

Edge AI for IoT Applications

Course Description:

This hands-on training program equips participants with the knowledge and practical skills to implement AI on edge devices for real-world IoT applications. Starting with the fundamentals of Edge AI and IoT architecture, the course guides learners through sensor integration, data acquisition, model training and optimization, and finally to deployment on microcontrollers. Participants will also explore optional cloud integration techniques to complete a full edge-to-cloud AI pipeline.

Audience Profile:

This course is designed for:

- Embedded systems engineers and IoT developers
 - AI/ML engineers interested in deploying models on the edge
 - Robotics and automation professionals
 - Engineering students and researchers working on edge intelligence
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Prerequisites:

Participants are expected to have:

- Basic understanding of programming (C/C++ or Python)
 - Familiarity with electronics and microcontrollers
 - Introductory knowledge of AI/ML concepts
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Course Objectives:

By the end of the course, participants will be able to:

- Understand the architecture and benefits of Edge AI and IoT systems
- Integrate and collect data from various sensors using microcontroller platforms
- Build, train, and optimize AI models suitable for edge deployment

- Deploy AI models on microcontrollers such as Arduino and STM32
 - Optionally integrate cloud services for data visualization and OTA updates
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Table of Contents (TOC):

Module 1: Fundamentals of Edge AI and IoT

- Overview of IoT and Edge Computing
- Edge AI concepts and benefits
- Architecture and use cases in industries

Module 2: Edge Hardware and Sensor Integration

- Hardware overview: Arduino, STM32
- Sensor types and interfacing
- Hands-on sensor data collection
- Tools: Arduino IDE, STM32CubeMX

Module 3: Data Acquisition and Preprocessing

- Real-time data collection
- Noise filtering, sampling, windowing
- Tools: Edge Impulse Studio, Jupyter Notebook

Module 4: Model Training

- Model creation and transfer learning
- Tools: TensorFlow, Edge Impulse

Module 5: Model Optimization and Conversion

- Pruning, quantization, compression
- Tools: TensorFlow Lite Converter, STM32Cube.AI

Module 6: AI Deployment on Microcontrollers

- Model deployment on Arduino, STM32
- Testing inference on MCUs
- Tools: Arduino IDE, STM32CubeIDE

Module 7: AI Deployment

- Deploying TFLite models
- Real-time image/audio inference
- Tools: TensorFlow Lite

Module 8: Cloud Integration

- OTA updates, MQTT, Cloud dashboards
- Tools: Azure IoT Hub, MQTT Explorer