

## AI-212 Deep Learning Foundations with PyTorch

**Planned Course Length:** 16 training hours

### Course Description:

Artificial intelligence has become an extremely important area for IT professionals and engineers in the past 10-20 years with the scientific breakthroughs and practical applications of deep learning and more recently of generative AI systems, especially with its Large Language Model (LLM) variant such as OpenAI's ChatGPT and Google's Bard. Due to its importance and impact on every aspect of our lives, understanding the concepts, functionalities and practical usage of AI systems is quickly becoming essential for all IT and other technical professionals as well as for managers with technical background.

This training focuses on Machine Learning and Deep Learning (aka Artificial Neural Networks) foundations and teaches participants the following topics:

- Basic concepts and building blocks of Artificial Neural Networks (ANN)
- PyTorch Introduction and its usage for basic Deep learning models
- Convolutional Neural Networks (CNN) for Image recognition
- Recurrent Neural Networks (RNN) for Text classification
- Transfer Learning with PyTorch

Besides gaining basic understanding of the theory of deep learning, students will also make extensive lab exercises using the Python based PyTorch deep-learning framework to see how these concepts work in practice.

This training is part of the AI portfolio of Component Soft which explores essential AI topics, such as:

- AI-110: Intro to Large Language Model (LLMs) and LLM-based apps.
- AI-212: Deep Learning Foundations with PyTorch
- AI-434: GPT and Open-source LLM Application Developer

**Structure:** 50% theory, 50% hands on lab exercises

**Target audience:** All types of IT, telecom, and other technical professionals as well as managers with technical background who want to understand the basic concepts, programming of Deep Learning (aka Artificial Neural Networks) using the most popular Python based PyTorch framework.

**Prerequisites:** Basic understanding of IT systems and programming concepts. Basic Python programming skills needed for doing the lab exercises.

## Detailed Course Outline

### **Module 1. Basic concepts and building blocks of Artificial Neural Networks (ANN)**

- Neurons
- Activation functions
- Example workflow of artificial neural networks
- ANN learning method
- Gradient Descent
- Stochastic Gradient Descent
- Forward and Backpropagation

### **Module 2. PyTorch Introduction and its usage for basic Deep learning models**

- PyTorch Basics
- Main building blocks of PyTorch
- Forward and backward propagation in PyTorch
- Choosing the right Loss Function
- Model training and evaluation with PyTorch
- Experiment tracking and reproducibility with PyTorch
- Lab: Playing with a small neural network written in Python and PyTorch
- Lab: Create your first ANN

### **Module 3. Convolutional Neural Networks (CNN) for Image recognition**

- Basic understanding of CNNs
- How CNNs work, introduction
- Parts of CNNs:
  - Convolution
  - ReLU Layer
  - Pooling
  - Flattening
  - Full connection
- Lab: Create your first CNN

### **Module 4. Recurrent Neural Networks (RNN) for Text classification**

- Basic understanding of RNNs
- The problem of Vanishing Gradient
- A solution: Long Short-Term Memory - (LSTM)
- Lab: Create your first RNN

### **Module 5. Transfer Learning with PyTorch**

- Transfer learning with PyTorch
- Fine-tuning a pre-trained model with PyTorch
- Using a pre-trained neural network to build a state-of-the-art text or image classifier
- Lab: Load and test a pre-trained neural network to build a state-of-the-art text/image classifier