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Computer Vision

Quantum Physics & Quantum Computing in AI With Hybrid Encryption using (AES,LSB, AI Auto encoder)

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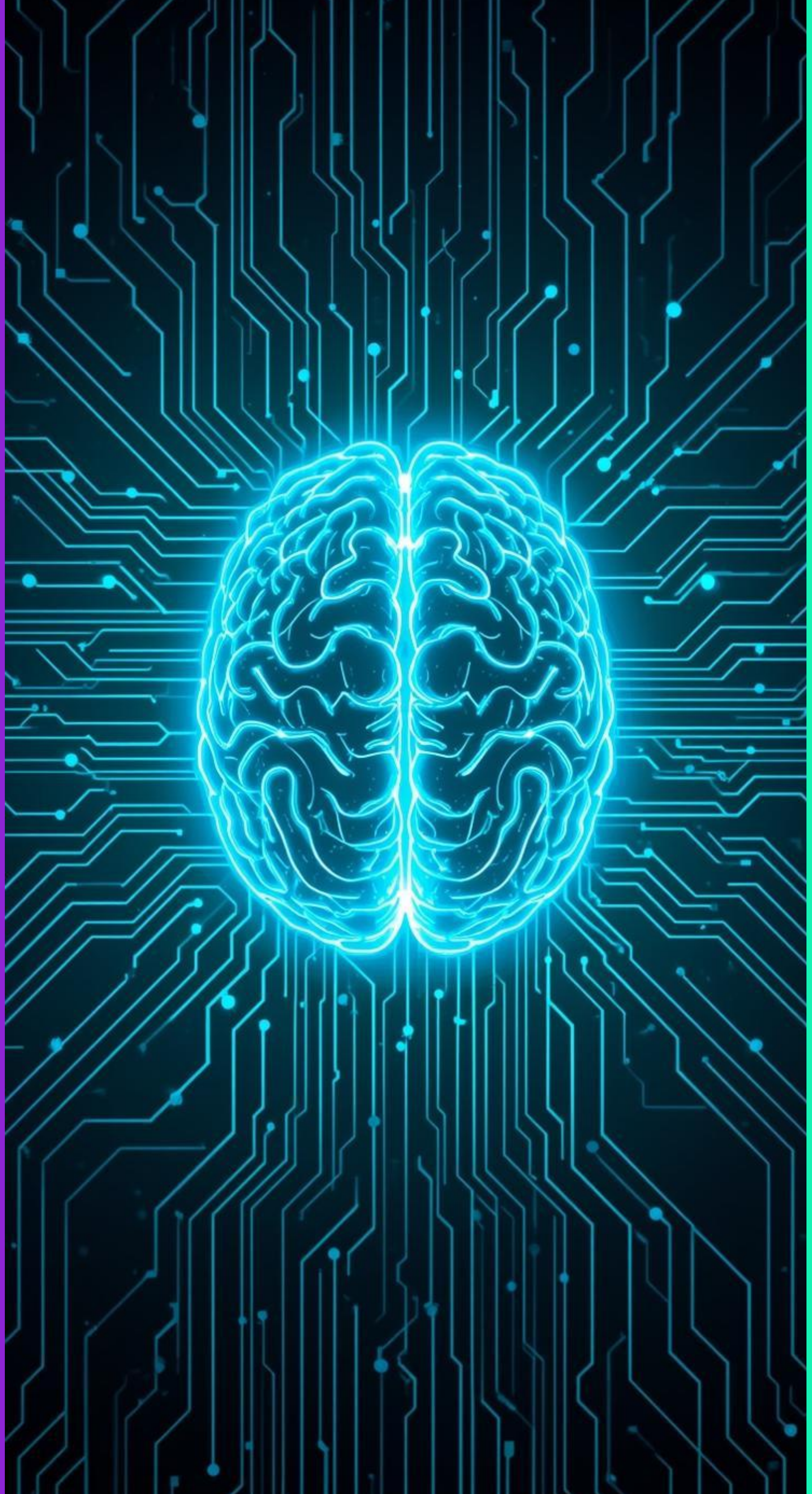

