Professional Certification in MERN Stack

Duration: 80 hours

Objective: To acquire the knowledge of Full Stack Web Development using NodeJs, ReactJS and Database Management.

Prerequisites:

1. Students are expected to know any OOP's Based Language.
2. They **must have** good understanding of HTML, CSS and knowledge of any database is required.

Module 1: Introduction to Web
- Brief history of the Internet, How does the Internet work?
- Internet Protocol, Domain Name Service servers, HTTP Protocol
- Web Server vs Application Server
- Architecture of the Web

Module 2: Quick Recap of HTML & CSS
- Introduction to HTML
- Basic HTML Tags, HTML Form
- HTML Form & Controls
- Introduction to CSS, Styling HTML with CSS
- CSS Selectors
- Responsive Web Design with Bootstrap

Module 3: JavaScript
- Introduction to JavaScript
- Data Types and Control Structures
- JavaScript Scopes
- Strings, Numbers, Date
- Arrays, Array Methods

Module 4: JavaScript
- Objects, Object Definitions, Object Properties, Object Methods, Object Prototypes
- Functions, Function Definitions, Function Parameters, Function Invocation, Function Closures

Module 5: JavaScript
- Document Object Model (DOM)
  - o Object hierarchy in JavaScript
  - o HTML DOM, DOM Elements, DOM Events
  - o DOM Methods, DOM Manipulation, Forms & Forms Validation

Module 6: JSON
- JSON: JavaScript Object Notation (JSON)
  - o Introduction and need of JSON o JSON Syntax Rules
  - o JSON Data - a Name and a Value,
  - o JSON Objects, JSON Arrays, JSON Files, JSON parsing

Module 7: Introduction to Node.js
- Introduction to Node.js, Browser JS vs. Node.js
- ECMAScript 2015 (ES6), Node.js REPL

Module 8: Node.js Asynchronous Programming
- Introduction to Asynchronous programming and callbacks
- Promises and async & await
- The Event Loop and Timers

Module 9: Node.js Modules
- Understanding Node modules, exports, and require
- Introduction to npm
  - o package.json and package-lock.json files
  - o Install, update, and manage package dependencies
  - o Local and global packages

Module 10: Node.js Modules – *fs* and *http*
- File I/O – Sync & Async Methods
- HTTP Module – Building an HTTP server
- Developing a Node web application

Module 11: Introduction to Express
- Introduction to Express, Getting started with Express
- Application, Request and Response Objects
- Routes and Middlewares

Module 12: CURD using Express & MYSQL/MongoDB:
- Working with MYSQL/MongoDB
- Performing CURD operations with Express

Module 13: Introduction to React JS:
- Introduction to React, Getting started with React
- React Elements and React Components
- Function and Class Components
- Working with React Components and Props
  - o Compose components
  - o Render components
  - o Declutter components

Module 14: React JS
- Introduction to State and Lifecycle
- Stateful components and lifecycle methods
- Props vs. State vs. Context
- Handling events
- Conditional rendering

Module 15: React JS
- Lists and Keys
  - o Rendering Multiple Components
  - o Basic List Component
- Working with forms and inputs
- Composition vs. Inheritance
  - o Containment
  - o Specialization

Module 16: Express & React JS
- Build React App
- Merging React with Express

Module 17: Capstone Project

Professional Certification in AI and Data Science using Python

Duration: 80 hours

Objective: This course is designed to provide a broad overview of AI and its various applications, including machine learning and deep learning. Students will learn about AI, and explore the different types of AI systems.

Prerequisites: Familiarity with the basics of Mathematics, Statistics and Python Programming would be helpful for this course.

Module 1: Basics of Python (Quick Recap)
- Introduction of python, Variables, Data Types, Operators
- Control flow statements (Loops)
- Python Data Structures
- Functions, Modules & Packages

Module 2: Mathematical Computing using NumPy
- Introduction to NumPy
- Create and Print Numpy Arrays
- Numpy Operations

Module 3: Data Manipulation with Pandas
- Introduction to Pandas
- Pandas Series & DataFrames
- Missing Values, Handling Missing Values
- Various Data Operations

Module 4: Data visualization with Python
- Data Visualization, Considerations of Data Visualization
- Factors of Data Visualization, Line Properties
- Multiple Plots and Subplots, Create a Plot with Annotation
- Creating different types of graphs

Module 5: Introduction of AI
- What is AI, Terminologies of Artificial Intelligence
- History and Evolution of AI
- Components of Artificial Intelligence – ML & DL
- Difference between AI, ML & DL
- Find out where AI is applied in Technology and Science
- Difference between Traditional Programming and AI Programming

Module 6: Maths for AI/ML
- Linear Algebra: Vectors, Matrices, Operations, Projections, Dimensionality Reduction
- Calculus: Differentiation & Partial Derivatives, Gradient, Chain Rule, Gradient Descent

