

Presented at 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023),
Waseda University, Tokyo, Japan, August 20-25, 2023

Investigation of Barren Plateaus in Quantum Neural Network Development

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Abstract

Training of Quantum Neural Networks (QNN) inherits the flaws of Machine Learning itself, which includes the emergence of large flat areas in the cost function landscape, known as Barren Plateaus, which impede the convergence of gradient-based QNN optimisers.

This project, therefore, aimed to investigate the effectiveness of three different approaches used in dealing with barren plateaus in various QNN developmental circumstances.

Each approach was applied to QNN circuit structures of different depth, the number of qubits and methods of parameters initialisation. The barren plateaus mitigation strategies were then evaluated by analysing the QNN random gradient landscape, as well as, their performance on the selected classification problem.