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Implementing Machine Learning Methods on QICK Hardware for Qubit Readout

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Quantum readout and control is a fundamental aspect of quantum computing that requires accurate measurement of qubit states. Errors emerge in all stages, from initialization to readout, and identifying errors in post-processing necessitates resource-intensive statistical analysis. In our work, we use a lightweight fully-connected neural network (NN) to classify states of a superconducting transmon system. Our NN accelerator yields higher fidelities (92%) than the classical matched filter method (84%). By exploiting the natural parallelism of NNs and their placement near the source of data on field-programmable gate arrays (FPGAs), we can achieve ultra-low latency (˜1µs) below decoherence on the Quantum Instrumentation Control Kit (QICK). Integrating machine learning methods on QICK opens several pathways for efficient real-time processing of quantum circuits.

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