

# Automated Discovery and Optimization of Quantum Error Correction Codes Using ML

Course: IITM-DA6300(QML)

Faculty: Chandrashekhar, Dhinakaran

Neeraj Kumar

ns25z054@smail.iitm.ac.in



# Update

## 1. Depolarizing Noise Model Implemented:

- Introduced a realistic quantum noise (depolarizing noise) using Qiskit Aer.
- Applied both 1-qubit and 2-qubit depolarizing errors.

# Cont...

## 2. Simple Reinforcement Learning (RL) Agent:

- Implemented a basic RL agent with a Q-table mapping syndrome outcomes to corrective actions.

# Cont...

### **3. Simulation With/Without Noise:**

- Simulation with/without Noise
- Simulated the QEC circuit with and without noise to show the impact of QEC.
- Compared measurement results to demonstrate effectiveness of error correction.

# Cont...

## 4. Error Correction via RL:

- Used syndrome results from noisy simulations as input to RL agent.
- Agent recommends correction actions based on observed syndromes.

# What's Next?

- Train and show reward curve
- Prove that RL improves QEC