KOENIG SOLUTIONS · COURSE OUTLINE

# In-House AI: Ollama, LangChain & CrewAI

Learn to build in-house AI systems with Python, Ollama, LangChain, CrewAI, AutoGen and LangGraph, from data analysis to autonomous agents.

| 15 Days | 5 | 38 | 23 |
|---|---|---|---|
| DURATION | MODULES | TOPICS | HANDS-ON ACTIVITIES |

## COURSE OVERVIEW

To equip participants with elite skills in Python and cutting-edge AI frameworks including Ollama, LangChain, CrewAI, AutoGen, and LangGraph. The program is designed to enable the architecture, deployment, and maintenance of a secure, in-house AI ecosystem for advanced data analysis and the creation of sophisticated autonomous agents.

## WHO THIS COURSE IS FOR

- **AI Developers**
- **Data Analysts**
- **Python Developers**
- **Machine Learning Engineers**
- **Data Scientists**

## LEARNING OBJECTIVES

- Set up and run open-source LLMs locally with Ollama
- Manipulate and visualise data using Pandas, Matplotlib and Seaborn
- Build LLM chains and prompts with the LangChain framework
- Apply machine learning techniques such as regression and clustering
- Implement retrieval-augmented generation pipelines with vector databases
- Develop tool-using agents with LangChain, CrewAI, AutoGen and LangGraph
- Compare agentic frameworks to select one for a given problem
- Design a secure agentic workflow for institutional data analysis

COURSE SYLLABUS

# 5 Modules, 38 Topics

01

Days 1-3 | 2 Activities | 2 Activities | 3 Activities

## The AI Development Toolkit

### DAY 1: PYTHON & THE LOCAL AI ECOSYSTEM

- **Essential Python:** Syntax, data structures, and functions for AI
- **Environment Setup:** Anaconda & Jupyter for iterative development
- **Introduction to Ollama:** Setting up and running powerful open-source LLMs entirely in-house

### DAY 2: DATA HANDLING & VISUALIZATION

- Advanced Data Manipulation with Pandas
- **Visual Storytelling:** Creating compelling charts with Matplotlib & Seaborn
- Preparing data for both traditional ML and LLM analysis

### DAY 3: THE OPEN-SOURCE AI ECOSYSTEM: HUGGING FACE & LANGCHAIN

- **Introduction to Hugging Face:** Exploring the hub for models, datasets, and the transformers library
- Understanding the ecosystem for open-source AI
- **The LangChain Framework:** The “glue” for LLM applications
- Connecting LangChain with Ollama for secure, local-first development

02

Days 4-6 | 2 Activities | Activity | Activity

## Predictive Analytics & RAG

### DAY 4: MACHINE LEARNING FOR DATA INSIGHTS

- **Supervised Learning:** Regression & Classification with Scikit-learn
- **Unsupervised Learning:** Clustering with K-Means
- Generating quantitative insights from structured data

### DAY 5: RETRIEVAL-AUGMENTED GENERATION (RAG)

- Securely augmenting LLMs with private knowledge using RAG
- **Vector Databases:** Indexing documents for efficient semantic retrieval
- Building RAG pipelines with LangChain

### DAY 6: BUILDING CHAINS & TOOL-USING AGENTS

- Creating complex, multi-step workflows with LangChain Expression Language (LCEL)
- **Introduction to AI Agents:** The concept of ReAct (Reason + Act)
- Equipping LangChain Agents with “tools” to interact with external systems (e.g., data analysis functions)

03

Days 7-9 | Activity | Activity | Activity

## Orchestrating Autonomous AI Agents

### DAY 7: COLLABORATIVE AI WITH CREWAI

- Introduction to CrewAI for orchestrating role-playing, autonomous agents
- Defining Agents with specific roles, goals, and backstories
- Designing collaborative Tasks and assembling a Crew

### DAY 8: CONVERSATIONAL MULTI-AGENT SYSTEMS WITH AUTOGEN

- Introduction to Microsoft's AutoGen framework
- Building systems with conversable agents that can solve tasks collectively
- Comparing AutoGen's conversation-driven approach to CrewAI's task-driven approach

### DAY 9: STATE MANAGEMENT WITH LANGGRAPH

- **Introduction to LangGraph:** Building robust, stateful agentic applications
- Defining agent states as nodes and decisions as edges in a graph
- Creating cyclical and more complex agent behaviors that go beyond linear chains

