QCBM Documentation 2

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30 November 2024

1 Model Description

Training Data: RELU + Sigmoid Distribution
Pre-training: Particle number distribution
Number of qubits: 6
Loss Function: MMD Loss
Kernel: Gaussian RBF kernel
Accuracy: KL Divergence
Learning rate: 1.0
Optimizer: optax.adam

2 Observations

2.1 Uniform superposition Pre - Training

S.No	qcbm circuit	Layers	min KL Div	Model
1	RX + RZ + CNOT	$\geq 3layers$	10^{-2}	Converges
2	RZ + IsingXY + IsingZZ	$\geq 2layers$	10^{-2}	Converges

Table 1: Model convergence based on different qcbm circuits

2.2 No Pre - Training

S.No	qcbm circuit	Layers	min KL Div	Model
2	RX + RZ + CNOT	$\geq 2layers$	10^{-2}	Converges
4	RZ + IsingXY + IsingZZ	-	inf	Doesn't Converge

Table 2: Model convergence based on different qcbm circuits

3 Conclusion

Pre-training the model with particle number distribution, as expected only helps in the case of Ising entangling gates.

The performance of the circuit RZ + IsingXY + IsingZZ with the pre-training scheme of uniform superposition of all the possible particle number states leads to convergence upto the same order of KL divergence as that of fully entangled circuit i.e., RX + RZ + CNOT with same number of layers.