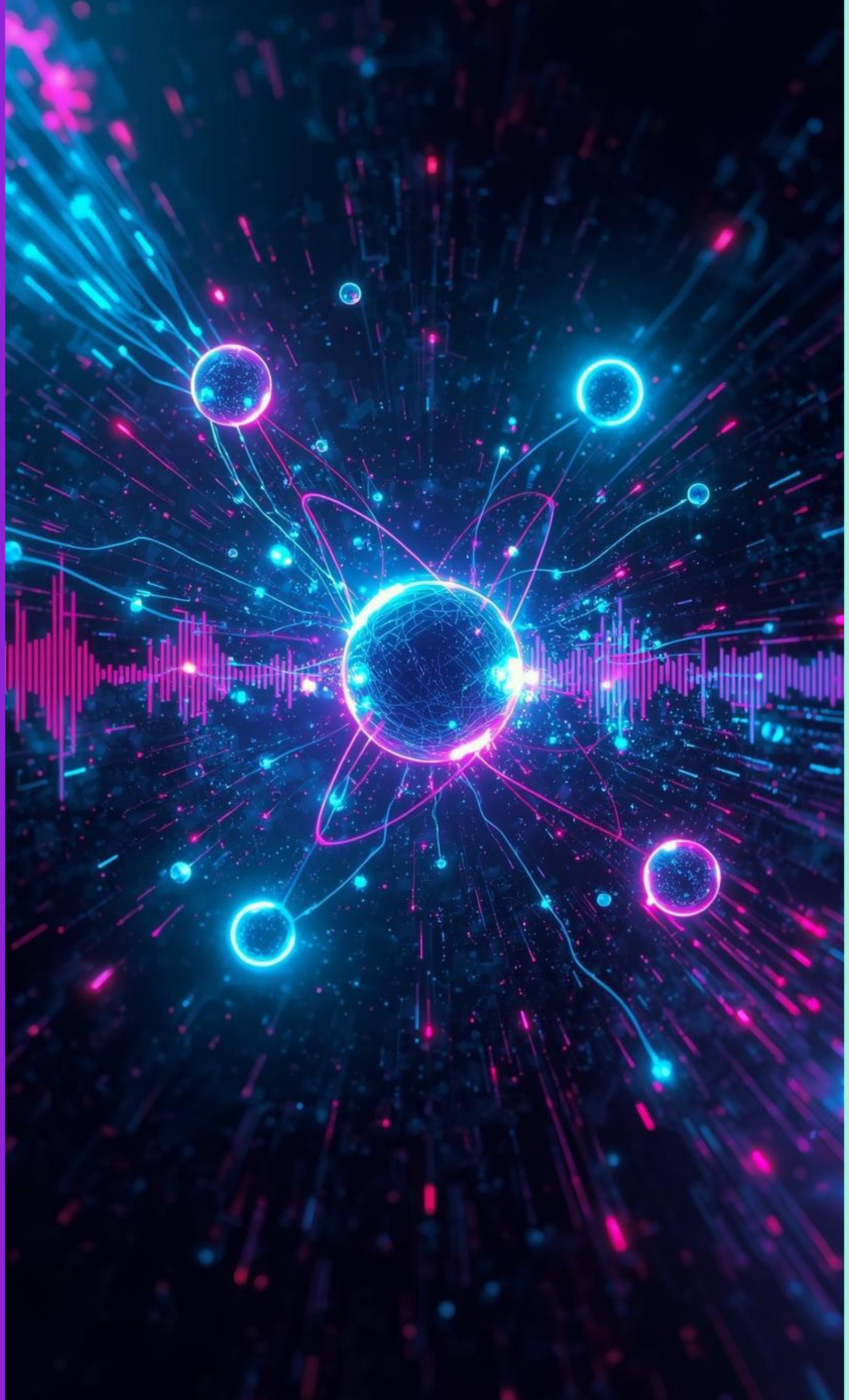

Outline of the project

Introduction → Brief overview of quantum principles (superposition, entanglement) and their link to AI and biological computation.

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Problem Statement → Classical AI models are limited in speed and efficiency for complex data processing and bio-simulation under radiation conditions.

