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Estimating unknown qubit phase under telegraph noises using Recurrent Neural Network

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Machine learning techniques have been widely used for many complex systems including quantum systems with noisy environments. In this work, we are interested in a system of qubits affected by the random-telegraph noise that could destroy the qubit coherence. We construct a theoretical model including one logical qubit and one probing qubit, the latter of which can be measured at various times and with various measurement bases to collect information of the unknown fluctuating noise. We then use the recurrent neural network (RNN), in particular the Long short-term memory (LSTM) model, to process the measurement readouts obtained from the probe qubit and train the machine to learn how to estimate the correct phase of the logical qubit. We show numerical results of the random qubit phase affected by the random noise and the estimation accuracy from the LSTM. The accuracy does depend on different parameters of the machine as well as the qubit sensitivity to noise.

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