

Workshop on Generative Artificial Intelligence

Duration: 30 Hours (5 Days)

Level: Intermediate to Advanced

Pre-requisite : Python programming

Overview

The Generative AI Workshop is a 30-hour, hands-on program covering LLM foundations, multimodal AI, LangChain-based application development, RAG systems, autonomous AI agents, local inference, and ethical considerations, enabling participants to build secure, production-ready, and future-focused AI solutions end to end.

Module 1: Foundations of Generative AI

Essential background, core architecture, and practical tools for working with various generative models.

- **The Dawn of Generative AI:** Understanding the technological backdrop of the current AI boom.
 - **The Transformer Architecture:** Deep dive into attention mechanisms, encoders, and decoders.
 - **Hugging Face Ecosystem:** Navigating the hub to access and utilize pre-trained LLMs.
 - **Core Language Labs:** * Text Completion, Classification, and Translation.
 - Sentence Similarity Analysis.
 - **Multimodal Applications:**
 - Text-to-Image Generation & Image Captioning.
 - Visual Question Answering (VQA) & Object Detection.
 - Automatic Speech Recognition (ASR).
 - **Project:** *Multimodal Content Analyzer* (Streamlit/Gradio app for image interrogation).
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Module 2: Building GenAI Applications with LangChain

Developing practical applications by prompting, fine-tuning, and chaining LLMs with external data.

- **Mastering Prompt Engineering:** Zero-shot, One-shot, and Few-shot prompting techniques.
 - **Fine-Tuning Models:** Adapting base models (GPT-2, Flan-T5) to custom datasets.
 - **LangChain Framework:** Introduction to chains, memory, and context handling.
 - **Vector Stores & Retrievers:** Embeddings and vector databases (ChromaDB, FAISS).
 - **Retrieval-Augmented Generation (RAG):** * Building PDF-based Q&A systems.
 - Creating general-purpose knowledge retrieval pipelines.
 - **Project:** *Personal Document Q&A Bot* (End-to-end RAG pipeline).
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Module 3: Advanced GenAI – Autonomous AI Agents

Creating agents that can reason, plan, and collaborate to solve complex tasks.

- **Introduction to AI Agents:** Moving beyond simple chains to decision-making systems.
 - **Agentic Workflows with LangGraph:** Building stateful, multi-actor applications using cyclic graphs.
 - **Collaborative AI with CrewAI:** Designing teams of specialized agents (Researcher, Writer, Reviewer).
 - **Advanced Concepts:** * Reinforcement Learning (RL) for complex decision environments.
 - Cognitive Architectures (SOAR, ACT-R, LSOAR).
 - **Capstone Project:** *Sequential Data Analysis & Report Generation Workflow.*
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Module 4: Computer Vision & Feature Extraction

Deep learning architectures for visual data.

- **Architectures:** CNNs and RNNs (ResNet, InceptionNet, LSTM).
 - **Object Detection:** Implementation of YOLO (YOLOv8, YOLOv11) for real-time detection.
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Module 5: Local Knowledge Assistant

Optimizing models for private, local deployment.

- **Inference Engines:** Running LLMs locally.
 - **Optimization:** Low-Rank Adaptation (LoRA) for efficient tuning.
 - **Local Integration:** Combining LangChain/LangGraph with local inference engines.
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Module 6: Future Trends & Ethics

The evolving landscape of AI and responsible implementation.

- **Trends:** Edge Native Models, Efficient Architectures, and Distributed Inferencing.
 - **Limitations:** Navigating context size constraints and token limits.
 - **Ethical Concerns:** Bias, safety, and the future of AI governance.
 - **Final Activity:** *Fully Offline Private Document Analyzer.*
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