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Objectives → Integrate Quantum Computing with AI to improve performance, accuracy, and model biological resilience (e.g., Cladosporium sphaerospermum).

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Methodology → Use Qiskit (Python) to simulate quantum algorithms like Grover, Shor, and QSVM, and develop an AES–AI encryption model for secure data encoding.

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Result&Conclusion → Quantum–AI integration achieved faster computation, improved encryption efficiency, and inspired bio-computational models for radiation resistance.

Introduction

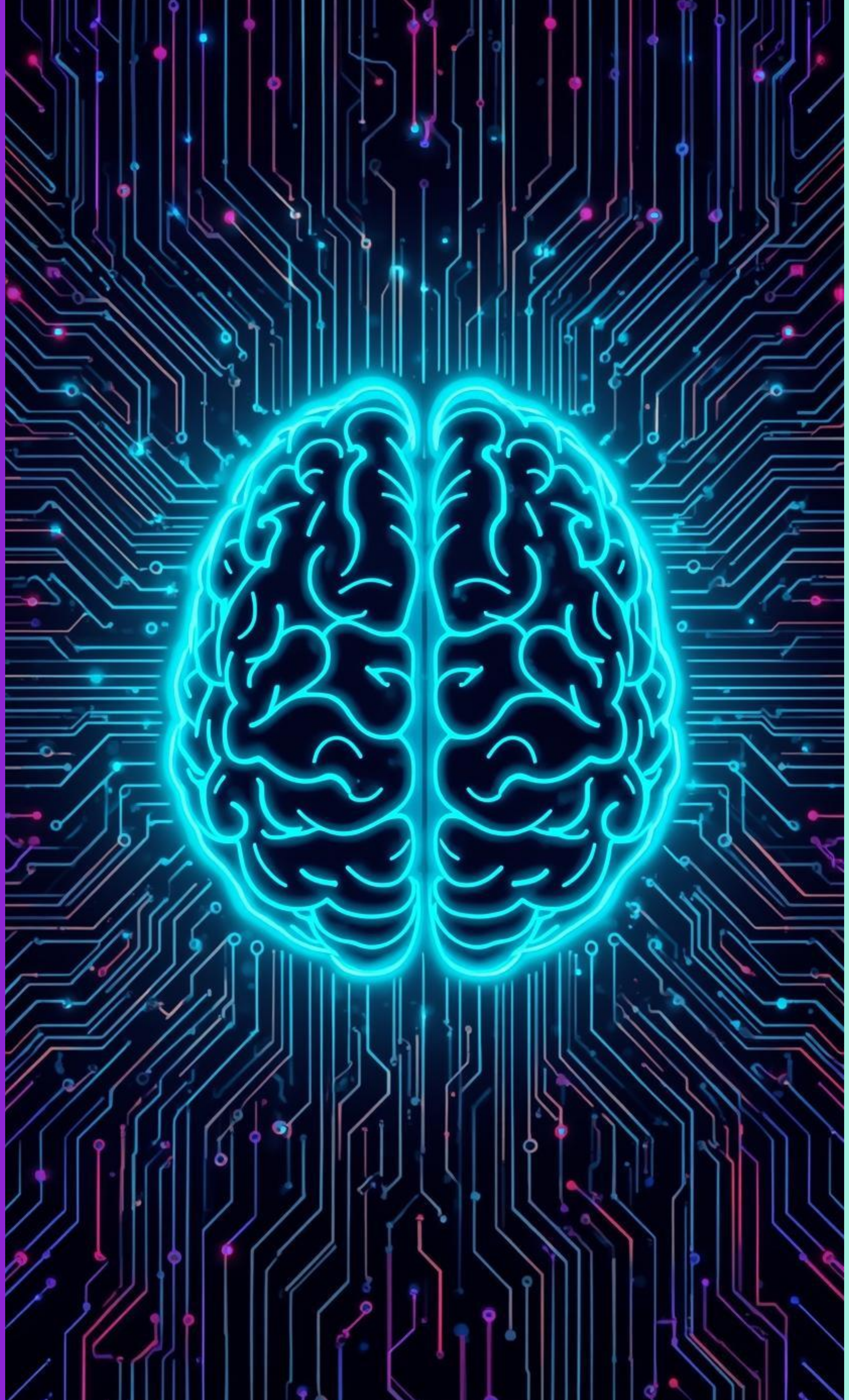
Quantum physics studies the behavior of matter and energy at the atomic and subatomic levels, where classical laws no longer apply.

