

UNIT III – Edge-Centric Architectures and Data Management

2-Mark Questions

1. List the main stages of the Data Lifecycle in Edge AI systems.
2. What is Federated Learning? Mention one major benefit.
3. Differentiate between data compression and data fusion in Edge AI.

10-Mark Questions

1. Discuss the complete Data Lifecycle in Edge AI systems (from data collection to deletion/archival). Highlight challenges on resource-constrained devices and propose mitigation techniques.
2. Elaborate on Real-time Stream Processing at the Edge. Draw a pipeline architecture and explain key components using one example framework (e.g., Apache Kafka or Flink).
3. Explain real-time stream processing at the edge. How does edge computing reduce latency compared to cloud processing? Give suitable real-world examples.
4. Write a case study on real-time video analytics using edge devices. Discuss architecture, workflow, advantages and limitations.

UNIT IV – Security, Privacy, and Ethical Aspects of AI at the Edge

2-Mark Questions

1. What is a DDoS attack in the context of Edge computing?
2. Define Differential Privacy and explain the significance of the epsilon (ϵ) parameter.
3. What is k-anonymity? Give one example use in Edge AI.
4. Name two widely used frameworks for implementing Federated Learning.
5. Define Explainable AI (XAI) and state why it is crucial for Edge-based decisions.

10-Mark Questions

1. Identify and explain major security threats in Edge AI environments (e.g., eavesdropping, model poisoning, physical tampering). Suggest a multi-layered defense approach.
2. Describe Federated Learning in detail, including the FedAvg algorithm and frameworks like Flower or TensorFlow Federated. Discuss communication and heterogeneity challenges in Edge deployment.
3. Explain suitable Data Anonymization (e.g., perturbation, generalization) and Encryption techniques (e.g., AES, homomorphic encryption) for Edge AI. Analyze their computational overhead on low-power devices.
4. Discuss important regulations (GDPR, CCPA) and ethical issues (bias, fairness, accountability) in Edge AI deployments. Propose practical strategies to ensure ethical compliance in real-world applications like surveillance.
5. Describe the concept of Federated Learning. Compare its implementation in Flower TensorFlow Federated Explain privacy benefits and communication overhead.

UNIT V – Applications and Future Trends in Edge AI

2-Mark Questions

1. What is TinyML? Name one typical hardware platform used for it.
2. Define Predictive Maintenance and mention one benefit of using Edge AI for it.
3. What is Multi-Access Edge Computing (MEC) in 5G?
4. Name two popular benchmarking tools or suites for evaluating Edge AI performance.
5. What is Neuromorphic Computing? State one key advantage over traditional von Neumann architecture.

10-Mark Questions

1. Discuss the application of Edge AI in Autonomous Vehicles, focusing on real-time perception, decision-making, and multi-sensor fusion (camera + LiDAR). Explain major challenges and solutions.
2. Explain how Edge AI supports Predictive Maintenance in Industrial Automation. Describe a typical ML workflow (data collection → model training → inference) and its impact on reducing downtime.
3. Analyze the integration of 5G with Edge AI. Describe MEC architecture in detail and explain how it enables ultra-reliable low-latency communication (URLLC) for critical Edge applications.
4. Explore two emerging trends: TinyML and Neuromorphic Computing in Edge AI. Provide examples, suitable hardware (e.g., Google Coral, Intel Loihi), and discuss their role in enabling ultra-low-power, sustainable AI at the Edge.
5. Explain applications of Edge AI in the following domains: a) Autonomous Vehicles b) Industrial Automation c) AI-Driven Surveillance d) Smart Home Systems e) Healthcare Monitoring Discuss benefits and challenges in each case.
6. Discuss emerging trends in TinyML and Edge Intelligence. What are the future research directions and innovation opportunities?