KOENIG SOLUTIONS · COURSE OUTLINE

ML, Deep Learning & GenAI: Transformers & RAG

Learn to build machine learning, deep learning and generative AI solutions, from data preprocessing to Transformers, prompt engineering, RAG and agentic AI.

15 Days	61	15
120 HOURS	TOPICS	HANDS-ON LABS

COURSE OVERVIEW

This course begins with Python foundations, data handling and exploratory data analysis before moving into core machine learning concepts, including supervised learning for regression and classification, unsupervised learning and model tuning. It then progresses to deep learning fundamentals with neural networks and TensorFlow/Keras, followed by natural language processing and Transformer architectures with attention mechanisms. The later modules cover generative AI and large language models, prompt engineering techniques, retrieval-augmented generation for knowledge-grounded systems, and an introduction to agentic AI concepts including tool calling and agent workflows.

WHO THIS COURSE IS FOR

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

PREREQUISITES

- Python fundamentals (mandatory)

LEARNING OBJECTIVES

The objectives of this course are to:

- Build a strong foundation in Machine Learning concepts and workflows required for real-world problem solving
- Enable learners to analyze, preprocess, and model data using Python and standard ML libraries
- Introduce Deep Learning fundamentals, including neural networks and modern training techniques
- Provide conceptual and hands-on understanding of Natural Language Processing and Transformer architectures
- Develop practical skills in Generative AI and Large Language Models (LLMs)
- Teach effective Prompt Engineering techniques to improve accuracy and reliability of LLM outputs
- Introduce Retrieval-Augmented Generation (RAG) for building knowledge-grounded AI systems
- Familiarize learners with basic Agentic AI concepts and how agents differ from traditional pipelines
- Prepare participants for industry-relevant AI roles by combining theory, labs, and applied use cases

TRAINING APPROACH

How the Course Is Taught

> Theory + Labs (Open Source + Koenig DC).

COURSE SYLLABUS

61 Topics

DAY 1 Python for Machine Learning (Foundations)

TOPICS — Lab

Python basics for ML · Data types, control flow · Functions, file handling · NumPy fundamentals

DAY 2 Data Handling & EDA

TOPICS — Lab

Pandas for data manipulation · Data preprocessing techniques · Missing values & outliers · Data visualization

DAY 3 Machine Learning Fundamentals

TOPICS — Lab

What is Machine Learning · Supervised vs unsupervised learning · ML workflow & lifecycle · Bias-variance tradeoff

DAY 4 Supervised Learning (Regression)

TOPICS — Lab

Linear & Polynomial Regression · Loss functions · Model evaluation (MSE, RMSE, R^2) · Overfitting & regularization

DAY 5 Supervised Learning (Classification)

TOPICS — Lab

Logistic Regression · KNN, Decision Trees · Confusion matrix, accuracy, precision, recall · ROC & AUC

DAY 6 Unsupervised Learning

TOPICS

Lab

Clustering concepts · K-Means & Hierarchical clustering · Dimensionality reduction (PCA - intuition)

DAY 7 Model Tuning & ML Best Practices

TOPICS

Lab

Feature engineering · Hyperparameter tuning · Cross-validation · Model comparison

DAY 8 Introduction to Deep Learning

TOPICS

Lab

Why Deep Learning? · ML vs DL · Neural network fundamentals · Perceptron & MLP · Activation functions

DAY 9 Deep Learning with TensorFlow / Keras

TOPICS

Lab

ANN architecture · Loss functions & optimizers · Training & validation · Overfitting in DL

DAY 10 Introduction to NLP

TOPICS

Lab

NLP overview & applications · Tokenization & text preprocessing · POS tagging & NER · Vectorization basics

DAY 11 Transformers & Attention

TOPICS

Lab

Limitations of classical NLP · Encoder-Decoder architecture · Attention mechanism · Transformer overview

DAY 12 Introduction to Generative AI

TOPICS

Lab

What is Generative AI · Generative vs predictive models · Text generation concepts · Ethical concerns & hallucination

DAY 13 Prompt Engineering for LLMs

TOPICS

Lab

Prompt anatomy · Zero-shot & few-shot prompting · Chain-of-thought reasoning · Prompt grounding

DAY 14 Retrieval-Augmented Generation (RAG)

TOPICS

Lab

Why RAG is required · RAG architecture · Document loading & chunking · Embeddings & vector databases

DAY 15 Introduction to Agentic AI

TOPICS

Lab

What is Agentic AI · RAG vs Agentic RAG · Agent lifecycle · Tool calling basics · Simple agent workflow

NOTES

- Course Learning Outcomes: By the end of this course, participants will be able to: Apply Python programming for data preprocessing, analysis, and machine learning tasks. Build and evaluate supervised and unsupervised machine learning models for regression, classification, and clustering problems. Perform feature engineering, model tuning, and performance evaluation using industry best practices. Design and train deep learning models using neural networks for real-world datasets. Understand and implement NLP pipelines, including text preprocessing and vectorization. Explain the working principles of Transformers and attention mechanisms. Develop Generative AI applications using Large Language Models. Create effective prompts using prompt engineering strategies such as few-shot and chain-of-thought prompting. Build RAG-based applications that combine LLMs with external knowledge sources. Understand Agentic AI workflows, including planning, tool usage, and basic agent reasoning.

HANDS-ON LABS

Practise What You Learn

MODULE	ACTIVITY
Python for Machine Learning (Foundations)	Python for ML workflows
Data Handling & EDA	EDA on real dataset
Machine Learning Fundamentals	ML pipeline overview
Supervised Learning (Regression)	Regression use case
Supervised Learning (Classification)	Classification problem

MODULE	ACTIVITY
Unsupervised Learning	Customer segmentation
Model Tuning & ML Best Practices	Improving ML performance
Introduction to Deep Learning	Build first neural network
Deep Learning with TensorFlow / Keras	ANN for classification
Introduction to NLP	Text analytics with NLP
Transformers & Attention	Transformer-based task (T5)
Introduction to Generative AI	Text generation using LLM
Prompt Engineering for LLMs	Prompt optimization exercises
Retrieval-Augmented Generation (RAG)	Build a simple RAG system
Introduction to Agentic AI	Mini agentic demo

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.

FLEXIBLE DELIVERY

Learn the Way That Suits You

Classroom Training | Live Online Classes (ILO) | Fly-Me-A-Trainer (FMAT) | Flexi (Self-Paced) | 1-on-1 Training

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Talk to a learning advisor about schedules, group training and customised delivery.

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