It is based on key principles such as **superposition**, **entanglement**, and the **uncertainty principle**.

These concepts enabled modern technologies such as **semiconductors, lasers, and nanotechnology**.

One of its most promising applications is **quantum computing**, which uses qubits to perform massive parallel computations.

When combined with **(AI)**, it creates **Quantum AI**, enhancing deep learning, big data processing, optimization, and cybersecurity.



Problem Statement

• Classical Artificial Intelligence systems face limitations in speed, accuracy, and data scalability.

• By integrating Quantum Physics principles with Quantum Computing, AI can process complex data faster and more efficiently through superposition and entanglement.

• Recent studies on the black fungi found in the Chernobyl reactor show unique radiation-adaptation behavior that can inspire new computational and encryption concepts.

• However, there are currently no scientific studies that apply Quantum AI or Quantum Encryption to biologically inspired behaviors similar to those observed in these fungi.

• This study explores how Quantum AI can overcome classical limitations and improve learning efficiency, optimization, and cybersecurity.

Objectives

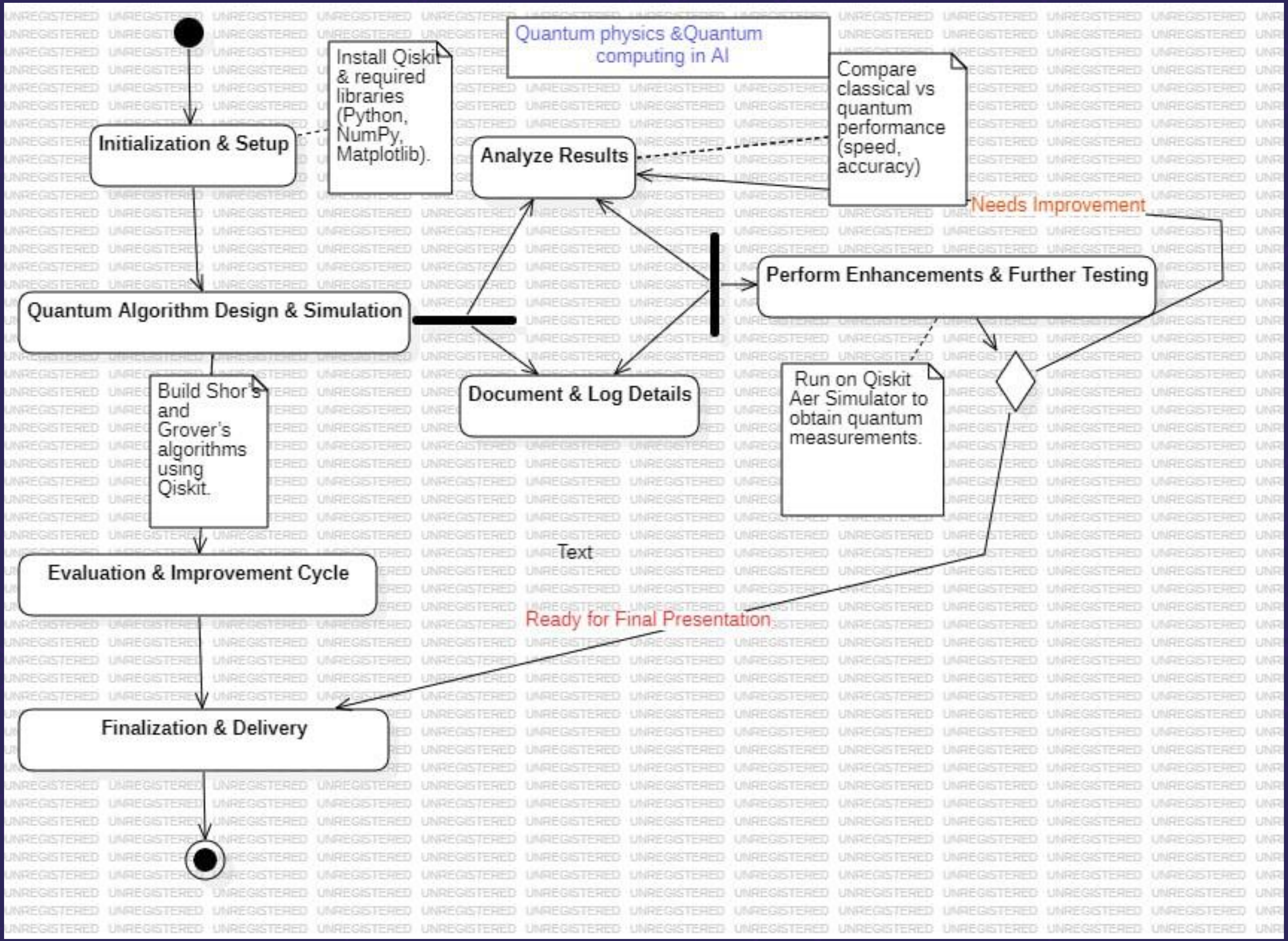
To explore how Quantum Computing principles can enhance Artificial Intelligence models in speed, accuracy, and learning efficiency.

