Quantum-Based Binary Classification of Histological Images of Salivary Glands with Sjögren Syndrome

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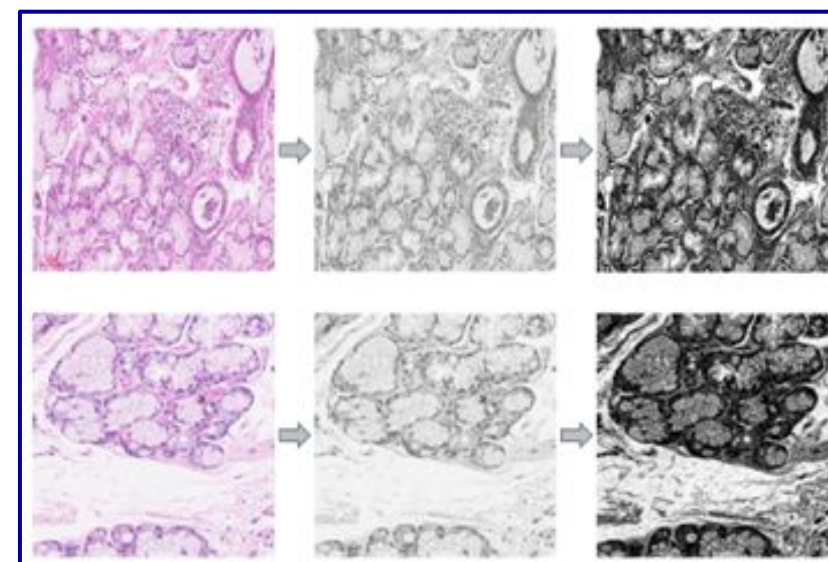Universidad Nacional de Colombia

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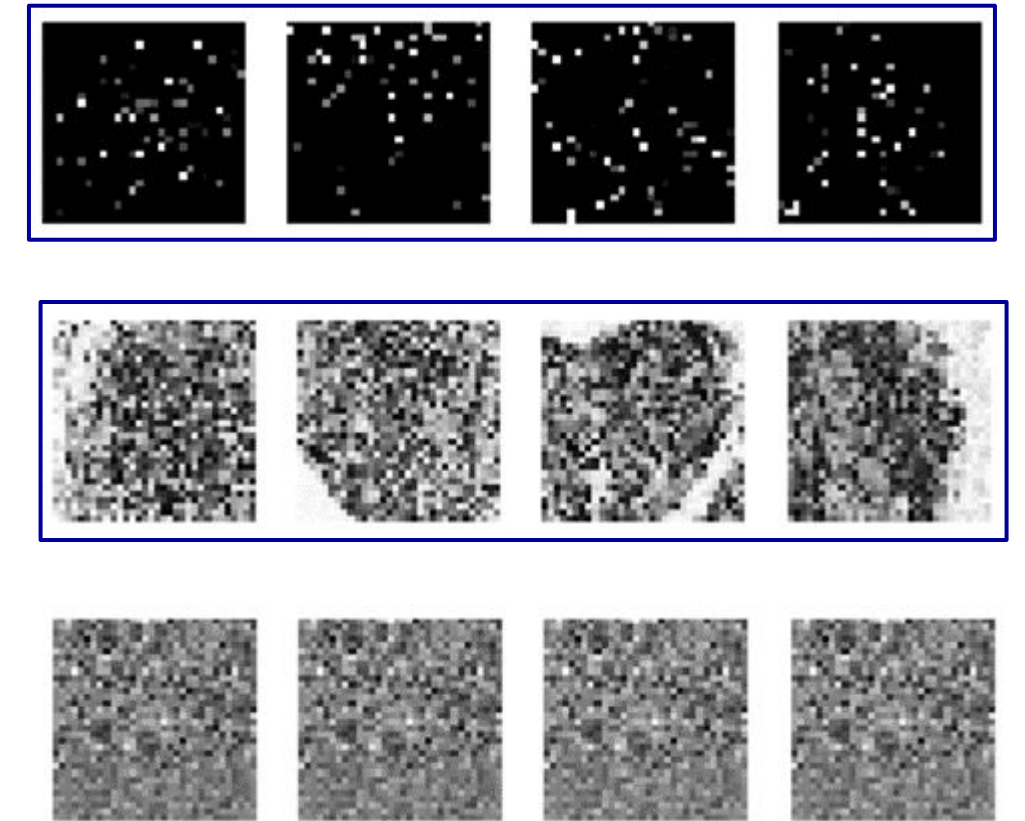Computer Systems Engineering
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Objective

