

Q1: Explain how Edge AI reduces latency and enhances privacy compared to cloud-based AI. Provide a real-world example (e.g., autonomous drones).

Reduced Latency: Since processing is local, data doesn't travel to a centralized server. As a result, the latency (delay) between data generation and action is minimal. *Cloud-based AI:* Data must travel to the cloud for processing, which introduces delays.

Privacy: Data is local to the Edge device. Thus, it is secured and reduces the risk of privacy breaches. Whereas in cloud-based AI, Data is exposed to risks during transfer and cloud storage

Robotic Process Automation (RPA): Smart robots use Edge AI to make real-time decisions based on sensor input without relying on cloud connectivity.

Q2: Compare Quantum AI and classical AI in solving optimization problems. What industries could benefit most from Quantum AI?

- Classical AI: Uses classical algorithms (e.g., gradient descent, simulated annealing, genetic algorithms) running on classical computers (CPUs/GPUs). Handles optimization problems with polynomial-time complexity but struggles with NP-hard problems.
- Quantum AI: Leverages quantum algorithms (e.g., QAOA, Grover's, VQE) on quantum computers. Exploits superposition, entanglement, and interference to explore multiple solutions simultaneously, potentially solving certain problems exponentially faster.
- Processing larger data sets: Quantum machine learning algorithms could process and classify large datasets more efficiently than classical methods.
- Overcoming classical hardware limits: Quantum computers could enable AI to tackle problems that classical computers struggle with, such as drug discovery and materials science.

Industries That Could Benefit Most from Quantum AI

- Finance- Portfolio optimization, risk analysis, arbitrage, and fraud detection via quantum-enhanced Monte Carlo simulations.
- Logistics & Supply Chain- Route optimization (traveling salesman problems), warehouse automation, and real-time fleet management.

- Pharmaceuticals & Chemistry- Molecular modeling for drug discovery, protein folding (quantum chemistry simulations via VQE).

Q3: Discuss the societal impact of Human-AI collaboration in healthcare. How might it transform roles like radiologists or nurses?

AI could significantly reduce inefficiency in healthcare, improve patient flow and experience, and enhance caregiver experience and patient safety through the care pathway; for example, AI could be applied to the remote monitoring of patients (eg intelligent telehealth through wearables/sensors) to identify and provide timely care of patients at risk of deterioration

2. Case Study Critique

- **Topic:** *AI in Smart Cities*

How does integrating AI with IoT improve urban sustainability? Identify two challenges (e.g., data security).

1.Real-Time Traffic Optimization

- IoT sensors (cameras, GPS, LiDAR) collect real-time data on vehicle flow, congestion, and pedestrian movement.
- AI algorithms (e.g., reinforcement learning, predictive analytics) optimize traffic signals, reducing idle times and fuel consumption.
- Impact: Lower emissions (CO₂ reduction) and improved air quality.

2.Predictive Congestion Management

- AI analyzes historical and live IoT data to predict traffic jams and reroute vehicles dynamically.
- Impact: Reduced travel time, energy efficiency, and better public transport coordination.

