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Robust quantum dot charge autotuning with Bayesian Neural Networks

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Quantum dots must be tuned to a specific charge regime before being used for qubit operation. This calibration procedure requires measuring the stability diagram and finding the proper gate voltages to confine one electron in the dot. Currently, this operation is performed manually, which is time-consuming and therefore not desirable for a large-scale quantum system. To overcome this limitation, autotuning protocols based on machine learning techniques were suggested. However, this approach generally lacks robustness when applied to noisy diagrams, since only one misclassification can lead to unexpected failures of the tuning procedure. In this work, we propose to train a Bayesian Neural Network for the task of charge transition detection. The uncertainty provided by this model gives valuable information about the quality of the measurement and the confidence of the detection, which allows us to design a robust procedure for single dots autotuning. This approach has been successfully validated on experimental stability diagrams from two different quantum dot technologies.

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