The aim of this study is to evaluate and contrast the performance of two neural network architecture: one incorporating a quanvolutional layer and the other utilizing a classical convolutional layer. A series of experiments is conducted to accomplish this. Additionally, as an initial exploration, a variational quantum classifier employing transfer learning is tested.
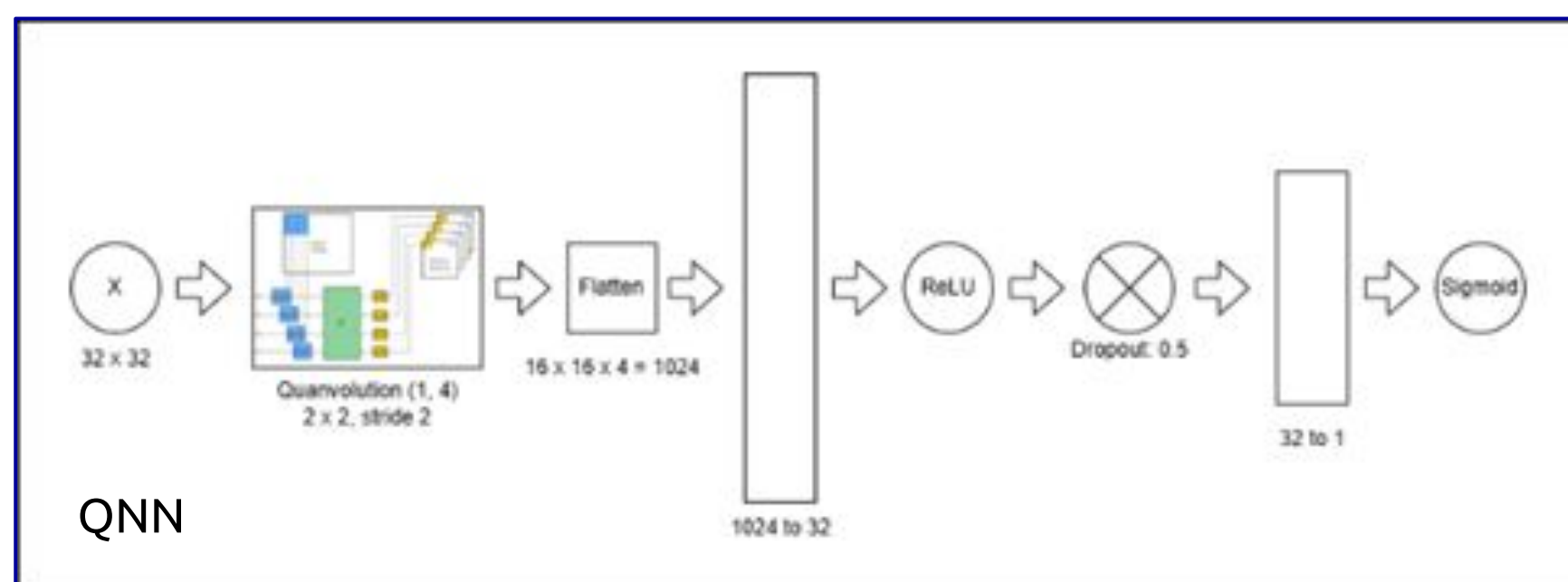
Dataset Preprocessing

