Instructions of Participation

Brief overview of the entire process:

1. Familiarising yourself with the web application
2. Task 1
3. Task 2
4. Completing post-task survey and giving feedback

In depth instructions:

1. Familiarising yourself with the web application

The web application allows you to create error correction codes and then allow you to evaluate the effectiveness of the error correction code under the perfect weight minimum matching decoder.

You will have time to explore the interface before starting the main task.

TASK 1 – Creating a repetition error correction code from a circuit diagram



In the above example, each time the ancilla qubits are established and then measured corresponds to a single ‘round’. Therefore, the above is 3 rounds.

Generating an error graph (think-aloud process)

Your task is to generate a logical error rate graph for a distance-3 repetition code experiencing single-gate noise.

The code will be in the Z-basis and the logical observable will be any singular data qubit

The range of physical errors rates is from 0.1 to 0.2 in 0.01 intervals.

Whilst performing the task, please verbalise your thought process.

Using the Minimum Weight Perfect Matching Decoder

TASK 2 – Creating an error correction code from a representation that looks relatively similar.

A distance-3 rotated surface code encodes a single logical qubit with a 2-D array of data qubits.

The data qubits interact with stabiliser generators which are measured using ancilla qubits to detect and correct errors.

After doing classical decoding physical errors can be corrected.

A diagram of a diagram of a number of circles and lines

Description automatically generated with medium confidence

A diagram of a circuit diagram

Description automatically generatedA diagram of a diagram

Description automatically generated

Before proceeding, you will have the opportunity to ask any questions you might have about the distance 3 rotated surface code.

Generating an error graph (think-aloud process)

Your task is to generate a logical error rate graph for a distance-3 surface code experiencing single-gate noise.

The code will be in the Z-basis and the logical observable is the last 3 data qubits. Use Minimum Weight Perfect Matching decoder.

The range of physical errors rates is from 0.1 to 0.2 in 0.01 intervals.

Whilst performing the task, please verbalise your thought process.

1. Completing post-task survey and giving feedback

Fill out the post-task survey

Provide feedback on your experience

During the task:

* I will observe your interaction with the interface.
* I will time how long you take to complete the task (but not how long it takes you to understand the instructions)
* I will take notes on the steps you follow and any comments you make during the think-aloud process.