To apply Quantum Physics concepts superposition and entanglement for parallel data processing and optimization.

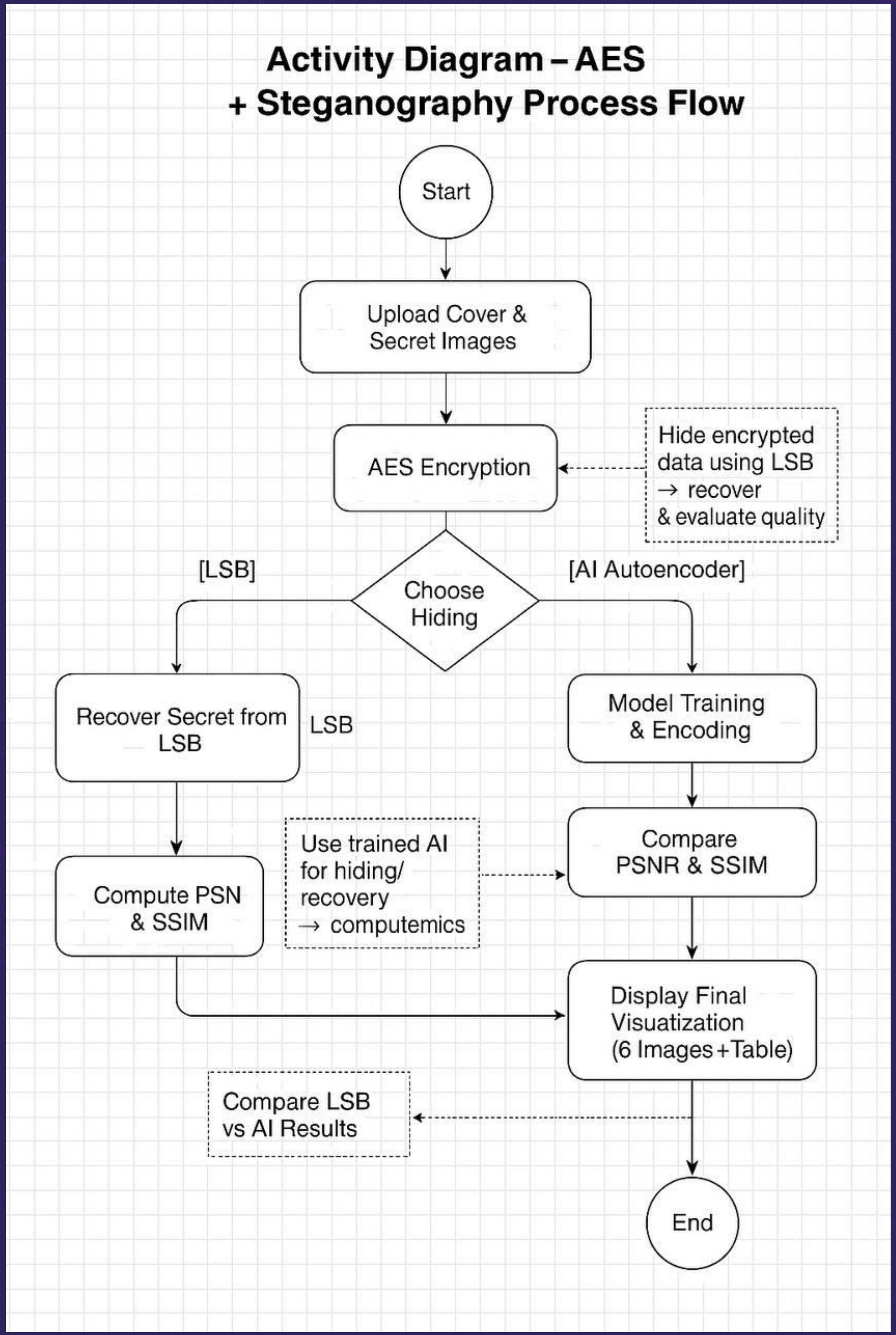
To design and simulate a Quantum AI model using Python (Qiskit) and compare results with classical AI algorithms.

