: first, disaggregated model access, where model parameters are delivered through over-the-air wireless broadcasting to support simultaneous inference across multiple edge devices; and second, in-physics computation, where general complex-valued matrix-vector multiplications are performed directly at radio frequency using a single frequency mixer. Together, these ideas point toward a new way of building low-power, scalable, and wireless-native machine learning systems at the edge.