

Miles Stoudenmire

New Directions for Tensor Networks: Machine Learning and Quantum Computing

After motivating and introducing tensor networks, primarily matrix product states, I will briefly review their uses in physics but then switch perspectives, discussing how these tools which were originally designed for modeling wavefunctions can be applied more broadly. A promising application is to use tensor networks to represent adjustable parameters or "weights" of models used in machine learning. After introducing machine learning and the tensor network framework in detail, I will discuss various recent works that have built on this idea with encouraging results. A particularly interesting benefit of tensor network machine learning models is that the exact same models can be implemented on both classical and quantum hardware. This supports a perspective of a quantum computer as a specialized device for contracting tensor networks, and I will present results showing that tensor network models have many useful aspects in a quantum machine learning context.