

AI-403 Generative AI Basics (preliminary version)

Planned Course Length: 24 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 Generative AI techniques and teaches participants the following topics (preliminary version):

- Introduction to Generative AI
- Variational Autoencoders
- Generative Adversarial Networks (GANs)
- Autoregressive Models
- Diffusion Models
- Transformers and General Pretrained Models (GPT)
- Multimodal Models

Besides gaining a basic understanding of the theory of Generative AI models, students will also make extensive lab exercises using the Python based TensorFlow or PyTorch as well as Keros framework to see how these models work in practice.

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

- AI-110 Large Language Models (LLM) Intro
- AI-202 Deep Learning Basics with PyTorch
- AI-403 Generative AI Basics
- AI-413: Open-source LLM Application Developer
- AI-423: ChatGPT/GPT4 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, types and functionalities of Generative AI.

Prerequisites: Basic understanding of AI, Machine Learning and Deep Learning concepts. Basic Python programming skills. Some experience in using TensorFlow and Keros deep-learning frameworks.

Suggested preliminary course: AI-202 Deep Learning Basics

Detailed Course Outline (preliminary version)

Module 1: Introduction to Generative Deep Learning

- What is generative modelling?
- Generative vs. discriminative modelling
- The generative modelling framework
- Types of generative modelling
- Lab: testing your TensorFlow + Keros environment

Module 2: Variational Autoencoders (VAE)

- Introduction to autoencoders and decoders
- Encoder architecture
- Decoder architecture
- Joining the encoder and decoder
- Variational autoencoders
- Lab: using VAE for manipulating images

Module 3: Generative Adversarial Networks (GAN)

- Understanding GAN models
- Types of GAN models
- Deep convolutional GAN
- Wasserstein GAN
- Conditional GAN
- Lab: using GAN for manipulating images

Module 4: Diffusion Models

- Principles and components of diffusion models
- The forward process: adding noise to the images in the training set
- The reparameterization trick
- The diffusion schedule
- The reverse diffusion process:
- Lab: creating new flower images with a diffusion model

Module 5: Transformers and General Pretrained Models (GPT)

- Introduction to decoder transformer models for text generation
- The attention mechanism: giving more weights to some words in a sentence
- Details of the attention mechanism
- Casual masking
- Attention heads and multihead attention layer
- Transformer block
- Positional encoding
- Lab: using GPT to predict the following word in a sentence

Module 6: Multimodal Models

- Multimodal model basics
- Multimodal model examples:
- DALL.E 2
- Imagen from Google Brain
- Flamenco from DeepMind
- Stable Diffusion