http://generativeintelligencelab.ai

# TUTORIAL
# Generative AI and Large Generative Models

## Description

This **half-day tutorial** revises the concepts and applications of Generative Artificial Intelligence (GenAI), Large Generative Models, Agentic Frameworks, and Multi-Agent Systems. The central questions for our discussion include:

- ❖ What is Generative AI, and how is it different from traditional AI?
- ❖ What are the real-world benefits and limitations of using GenAI in industry solutions?
- ❖ What does it mean for an AI to be agentic or autonomous?
- ❖ What are the broader implications around the rise of this technology for the industry, the workforce, and society as a whole?

The use of Generative Intelligence and Agentic systems is already underway and their rapid evolution promises to unlock unprecedented possibilities such as accelerated prototyping, personalized innovation, and collaborative ecosystems. Researchers, solution architects, and software developers are augmented by GenAI-powered tools to brainstorm on new ideas, elaborate on specific concepts, and develop MVP to support their research proposals. Generative AI combined with agentic systems act as an extension of human intelligence handling repetitive tasks, analyzing complex data, and proposing innovative solutions.

The objective of this **tutorial** include:

- ❖ Provide attendees with an understanding about Generative Intelligence, Agentic AI, Multi-Agent Systems, and 'automated thinking'.
- ❖ Investigate current perceptions about Generative Intelligence, Multi-Agent Systems, and automated research and development.

❖ Explore how GenAI-Multi-Agent Systems have the potential to redefine the essence of collaborative creative process, with the focus on automated research process but extensible to other areas of creative thinking.

**<u>Target audience</u>**:

Researchers, students, and practitioners with some technical background and some understanding about AI, Machine Learning, deep Learning, and programming. The tutorial includes practical demonstrations during this session and exercises that attendants can implement during their own time after the session.

# Proposed Structure

### Session 1: Foundations of Generative AI (30 mins)

Introduces the concept of Generative Intelligence Systems (GenAI) and its transformative role in industry and society through the lenses of research development. We will introduce foundational ideas about GenAI, how it impacts automation of reasoning, and outline practical applications for research support.

### Session 2: Large Generative Models (30 mins)

An in-depth look at the workings of Large Generative Models. Focus on Transformer Architecture, how Generative Models operate, what Generative Models can do, how to submit and configure requests to Generative Models.

### Break 15 minutes

### Session 3: Prompt Engineering (30 mins)

Learn about Prompt Engineering and how to apply these techniques to the design, structure, and refinement of prompts to optimize results. We discuss the art and science behind effective prompts to interact with Large Generative Models.

### Session 4: Generative AI Pipelines (30 minutes)

Learn the impact of AI Pipelines on GenAI-powered solutions and how to design complex AI pipelines that integrate multiple AI services, APIs, and models to create intelligent, adaptive systems.

### Break 15 minutes

### Session 5: Agentic AI Systems (30 minutes)

Introduction to agent-based systems, concepts of autonomy, reactivity, proactiveness,

and social ability. Role of agents in software automation and decision-making. Learn about intelligent agent architectures including BDI (Belief-Desire-Intention) models. Explore simple decision-making and state management.

### Session 6: Multi-Agent Systems Architectures (30 minutes)

Introduction to MAS architectures to compose systems of interacting agents, the impact of communication protocols, collaboration models, and conflict resolution strategies. Explore decentralized and dynamic agent networks where agents discover and connect with each other automatically to exchange services and capabilities. Learn about AI systems that collaborate with users or other AI entities in real time to augment creativity, problem-solving, and system development.

# Exercises

This tutorial is supported by practical exercise that will be presented as examples during the presentations. Attendants will be able to execute the exercises after the tutorial by following the instructions at:

http://generativeintelligencelab.ai/exercises.html

**Optional:**
Hands-on exercises along with the instructor; suitable for tech-savvy audience with Python programming experience and environment (add 1-hour)

# About the Instructor

**Dr. Fernando Koch** is a Research Professor at Florida Atlantic University, where he leads the Generative Intelligence Lab. He is a global leader in Artificial Intelligence and Generative AI with over 30 years of experience spanning academic research, enterprise innovation, and solution architecture. Dr. Koch holds a Ph.D. in Computer Science from Utrecht University and has held leadership roles at IBM Research, Samsung Research, and Openwave, as well as academic appointments at the University of Melbourne and Korea University. His work bridges academia and industry, with a proven track record of driving and scaling AI initiatives across Fortune 100 companies, startups, and research institutions. Dr. Koch is a technical advisor to entrepreneurs and innovation leaders, known for building high-performing development teams and delivering AI solutions in complex enterprise environments. He has co-edited 6 books, authored over 90 scientific publications, and filed more than 100 patent applications (http://www.fernandokoch.me)