Certified Generative / Deep Learning AI Professional For Neuro Healthcare

Course Duration: 4 Months

Course Technologies Stack:

1. Neuro Healthcare Data Exploration / Augmentation Stack

- Neuro Diseases Categories & Prediction Types [Alzheimer's, Parkinson's, Brain Tumors etc].
- Fetching / Exploration of Neuro Datasets [ADNI, OASIS].
- Data Formats of MRI / fMRI [Niftii, Dicom], Data Formats Conversion.
- Neuro Data Augmentation Using Python / Neuro Medical Tools.

2. Python Deep Learning / Explainable AI Stack

- Introduction to Tensor Flow / Pytorch.
- Deep Learning Models [CNN 2D / 3D].
- Transfer Learning Models [ResNet, DenseNet,VGG16/19].
- Transformers [Encoders / Decoders].
- GAN [Generative Adversial Networks].
- Image Diffusion Models.
- Explainable AI [XAI] For the Interpretation of Model Inference.
- Explainable AI Methods [LIME, SHAP, GRAD-CAM etc].

3. Python Generative / Agentic AI Stack

- Introduction to Generative / Agentic AI Frameworks [Langchain, LangGraph, OpenAI SDK, CrewAI, AutoGen, MCP etc).
- Generative AI Models [OpenAI, Gemini, Groq, DeepSeek R1, Hugging Faces] for the interpretation of Neuro BIDS / Neuropsychological Assessments.
- Neuro Chatbot Using Agentic AI.
- Neuro Agents Using Agentic AI.

Month 1: Neuro Healthcare Data Exploration & Augmentation

Week 1: Introduction to Neuro Diseases & Prediction Types

- Overview of Neuro Diseases (Alzheimer's, Parkinson's, Brain Tumors, etc.)
- Introduction to Neuroimaging modalities (MRI, fMRI).
- Introduction to Neuropsychological Assessments.
- Overview of Prediction Types and Clinical Significance.

Week 2: Fetching & Exploring Neuro Datasets

- Introduction to ADNI and OASIS datasets.
- Data access and download procedures.
- Basic data exploration using Python (Pandas, NumPy).
- Understanding dataset structure and metadata.

Week 3: MRI / fMRI Data Formats & Conversion

- Detailed explanation of NIfTI and DICOM formats.
- Python libraries for handling these formats (Nibabel, FmriPrep, MRIcroML).
- Data format conversion techniques.
- Visualization of MRI/fMRI data.

Week 4: Neuro Data Processing & Augmentation

- Image preprocessing techniques (noise reduction, bias field correction).
- Introduction to data augmentation concepts.
- Spatial transformations (rotation, translation, scaling).
- Implementation using Python libraries (Scikit-image, SimpleITK).

Month 2: Python Deep Learning / Neuroimaging

Week 1: Introduction to Deep Learning Frameworks / CNN 2D/3D.

- Fundamentals of deep learning.
- Introduction to TensorFlow and PyTorch frameworks.
- Tensor operations and basic neural network construction.
- Setting up development environments.
- CNN architectures for image analysis.
- 2D CNNs for slice-based analysis.
- 3D CNNs for volumetric analysis.

Week 2: Transfer Learning for Neuro Data

- Overview of ResNet, DenseNet and VGG16/VGG19 Models.
- Fine-tuning pretrained models for neuro disease classification.
- Implementing Transfer Learning on MRI scans.

Week 3: Transformers & GANs in Healthcare AI

- Understanding Transformer models (Encoders & Decoders).
- GANs (Generative Adversarial Networks) for synthetic neuro data.
- Implementing a simple GAN model for neuro image generation.

- Practical GAN implementations for MRI/fMRI.

Week 4: Explainable AI (XAI) for Model Interpretation

- Importance of Explainable AI in Healthcare.
- Introduction to XAI methods [LIME, SHAP, Grad-CAM] for interpretability.
- Hands-on project: Explaining CNN predictions using XAI techniques.

Month 3: Python Generative AI / Agentic AI

Week 1: Introduction to Generative AI & Agentic AI

- Overview of LangChain, LangGraph, CrewAI, AutoGen, MCP.
- Building simple LLM-based applications.
- Understanding BIDS (Brain Imaging Data Structure) & Neuro Assessments.

Week 2: Generative AI Models for Neuro Interpretation

- Exploring OpenAI, Gemini, Groq, DeepSeek R1, Hugging Face models.
- Fine-tuning LLMs for medical question answering.
- Hands-on: Extracting insights from neuropsychological assessments.

Week 3: Building a Neuro Chatbot using Agentic AI

- Designing chatbot pipelines for N**euro Consultations**.
- Using LangChain & OpenAI SDK APIs for chatbot interactions.
- Deploying a basic neuro chatbot.

Week 4: Neuro Agents for Healthcare

- Understanding **Autonomous AI Agents** for medical diagnosis.
- Building **Neuro AI agents** using AutoGen & CrewAI.
- Case study: Multi-agent neuro analysis system.

Month 4: Neuro Deep Learning / Agentic AI Applications & Deployment

Week 1: Project Selection & Dataset Preparation

- Choosing from:

  1. MRI-based disease classification using CNN.
  2. GAN-generated synthetic neuroimaging data.
  3. Agentic AI-powered neuro chatbot.

- Collecting and preprocessing dataset.

Week 2: Model Training & Evaluation / Neuro Agents.

- Implementing chosen Deep Learning or Generative AI models.
- Training & fine-tuning models on Neuro data.
- Evaluating model performance using XAI.
- Developing specialized agents for neuro data analysis.
- Creating agents for automated report generation.
- Testing and evaluation of agent performance.

Week 3: Deployment & API Integration

- Deploying models using FastAPI, Streamlit, Gradio, Docker Clouds.
- Integrating **Agentic AI solutions** into a working prototype.
- Testing chatbot interactions & AI-generated reports.

Week 4: Final Project Submission & Demo

- Preparing final project reports & documentation.
- Presenting Neuro AI projects.
- Future directions & career guidance in Neuro AI.

Tools and Technologies:

- Python (Pandas, NumPy, Scikit-learn, Scikit-image, Nibabel, FmriPrep, MRIcroGL)
- TensorFlow/PyTorch
- Langchain, Langgraph, CrewAI, AutoGen, MCP
- OpenAI API, Gemini API, Hugging Face Transformers
- LIME, SHAP, GRAD-CAM
- NIfTI and DICOM viewers / Converters

Assessment:

- Weekly assignments and quizzes.
- Mid-term project.
- Final project (development of a neuro-focused agent / chatbot or Neuro Convolutional Explainable Model).
- Class participation and presentations.

NOTE: This structure ensures a **Progressive Learning Approach**, covering both **Neuro Healthcare AI** and **Generative / Agentic AI** concepts, leading up to hands-on project deployment.