

**Fundamentals of Artificial Intelligence (Deep Learning) Including Generative AI Models**

**Course Number:** AI-110WA
**Duration:** 5 days

**Overview**

This Fundamentals of Artificial Intelligence/Deep Learning/Generative AI Models training course teaches attendees how to use the Python programming language to build modern machine learning (ML) applications that incorporate the latest ML technologies such as generative AI, deep learning, natural language processing, and computer vision.

Learners are introduced to the basic concepts of Python, such as variables, data types, functions, and control flow. They also learn how to use the Anaconda computing environment, which comes with many valuable tools for data science.

**Prerequisites**

All attendees must have prior experience using Python to perform exploratory data analysis and develop predictive models using machine learning techniques. Students must also have familiarity with base Python coding.

**Materials**

All AI Fundamentals training students receive comprehensive courseware.

**Software Needed on Each Student PC**

* A modern web browser and an Internet connection
* Windows, Mac, or Linux
* A current version of Anaconda for Python 3.x, or a comparable Python installation with the necessary libraries (Accelebrate can provide a list)

**Objectives**

* Build predictive models using machine learning and deep learning techniques to solve real-world problems
* Construct and evaluate artificial neural networks (ANNs), optimizing their architecture and performance
* Develop robust deep learning models for various data types, including tabular, sequential, and heterogeneous data
* Apply deep learning to natural language processing tasks, such as text classification and sentiment analysis
* Leverage deep learning for computer vision applications, including image classification, object detection, and segmentation
* Create generative AI models for text, images, and other modalities, understanding the ethical considerations of this technology
* Explore and utilize popular large language models (LLMs) and fine-tune medium-sized models for specific applications with your own data

**Outline**

* Introduction
* Review of Core Python Concepts (\*\*if needed – depends on tool context\*\*)
	+ Anaconda Computing Environment
	+ Importing and manipulating Data with Pandas
	+ Exploratory Data Analysis with Pandas and Seaborn
	+ NumPy ndarrays versus Pandas Dataframes
* Overview of Machine Learning/Deep Learning
	+ Developing predictive models with ML
	+ How Deep Learning techniques have extended ML
	+ Use cases and models for ML and Deep Learning
* Hands-on Introduction to Artificial Neural Networks (ANNs) and Deep Learning
	+ Components of Neural Network Architecture
	+ Evaluate Neural Network Fit on a Known Function
	+ Define and Monitor Convergence of a Neural Network
	+ Hyperparameter tuning
	+ Evaluating Models
	+ Scoring New Datasets with a Model
* Using Deep Learning for Prediction Models
* Hands-on Deep Learning Model Construction for Prediction Models
	+ Preprocessing Tabular Datasets for Deep Learning Workflows
	+ Data Validation Strategies
	+ Architecture Modifications to Managing Over-fitting
	+ Regularization Strategies
	+ Deep Learning Classification Model example
	+ Deep Learning Regression Model example
* Extending Deep Learning Models to more complex (heterogenous) data inputs
	+ What happens if we do not have a rectangle of data as the input?
	+ Pre-processing sequence data (i.e., time series) to use as inputs to feed-forward ANN
	+ Exploring model architectures that can handle sequence data
		- Recurrent Neural Network (RNN)
		- Long Short Term Memory (LSTM)
		- Transformers
	+ Extending model architecture to handle heterogenous (Sequence and non-sequence) data
* Natural Language Processing with Deep Learning
	+ Common use cases for text data and deep learning
	+ Exploratory Data Analysis on text data
	+ Cleaning/pre-processing text data
	+ Understanding word embeddings
	+ Text Classification models
		- Bag of Words approach
		- RNN / LSTM modeling approaches
	+ Transfer learning with text classification models: using BERT
		- Using Hugging Face to start with state-of-the-science models
		- Fine-tuning the model on your datasets
* Computer Vision with Deep Learning
	+ Common AI use cases with images
	+ Exploratory Data Analysis on image data
	+ Pre-processing images
	+ Data augmentation with existing images
	+ Image classification examples
		- Image classification with ANN
		- Image classification with convolutional neural networks
	+ Image classification and transfer learning:
		- Using Hugging Face to start with state-of-the-science models
		- Fine-tuning the model on your datasets
	+ Image segmentation and transfer learning
		- Using Hugging Face to start with state-of-the-science models
		- Fine-tuning the model on your datasets
* Generative AI with Deep Learning
	+ Generative AI fundamentals
		- Generating new content versus analyzing existing content
		- Example use cases: text, music, artwork, code generation
		- Ethics of generative AI
	+ Sequence Generation with RNN
		- Recurrent neural networks overview
		- Preparing text data
		- Setting up training samples and outputs
		- Model training with batching
		- Generating text from a trained model
		- Pros and cons of sequential generation
	+ Overview of current popular large language models (LLM)
		- ChatGPT
		- DALL-E 2
		- Bing AI
	+ Medium-sized LLM in your environment
		- Stanford Alpaca
		- Facebook Llama
		- Transfer learning with your data in these contexts
* Conclusion