## <u>11/16/23 Modified: Kernel-based training of quantum models. Schuld, M.</u>





**Purpose:** Thoroughly analyze the effects adding quantum parameters has on model performance

**Plan:** 1) Improve runtimes by switching from lightning.gubit to lightning.gpu guantum device

- 2) Improve runtimes by switching from parameter-shift to adjoint differentiation method
- 3) Run 3 sets of 10 experiments: Increasing Layers 1-10 for 'CNOT', 'CZ', and 'CY' imprimitives
- **Experimental:** Using a Python IDE, 30 experiments were completed to determine accuracies of the Iris 2 Class dataset, the test loss, and model runtimes



**Results:** All experiments with at least 4 Ansatz Layers achieved 100% Test Accuracy. The CY based circuit with 8 Layers achieved the best Loss minimum of 0.035. Runtimes for 10 Layers favored 'CNOT' at 95.8s, followed by 'CY' at 104.2s, and 'CZ' at 104.2s. A separate embedding guantum circuit in the demonstration also achieved perfect test accuracy 123



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