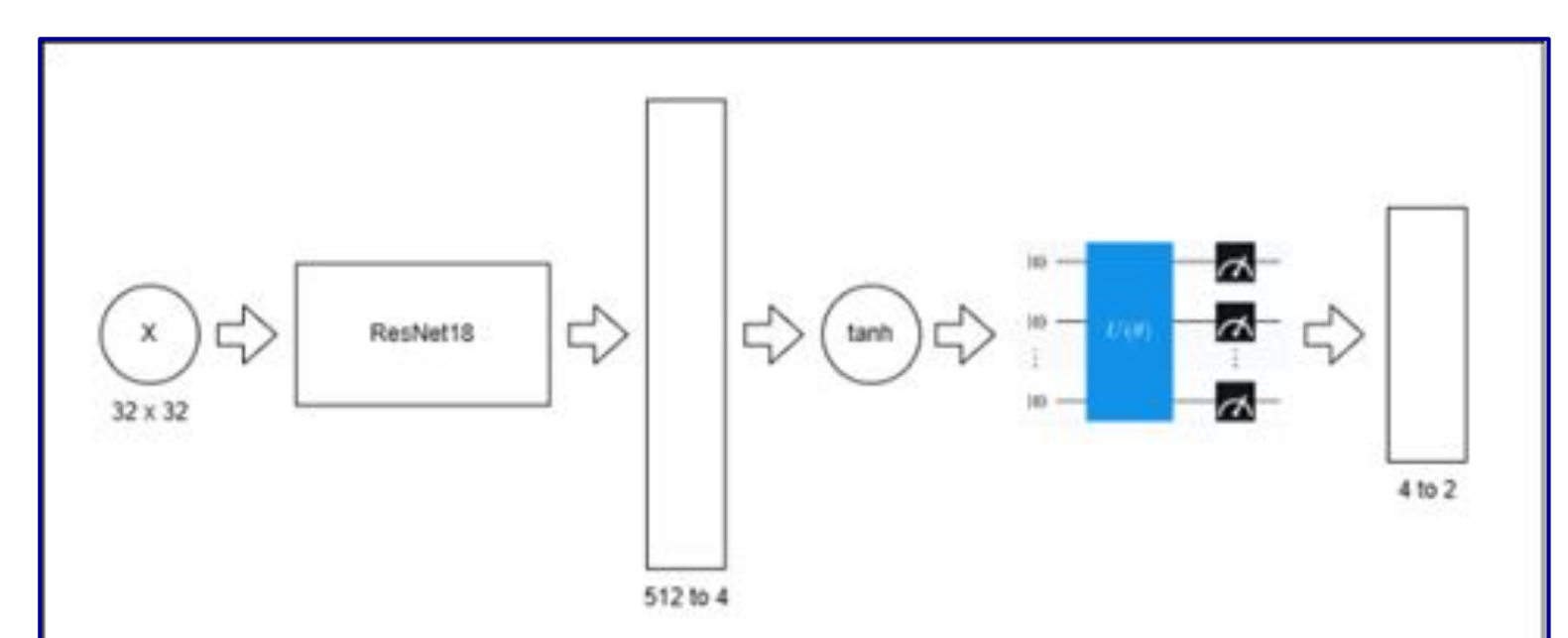Grayscale Conversion + Histogram Equalization