04

Days 10-12 | Activity | Activity | Activity

## Advanced Applications & Capstone Project Prep

### DAY 10: INTEGRATING AGENTS WITH INSTITUTIONAL DATA

- Creating custom tools for agents to securely query institutional data (from NASMS, goAML)
- Security best practices for agent-based data access

### DAY 11: COMPARING AGENTIC FRAMEWORKS

- A deep-dive workshop comparing the strengths and weaknesses of LangChain Agents, CrewAI, AutoGen, and LangGraph
- Choosing the right framework for a given problem

### DAY 12: CAPSTONE PROJECT SCOPING

- Defining the final project deliverables
- Designing the agentic workflow for the final project
- Setting up the secure, in-house development environment for the project

05

Days 13-15 | Activity | 2 Activities | 3 Activities

## Capstone Project: Secure Intelligence Synthesis

### TOPICS

- **Day 13:** Project Build Day I - Agent & Tool Development
- **Day 14:** Project Build Day II - Workflow Orchestration
- **Day 15:** Automated Reporting & Final Presentation

HANDS-ON ACTIVITIES

# Practise What You Learn

| # | MODULE | ACTIVITY |
|---|---|---|
| 01 | **The AI Development Toolkit** | **HANDS-ON LAB (DAY 1)**<br>■ Write foundational Python scripts<br>■ Install Ollama and interact with a local language model for the first time<br>**HANDS-ON LAB (DAY 2)**<br>■ Perform a complete exploratory data analysis (EDA)<br>■ Generate insightful charts to present findings from a sample dataset<br>**HANDS-ON LAB (DAY 3)**<br>■ Explore and identify suitable models on the Hugging Face Hub<br>■ Build your first LLM chains using LangChain, powered by your local Ollama model<br>■ Practice advanced prompt engineering techniques within the LangChain framework |
| 02 | **Predictive Analytics & RAG** | **HANDS-ON LAB (DAY 4)**<br>■ Build, train, and evaluate a classification model<br>■ Interpret performance metrics like Accuracy and the Confusion Matrix<br>**Hands-on Lab (Day 5):** Build a functional RAG system to enable a “chat with your documents” feature, powered by your local Ollama model<br>**Hands-on Lab (Day 6):** Develop an agent that can dynamically select and use a Python tool to solve a problem |
| 03 | **Orchestrating Autonomous AI Agents** | **Hands-on Lab (Day 7):** Build a simple research crew where one agent finds information and another summarizes it<br>**Hands-on Lab (Day 8):** Create a multi-agent chat environment where agents collaborate to write code or analyze a problem<br>**Hands-on Lab (Day 9):** Build an agent that can loop, self-correct, and modify its plan based on tool outputs, using LangGraph |
| 04 | **Advanced Applications & Capstone Project Prep** | **Hands-on Lab (Day 10):** Develop a custom Python tool that a CrewAI or LangGraph agent can use to fetch and analyze sample data<br>**Hands-on Lab (Day 11):** Implement the same simple task in two different frameworks to directly compare development experience and results<br>**Hands-on Lab (Day 12):** Begin developing the data connectors and core agent logic for the capstone project |

| # | MODULE | ACTIVITY |
|---|---|---|
| 05 | **Capstone Project: Secure Intelligence Synthesis** | **Hands-on Lab (Day 13):** A full day dedicated to building the core agents (using the chosen framework), defining their roles, and developing the custom tools they need to perform their tasks on institutional data<br>**HANDS-ON LAB (DAY 14)**<br>■ A full day focused on orchestrating the agents into a cohesive workflow<br>■ Connecting the agents' outputs to generate narrative summaries and quantitative findings<br>**HANDS-ON LAB (DAY 15)**<br>■ Develop a Python script to automatically generate a polished PDF report from the final output of the agent crew<br>■ Finalize and present the end-to-end pipeline that transforms raw data into a finished, insightful report<br>■ Discuss strategies for in-house deployment, monitoring, and maintenance |

WHAT IS INCLUDED

## Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

ABOUT KOENIG

## Who We Are

Established in 1993, Koenig Solutions is a globally recognised training provider with 35+ technology partnerships, 5,000+ training programmes and a network of certified instructors and subject matter experts, supporting individuals and enterprise teams worldwide.

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