Domain: Speech Processing

Project Title: “Quantum-Based Lie Detection via Micro-Speech Cues”

Brief Description of the Problem:

Detecting lies accurately is a long-standing challenge. Traditional methods often rely on physiological signals like heartbeat or facial expressions, which can be invasive and not always reliable. While some modern tools try to analyze speech content, they usually miss out on the subtle cues hidden in how something is said — like slight tremors, hesitation, or stress in the voice. These micro-signals are often better indicators of deception but are hard to detect using classical machine learning, especially when the dataset is small or noisy.

How Quantum Machine Learning (QML) Can Be Applied:

Quantum Machine Learning (QML) offers a unique advantage when dealing with complex, high-dimensional data like voice signals. In this project, we aim to use QML to pick up on those tiny, hard-to-detect vocal features that may suggest someone is lying.

Here’s how QML makes a difference:

- It allows us to encode detailed speech characteristics (like pitch jitter, pause patterns, or tremors) into quantum states that can represent data more richly.
- Quantum circuits, especially quantum kernel methods or variational quantum classifiers, can capture hidden patterns that traditional models may miss.
- Even with limited labeled data, QML models have shown potential to generalize better, which is important in scenarios like lie detection where data is sensitive and rare.

Expected Outcomes or Impact:

- A non-invasive, voice-based system that can analyze speech for potential deception — without needing physical sensors or invasive tests.
- Can be used in interviews, security screenings, or psychological studies where voice alone can reveal deeper truths.
- This project could open new doors in ethical AI and speech processing by introducing a novel way to approach lie detection using quantum technology.