

# Improving Neural Belief Propagation (NBP) decoder for QLDPC codes

## Master's Thesis

### Project

In our recent work [1], we proposed a new approach for decoding Quantum Low-Density Parity-Check (QLDPC) codes using the Neural Belief Propagation (NBP) decoder with overcomplete check matrices, which has shown significant decoding gain. As the NBP model proposed in our work is relatively simple, it is interesting to investigate if it is possible to further improve the NBP decoder by employing some machine learning-based optimizations.

[1] Miao, Sisi, et al. "Neural Belief Propagation Decoding of Quantum LDPC Codes Using Overcomplete Check Matrices." arXiv preprint arXiv:2212.10245 (2022).

### Tasks

1. Obtain basic knowledge in quantum error correction.
2. Implement some optimizations of the NN decoder.
3. Evaluation of the proposed optimizations.

### Requirements

- ✓ Basics in channel coding and machine learning/neural networks.
- ✓ Good programming skills in Python.

### Institute

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