Portfolio Summary

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AI at the Edge and IIOT Environments - ITAI 3377

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Module 1: Introduction & AI Tools

- A01: Explored ChatGPT and GitHub Copilot in coding tasks.

- Reflected on AI-assisted programming and creativity in prompt design.

- Key Takeaway: Generative AI can enhance developer productivity when used with intention.

Module 2: Model Conversion & Edge Tools

- L02a/b & A02: Converted models to TensorFlow Lite for edge deployment.

- Learned TFLite advantages: size, speed, on-device AI capability.

- Compared TFLite to standard TensorFlow models in size and speed.

- Key Takeaway: Optimized models enable real-time AI inference on low-power edge devices.

Module 3: Edge Deployment Simulation

- L03 & A03: Simulated edge AI deployment in smart city use cases.

- Tools: Edge Impulse Studio, focus on low-latency inference.

- Focused on low-latency inference and real-time decision-making.

- Key Takeaway: Deploying on the edge reduces cloud dependency and enhances responsiveness.

Module 3: Edge Deployment Simulation

- A04 & L04: Implemented MQTT, CoAP, and OPC UA in sensor simulations.

- Designed a conceptual IIoT network for real-time monitoring.

- Key Takeaway: Protocol selection impacts interoperability and system scalability.

Module 6: Time-Series Forecasting

- L06 & A06: Forecasted temperature using TimeGPT + VAE for synthetic data.

- Achieved improved accuracy: MAE dropped from 3.72 to 3.55.

- Key Takeaway: Combining generative models with forecasting boosts prediction reliability.

Module 7: AoI vs Reliability in IIoT

- L07: Modeled Age of Information (AoI) using Random Forest.

- Analyzed the impact of packet loss and transmission probability.

- Key Takeaway: Network quality and traffic type significantly affect information freshness.

Module 9: RL in Industry 4.0

- A09: Case study on reinforcement learning for autonomous AGVs.

- Learned benefits of decentralized control and Q-learning algorithms.

- Learned Q-learning within multi-agent decentralized systems.

- Key Takeaway: RL enables adaptive, autonomous behavior in dynamic industrial environments.

Midterm Project: Cybersecurity Plan

- Designed a defense-in-depth strategy for healthcare IIoT system.

- Covered device/network/AI vulnerabilities and mitigation tactics.

- Proposed layered defense across devices, AI, and data.

- Key Takeaway: Proactive, multi-layered security ensures trust in AI-integrated healthcare systems.

Capstone: Energy Monitoring System

- Proposed a hybrid edge-cloud AI system for building energy efficiency.

- Used Isolation Forest + PPO RL, achieving ROI > 300%, 150+ tons CO_2 saved/year.

- Key Takeaway: Smart energy systems blend AI efficiency with sustainability at scale.

Reflection & Skills Gained

- Strengthened skills in edge AI and generative models.

- Learned edge AI deployment, protocol integration, and cybersecurity planning.

- Built forecasting and anomaly detection models using real-world tools.

- Key Takeaway: Equipped to design, deploy, and secure intelligent industrial systems.