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Session K00: Poster Session II (4pm-6pm CDT)

4:00 PM, Wednesday, June 5, 2024
Room: Hall BC

Abstract: K00.00087 : Enhanced Measurement of Neutral Atom Qubits with Machine Learning*

← Abstract →

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The ability to make high-fidelity qubit measurements with minimal collateral disruption to the system is not only relevant to initialization and final read-out -- it is also essential to achieving quantum error correction on a universal quantum computation. Qubit state measurements in a neutral atom array are achieved by probing the array with light detuned from a cycling transition and capturing resulting fluorescence with a high quantum efficiency imaging device, producing a greyscale image of the neutral atom array. Conventionally, to achieve a fidelity above 99%, the typical probing period is several ms. This is a significant delay, given that the longest gate operation only takes several ns.

In this poster, we demonstrate qubit state measurements assisted by a supervised convolutional neural network (CNN) in a neutral atom quantum processor. We present two CNN architectures for analyzing neutral atom qubit readout data: a compact 5-layer single-qubit CNN architecture and a 6-layer multi-qubit CNN architecture. We benchmark both architectures against a conventional Gaussian threshold analysis method. We demonstrate up to 56% reduction of measurement infidelity using the CNN compared to a conventional analysis method. This work presents a proof of concept for a CNN network to be implemented as a real-time readout processing method on a neutral atom quantum computer, enabling faster readout time and improved fidelity.

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