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Pneumonia Classification from Chest X-Rays Using a Quantum Spiking Neural Network

The increasing use of neural networks in medical image analysis has motivated the exploration of alternative computational paradigms, including Quantum Spiking Neural Networks (QSNNs). These models combine quantum computing principles with the temporal processing characteristics of spiking neurons. In this work, we explore their application to chest X-ray classification using the PneumoniaMNIST dataset.

A previously published QSNN architecture based on the QLIF neuron is implemented with a proposed memory formulation that introduces the expected exponential decay of the neuronal state. The network is trained to classify chest X-ray images into “Pneumonia” and “Normal”, and its performance is evaluated using a test set. The evolution of the training loss, classification results, and neuronal memory dynamics are analyzed to characterize the behavior of the proposed model.

The results indicate that the proposed QSNN is capable of learning meaningful distinctions between the two classes. This study establishes a reproducible basis for further investigation of QSNNs in image classification, including evaluations across multiple random seeds and future experiments involving quantum noise models and real hardware implementations.

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