3 Versions of the same dataset: downsampled (28 x 28), original resized (32x 32), MedViT Features
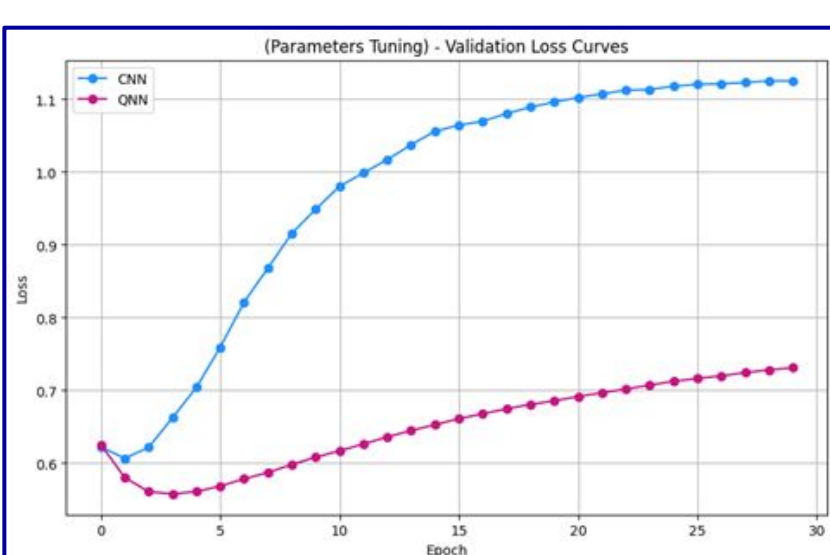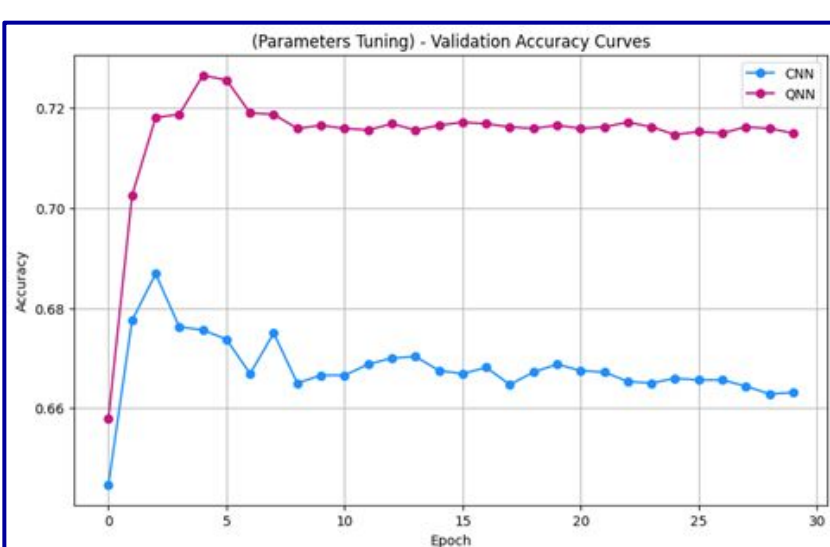
QNN/CNN Architectures

QNN

CNN architecture is the same as QNN replacing the quanv. layer for a classic one
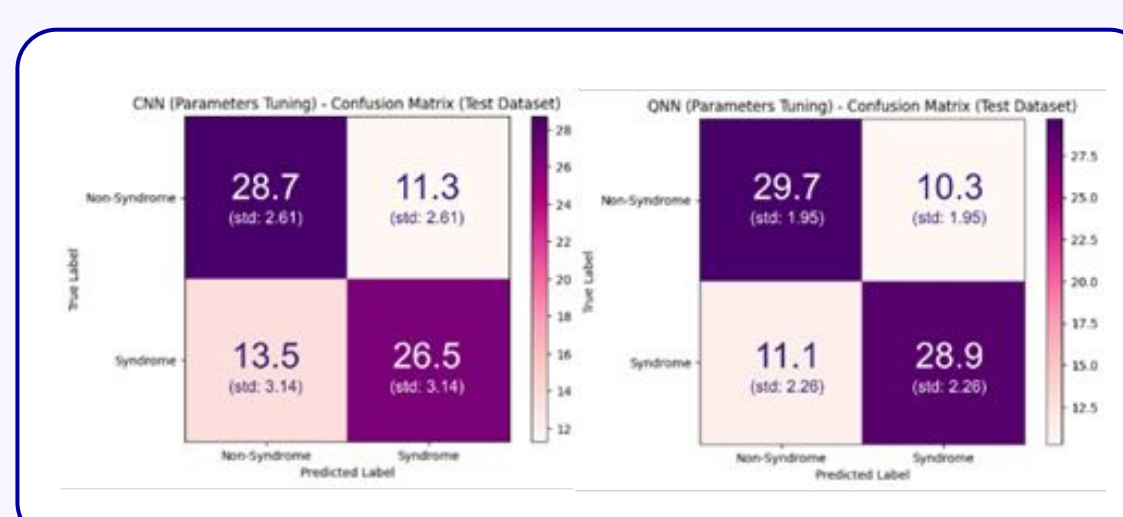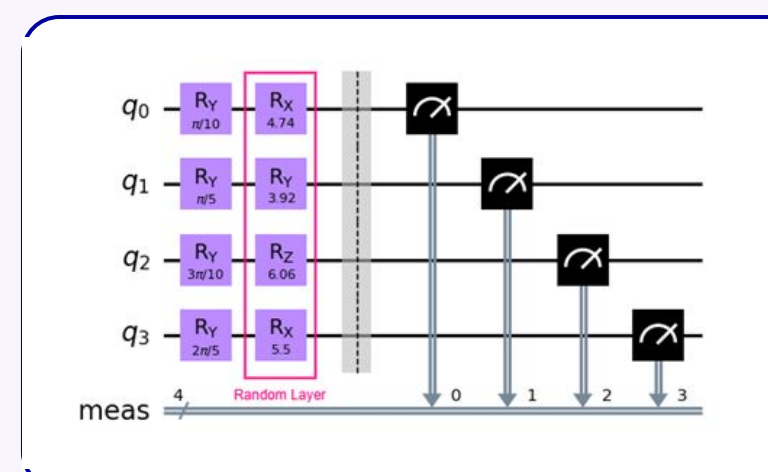
Transfer Learning Architecture

