

Course Outline

Advanced Topics in Deep Learning

Module 1: Neural Network Foundations

- Multi-class Classification
- Activation Functions: Sigmoid, Tanh, ReLU and its Variants
- Vanishing Gradient Problem

Module 2: Generative AI – Theory & Practice

- Theoretical Foundations of Generative AI
- Practical Generative AI Applications

Module 3: LangChain & Agentic AI

- Fundamentals of LangChain: Components, Models, Prompts, Parsing Output, Runnables & LCEL, Chains, Memory
- Retrieval-Augmented Generation (RAG): Document Loaders, Text Splitters, Embeddings, Vector Stores, Retrievers, Building a RAG Application
- Agents: Tools & Toolkits, Tool Calling, Building an AI Agent

Module 4: Recurrent Neural Networks (RNNs)

- Introduction to RNNs
- Why RNNs? RNN vs ANN
- RNN Forward Propagation (Example: Sentiment Analysis)
- Types of RNNs: One-to-Many, Many-to-One, Many-to-Many
- RNN Backpropagation and its Working

Module 5: Advanced RNN Architectures

- Long Short-Term Memory (LSTM): Architecture & Applications
- LSTM for Next Word Prediction
- Stacked and Bidirectional RNNs

Module 6: Large Language Models & Transformers

- Large Language Models (LLM)

- Encoder-Decoder and Sequence-to-Sequence Architectures
- Attention Mechanism
- Bahdanau vs Luong Attention Models
- Introduction to Transformers
- Self-Attention Mechanism
- Scaled Dot-Product Attention
- Multi-Head Attention in Transformers
- Positional Encoding, Layer Normalization
- Transformer Encoder & Decoder Architectures
- Masked Self-Attention, Cross-Attention
- Inference in Transformers

Assignments (30%)

- Assignment 1: AWS Academy Cloud Foundation Course Badge
- Assignment 2: AWS Academy Machine Learning Course Badge
- Assignment 3: To be announced

Recommended Books

- Dive into Deep Learning – Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola (1st Edition, 2023)
- Transformers for Natural Language Processing – Denis Rothman (2nd Edition, 2022, Packt Publishing)
- Natural Language Processing with Transformers: Building Language Applications with Hugging Face
- Mastering LangChain – Tarik Kaoukji, Adarsh Valliath, Harish Raj (1st Edition, 2024, Packt Publishing)