**Automatic Characterization of Fluxonium Superconducting Qubits Parameters with Deep Transfer Learning**

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Accurate determination of qubit parameters is a critical step in the successful implementation of quantum information and computation applications. In solid-state systems, individual qubits’parameters lack universality across the entire system, and hence qubit characterization was forced to rely on time-consuming measurements and manual-fitting processes. In this work, we propose a machine learning-based methodology to automatically and accurately initialize parameters of a fluxonium qubit, which is known to be a promising alternative qubit with a more complicated physical and spectral structure but higher fidelity operations than transmon qubits. The input features we utilized are the energy spectrum calculated by a model Hamiltonian with various magnetic fields, and the output is the essential parameters of a fluxonium qubit, EJ , EC , and EL. The machine learning results are remarkably accurate (with an accuracy ∼ 94%), and hence an automatic fitting procedure can be readily obtained for direct application to realistic experimental data. Moreover, we find that similar accuracy can still be retrieved even when the input experimental spectrum is fuzzy or incomplete, demonstrating the general reliability of our model for future extension to other fluxonium qubits or different solid-state systems. As a result, we believe that our automated characterization method based on the transfer learning approach paves the way for the construction of large-scale quantum processors in the future.