To evaluate the potential of Quantum AI in cybersecurity, decision-making, and future intelligent systems.

Methodology



Methodology



Result

1. Classical vs Quantum Search (Grover's Algorithm)

• Classical search time: 0.000182 sec

• Grover (3 qubits) time: 0.000089 sec

• Quantum search is ≈51% faster

• Time Complexity:

• Classical: O(N)

• Grover: O(√N)

Quantum amplitude amplification successfully identified the target state |101⟩

2. Grover Circuit Execution

• Grover circuit amplified the target probability.

• Measurement results show the highest peak at the correct target state.

• Confirms the quadratic speedup of quantum search.

Result

3. AES-Based Image Encryption (AI Autoencoder)

- Encrypted Gray image appears as random noise → high security
- AI Autoencoder successfully recovered:
- Recovered Gray (decrypted AI)
- Recovered Secret (AI)
- Quality metrics:
- PSNR = 31.55
- SSIM = 0.985

High-quality recovery with minimal distortion.

Result

4. LSB vs AI Encryption – Comparison

• LSB method:

• Low-quality recovered secret

• More noise leakage

• AI-based AES model:

• Much higher reconstruction accuracy

• Better visual quality & structural similarity

AI encryption clearly outperforms traditional LSB.

5. Combined Encryption + Steganography

• Secret image successfully hidden inside cover image using AES + AI.

• Recovered secret matches the original with high fidelity.

• Cover image maintained clarity after embedding.

Secure and effective end-to-end encryption + hiding workflow.

Challenges:

• **Biological Image Challenge (Cladosporium sphaerospermum)**
Difficulty using a complex radiation-adapted fungus image, which contains dark textures that affect hiding stability and data clarity.

• **Quantum–AI Integration Difficulty**
Maintaining stable and accurate results while combining Grover’s quantum search with AI-based encryption and reconstruction.

• **Data Stability & Simulation Accuracy**
Ensuring reliable processing of encrypted, noisy, or radiation-exposed images, especially when converting AES bytes into image matrices.

• **Computational Limitation**
Limited processing power caused slow execution for quantum simulations and AI model training, particularly when simulating radiation–biological behavior.

Futuer Work

•Scaling Grover’s algorithm to more qubits to extend the observed quantum speedup.

•Enhancing AES–AI reconstruction to increase PSNR and reduce noise.

•Improving AI-based image recovery to outperform LSB on complex biological textures.

•Designing an AI-guided hiding method to minimize noise leakage.

•Integrating melanin-based biological radiation models into quantum–AI security research.

Conclusion

• This study demonstrates that integrating Grover’s quantum search with AI-based AES encryption significantly enhances computational speed, security, and reconstruction quality.

• The proposed framework also enables preliminary modeling of radiation-resistant fungi such as *Cladosporium sphaerospermum*, paving the way for future secure quantum-AI bio-computational systems.

Reference

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