

**Deep Learning and Development of Generative AI Models**

**Course Number:** AI-104WA  
**Duration:** 5 days

**Overview**

This Fundamentals of Deep Learning and Generative AI Models course teaches attendees the fundamentals of Machine Learning (ML) and deep learning using Python programming. Participants learn how to use Python to import and manipulate data, perform exploratory data analysis, and build machine learning models. Attendees also learn about the different types of ML models, classification and regression, and Neural Networks.

**Prerequisites**

All attendees must have experience developing Deep Learning models, including architectures such as feed-forward artificial Neural Networks, recurrent, and convolutional.

**Materials**

All Deep Learning training students receive comprehensive courseware.

**Software Needed on Each Student PC**

All attendees must have a modern web browser and an Internet connection.

**Objectives**

* Construct predictive models using machine learning and deep learning techniques, understanding their applications and limitations
* Build and evaluate artificial neural networks (ANNs) for various tasks, optimizing their architecture and monitoring convergence
* Develop robust deep learning models for classification and regression tasks, implementing preprocessing, validation, and regularization strategies
* Apply generative AI techniques to create new content across various domains, understanding the ethical considerations involved
* Utilize recurrent neural networks (RNNs) and variational autoencoders (VAEs) for sequential data generation and other applications
* Create generative adversarial networks (GANs) to generate realistic data samples and address adversarial examples
* Leverage transformer architectures for natural language processing and time series classification tasks
* Explore popular large language models (LLMs) like ChatGPT, DALL-E 2, and Bing AI, and understand their capabilities
* Fine-tune medium-sized LLMs like Stanford Alpaca and Facebook Llama with your own data for specific use cases

**Outline**

* Review of Core Python Concepts (optional)
  + 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
* 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 the convergence of a Neural Network
  + Evaluating models
  + Scoring new datasets with a model
* Deep Learning Model Construction for Prediction
  + Preprocessing tabular datasets for Deep Learning workflows
  + Data validation strategies
  + Architecture modifications for managing over-fitting
  + Regularization strategies
  + Deep Learning classification model example
  + Deep Learning regression model example
  + Trustworthy AI Frameworks for this DL prediction context
* Generative AI Fundamentals
  + Generating new content versus analyzing existing content
  + Example use cases: text, music, artwork, code generation
  + Ethics of Generative AI
* Sequential Generation with Recurrent Neural Networks (RNN)
  + RNN 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
* Variational Autoencoders
  + What is an autoencoder?
  + Building a simple autoencoder from a fully connected layer
  + Sparse autoencoders
  + Deep convolutional autoencoders
  + Applications of autoencoders to image denoising
  + Sequential autoencoders
  + Variational autoencoders
* Generative Adversarial Networks
  + Model stacking
  + Adversarial examples
  + Generational and discriminative networks
  + Building a generative adversarial network
* Transformer Architectures
  + The problems with recurrent architectures
  + Attention-based architectures
  + Positional encoding
  + The Transformer: attention is all you need
  + Time series classification using transformers
* Overview of Current Popular Large Language Models (LLM)
  + ChatGPT
  + DALL-E 2
  + Bing AI
* Medium-sized LLM in Your Own Environment
  + Stanford Alpaca
  + Facebook Llama
  + Transfer learning with your own data in these contexts
* Conclusion