Module 7: AI/ML Implementations
- Introduction to Machine Learning and its types
- Labelled Data and Unlabelled Data, Data Acquisition, Pre-processing data
- Data Transformation: Rescale, Standardize & Normalize Data
- Splitting the Dataset into Training and Testing Data
- Algorithms of Regression, Classification & Clustering
- Validation Set (k-fold) and Evaluations Metrics (Accuracy, Confusion Matrix, MAE, MSE, RMSE)

Module 8: Introduction to Deep Learning
- A revolution in Artificial Intelligence
- Limitations of Machine Learning
- Deep Learning and its advantages over ML
- ANN vs BNN, Neuron Architecture, Backpropagation Algorithm

Module 9: Introduction to Neural Networks, Computer Vision & RNN
- Introduction to Perceptron, MLP, Activation Functions
- Introduction to Image Processing using OpenCV
- Convolution, Padding, Stride, Pooling Operations
- Popular CNN Architectures: LeNet-5, AlexNet, VGGNet etc.
- Introduction to NLP, RNN & LLM

Module 10: Capstone Project

Professional Certification in Modern Deep Learning and Generative AI

Duration: 80 hours

Objective: To provide learners with foundational and advanced knowledge of modern deep learning and generative AI, along with practical skills to build and apply real-world AI solutions.

Prerequisites: Working knowledge of Python Programming and fundamental machine learning concepts is required.

Module 1: Foundations of Modern Artificial Intelligence

- What is Artificial Intelligence? Contemporary Definitions and Scope
- Evolution of AI: From Symbolic AI to Deep Learning and Foundation Models
- Core Components of AI: Machine Learning, Deep Learning, NLP, Computer Vision
- Differences between AI, Machine Learning, Deep Learning, and Generative AI
- Traditional Programming vs AI Programming
- Modern AI Workflow: Data → Model → Training → Evaluation → Deployment
- Real-World Applications of AI across Industry, Science, and Society

Module 2: Machine Learning Essentials for Deep Learning

- Machine Learning Revisited: Objectives, Assumptions, and Limitations
- Types of Machine Learning: Supervised, Unsupervised, Reinforcement
- End-to-End ML Pipeline: Problem Framing to Model Evaluation
- Data Understanding and Preparation: Cleaning, Encoding, Scaling, Feature Engineering
- Train–Validation–Test Splits and Cross-Validation
- Core Algorithms Overview: Linear Models, k-NN, Decision Trees
- Model Evaluation Metrics: Accuracy, Precision, Recall, F1-score
- Overfitting, Under fitting, Bias–Variance Tradeoff

Module 3: Deep Learning Fundamentals

- Why Deep Learning? Representation Learning and Scalability
- Biological Neurons vs Artificial Neurons
- Neural Network Building Blocks and Mathematical Intuition
- Architecture of Feedforward Neural Networks (ANNs)
- Activation Functions: Sigmoid, Tanh, ReLU
- Loss Functions and Optimization Objectives
- Gradient Descent Variants and Backpropagation Algorithm
- Hyper parameters: Learning Rate, Batch Size, Epochs

Module 4: Deep Learning Frameworks with PyTorch

- Introduction to PyTorch and Modern DL Ecosystem
- Tensors, Autograd, and Dynamic Computation Graphs
- Dataset and DataLoader Abstractions
- Building Neural Networks using nn.Module
- Forward Pass, Loss Computation, and Backward Pass
- Optimizers: SGD, Adam, RMSProp
- Training, Validation, and Evaluation Loops

Module 5: Convolutional Neural Networks (CNNs)

- Motivation for Convolutions and Spatial Feature Learning
- Convolution Operation, Padding, Stride, Pooling
- CNN Architecture Design: Conv Layers, Pooling, Fully Connected Layers
- Popular CNN Architectures: LeNet, AlexNet, VGG, ResNet etc.
- Transfer Learning and Fine-Tuning Pretrained Models
- Regularization Techniques: Dropout, Batch Normalization
- Applications: Image Classification, Object Detection, Feature Extraction

Module 6: Sequence Models and Transformers

- Sequential Data and Temporal Dependencies
- Recurrent Neural Networks and Their Limitations
- LSTM Architecture: Gates, Memory Cells, and Information Flow
- GRU: Simplified Gated Architecture
- Introduction to Attention Mechanisms
- Self-Attention and Scaled Dot-Product Attention
- Transformer Architecture: Encoder–Decoder Framework
- Positional Encoding and Multi-Head Attention
- Overview of BERT, GPT, and Vision Transformers (ViTs)

Module 7: Modern Generative AI and Large Language Models

- What is Generative AI? Capabilities and Limitations
- Large Language Models (LLMs): Architecture and Training Overview
- Tokenization, Embeddings, and Context Windows
- Prompt Engineering Techniques: Zero-Shot, Few-Shot, Chain-of-Thought
- Retrieval-Augmented Generation (RAG): Concepts and Use Cases
- Real-World Applications of GenAI in Industry and Research

Module 8: Capstone Project