QNN/CNN Results

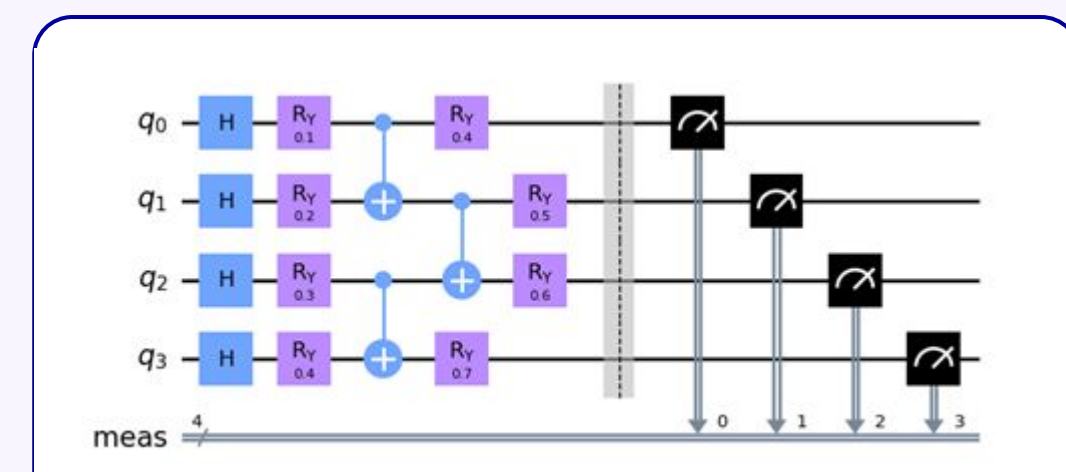| Metric	QNN	CNN
Accuracy	0.73250000	0.69000000
Precision	0.73832343	0.70399016
Recall	0.72250000	0.66250000
F1-Measure	0.72920578	0.67933588

TL Results

QNN Circuit

TL VQC

Conclusions

- Apparent QNN Superiority
- MedViT Features Not Working in Quantum Approaches
- Data Augmentation Increases QNN Peformance
- Extra Quanvolutional Layer Reduces Performance
- Future Work: Data Augmentation + Tuning, Pre-Set Circuits, QNN Layer Parameters Exploration, MedViT Features Leverage in Quantum Approaches, Transfer Learning Approaches Experimentation
- https://www.youtube.com/watch?v=E93dtL7zJ2w