FRQI

This program is designed to simulate and analyze a quantum circuit for image processing tasks.

1. Define Quantum Circuit:

- The qc, qc1, and qc2 circuits are defined with 3 qubits, representing pixels in an image.
- The theta parameter controls the initial state of the qubits (black, white, or grey).
- A series of controlled-RY and CNOT gates are applied to manipulate the qubits, potentially representing image processing operations.
- The circuits are measured to obtain the final state of the qubits.

2. Simulate and Analyze Circuit:

- The transpile function converts the circuits to a format suitable for the simulator.
- The aer_sim.run function executes the circuit on the simulator.
- The result.get_counts function extracts the measurement results.
- The plot_histogram function visualizes the distribution of measurement outcomes.
- The qc1.depth() and qc1.count_ops() functions provide information about the circuit's depth and gate counts.

3. Transpile to Target Basis:

- The BasisTranslator pass is used to rewrite the circuit using only u3 and cx gates.
- The transpiled circuit is analyzed for depth and gate counts.

Overall:

The code simulates quantum circuits for image processing, focusing on the effects of different initial states and gate operations. The analysis includes circuit depth, gate counts, and measurement outcomes. The transpilation step demonstrates how the circuit can be optimized for specific hardware constraints.