Arfa Karim
Technology Incubator

Gen AI Course Outline

Total Lectures: 24 **Instructor: Noor Ul Hassan**

Module 1: Foundations of Generative AI and LangChain (6 Lectures)

Lecture 1: Introduction to Generative AI

- - What is Generative AI?
- - Applications of Generative AI across different fields
- - Key concepts: LLMs, Transformers, Prompt Engineering
- - Understanding the Generative AI landscape

Lecture 2: Fundamentals of Machine Learning for Gen AI

- - Basic concepts: supervised, unsupervised, and reinforcement learning
- - Neural networks basics
- - Introduction to deep learning

Lecture 3: Transformer Architecture

- - Overview of the Transformer model
- - Attention mechanism
- - Positional encoding
- - Encoder-Decoder structure

Lecture 4: Understanding Language Models

- - What are language models?
- - Types of language models (n-gram, neural, etc.)
- - Introduction to Large Language Models (LLMs)
- - Popular LLMs: GPT-3, LaMDA, BLOOM

Lecture 5: Introduction to LangChain

- - What is LangChain?
- - Components and use cases
- - Understanding LangChain components: Chains, Agents, Memory

Lecture 6: Hands-on with LangChain (Part 1)

- - Setting up LangChain
- - Building basic chains
- - Working with prompts

Module 2: Advanced LLM Techniques and LangChain Applications (6 Lectures)

Lecture 7: Hands-on with LangChain (Part 2)

- - Integrating external tools and APIs
- - Building a simple chatbot
- - Implementing memory in LangChain applications

Lecture 8: Advanced LangChain Techniques
- - Building complex chains
- - Integrating LangChain with other libraries
- - Case study: Developing a sophisticated AI assistant

Lecture 9: Introduction to Hugging Face
- - Overview of Hugging Face ecosystem
- - Hugging Face Transformers library
- - Accessing models, datasets, and tools on Hugging Face Hub

Lecture 10: Hands-on with Hugging Face
- - Setting up the environment
- - Loading pre-trained models
- - Basic inference tasks
- - Exploring model capabilities

Lecture 11: Fine-tuning LLMs (Part 1)
- - Introduction to fine-tuning: Adapting pre-trained models to specific tasks
- - Understanding Peft and QLoRA as efficient fine-tuning methods
- - Hands-on: Preparing data for fine-tuning

Lecture 12: Fine-tuning LLMs (Part 2)
- - Hands-on: Fine-tuning LLMs for specific tasks like summarization or question answering
- - Evaluating fine-tuned models
- - Best practices and common pitfalls in fine-tuning

Module 3: LlamaIndex and Retrieval Augmented Generation (RAG) (6 Lectures)

Lecture 13: Introduction to LlamaIndex
- - What is LlamaIndex?
- - Use cases and applications
- - Understanding the concept of Retrieval Augmented Generation (RAG)

Lecture 14: Hands-on with LlamaIndex
- - Setting up LlamaIndex
- - Building basic indexes
- - Query processing
- - Combining LlamaIndex with LLMs for better information retrieval and generation

Lecture 15: Introduction to Retrieval Augmented Generation (RAG)
- - What is RAG?
- - Components of a RAG system
- - Advantages and use cases
- - Exploring different RAG architectures

Lecture 16: Building a RAG System with LlamaIndex
- - Implementing document retrieval
- - Integrating with a language model
- - Fine-tuning the RAG pipeline
- - Hands-on: Building a Q&A system using LlamaIndex and RAG

Lecture 17: Advanced RAG Techniques

- - Modular RAG: Customizing retrieval and generation components
- - Hybrid search strategies
- - Hands-on: Building a custom RAG system with modular components

Lecture 18: RAG Applications

- - Chatting with SQL databases using RAG
- - Building conversational interfaces for data interaction
- - Implementing RAG for document summarization and analysis
- - Case study: Developing a complex RAG system for enterprise data

Module 4: Gemini API, AI Agents, and Vision AI (6 Lectures)

Lecture 19: Introduction to Gemini API

- - Overview of Gemini models
- - Setting up and using the Gemini API
- - Exploring Gemini's text, image, and multi-modal capabilities

Lecture 20: Gemini for Text and Image Tasks

- - Text generation and summarization with Gemini
- - Image analysis and generation
- - Multimodal tasks
- - Hands-on: Building applications with Gemini API

Lecture 21: Introduction to AI Agents

- - What are AI agents?
- - Types of AI agents
- - Components of AI Agents: Perception, planning, and action
- - Use cases and applications

Lecture 22: Building AI Agents

- - Introduction to agent frameworks: LangChain Agents, Autogen
- - Implementing simple agents
- - Tool integration
- - Hands-on: Building an agent that can perform complex tasks

Lecture 23: Introduction to Generative AI for Vision

- - Overview of computer vision tasks
- - Representation of images for AI
- - Introduction to diffusion models
- - Exploring popular generative models for vision: DALL-E, Stable Diffusion, Midjourney

Lecture 24: Hands-on Vision AI and Course Wrap-up

- - Implementing basic image generation
- - Prompt engineering for image tasks
- - Building and deploying an image generation project
- - Course summary and future learning paths

Note: This is a tentative outline and might be adjusted with course and content completion.