

Planck'd 2025: Quantum Machine Learning Track

Team: The Debug Bar

Results

Run: .\Planckd2025\Submission\results\cnn

Accuracy: 0.9650
ROC-AUC: 0.9990
Loss: 0.1238

Run: .\Planckd2025\Submission\results\svm

Accuracy: 0.9315
ROC-AUC: 0.9968

Run: .\Planckd2025\Submission\results\vqa

Accuracy: 0.8755
ROC-AUC: 0.9812
Loss: 1.0798

Methods

Classical baselines include a convolutional neural network and an SVM with scaling and PCA. The hybrid model uses a small convolutional feature extractor mapped into an 8-qubit variational circuit built with PennyLane, followed by a linear classifier.

Training used MNIST with default subset sizes for quick iteration. Batches of 128 and 3 epochs were used for the CNN and hybrid model; SVM trained on flattened images with PCA to 64 components.

Quantum model execution

The quantum layer ran on a simulator backend (PennyLane default.qubit) using expectation values without shot noise. The circuit used AngleEmbedding, layerwise Rot gates, and CZ entanglers across 8 wires.

Analysis and limitations

The CNN achieved higher accuracy than the hybrid model in these settings. This aligns with expectations: shallow circuits with limited qubits and basic encodings can underperform strong classical baselines. Contributing factors include feature-encoding bottlenecks, shallow depth, optimization difficulty, and simulator constraints. These findings constitute well-documented negative results.

Reproducibility

All dependencies are listed in requirements.txt. Scripts accept standard flags for seeds, CPU/GPU selection, and dataset subset sizes. CI includes smoke tests for all models.