

Applied NLP with BERT and Transformers: LLMs, RAG, and Agentic AI

Course Duration: 07 Days(56 hours)

Course Description:

This course provides a comprehensive, industry-aligned journey into modern Natural Language Processing (NLP), Large Language Models (LLMs), Retrieval-Augmented Generation (RAG), and Agentic AI systems.

Module 1 – Foundations of Text Analysis and NLP

- Evolution of NLP
- Core NLP tasks
- Text preprocessing
- Limitations of traditional NLP
- Why transformers dominate

Module 2 – Transformer Architecture and Attention Mechanisms

- Transformer overview
- Self-attention
- Encoder vs decoder models
- Context modeling
- Scaling behavior

Module 3 – Tokenization, Embeddings, and Semantic Representation

- Subword tokenization
- Attention masks
- Token vs sentence embeddings
- Vector semantics
- Embedding use cases

Module 4 – Pre-trained Transformer Models: BERT and RoBERTa

- Encoder-based models
- BERT architecture
- RoBERTa improvements
- Loading models from Hugging Face
- Inference workflows

Module 5 – Core NLP Tasks with Transformers

- Text classification
- Named Entity Recognition
- Zero-shot vs fine-tuned models
- Clustering with embeddings
- Evaluation strategies

Module 6 – Topic Modeling using Transformer Embeddings

- Limitations of LDA
- Embedding-based topic modeling
- Clustering techniques
- Topic interpretation

Module 7 – Fine-Tuning Transformer Models for Text Analysis

- When to fine-tune
- Dataset preparation
- Fine-tuning BERT/Roberta
- Training & evaluation
- Parameter-efficient tuning

Module 8 – Large Language Models (LLMs): Concepts and Capabilities

- What defines LLMs
- Encoder vs LLMs
- Prompting vs fine-tuning
- Limitations of LLMs
- Enterprise considerations

Module 9 – Retrieval-Augmented Generation (RAG)

- Motivation for RAG
- RAG architecture
- Vector databases
- Retrieval pipelines
- Hallucination reduction

Module 10 – Agentic AI and Microsoft Agent Framework (Open Source)

- Agentic AI concepts
- Single vs multi-agent systems
- Tools and orchestration
- Microsoft Agent Framework overview
- Enterprise agent use cases