ScaleÛp

Hands-on Machine Learning with Python

Sharad Kolse

ScaleUp Analytics

scaleupanalytics01@gmail.com

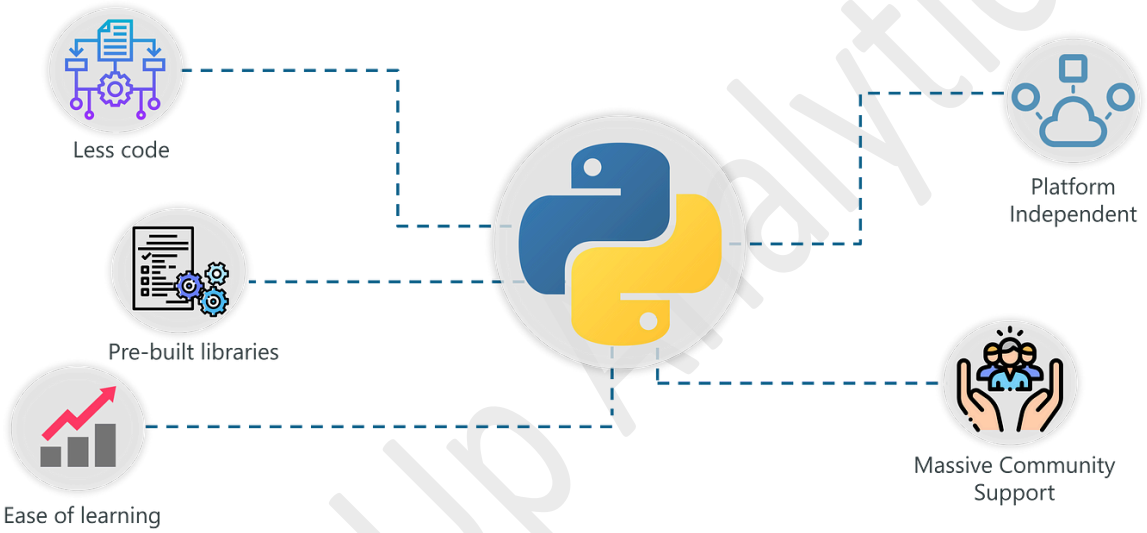
🚀 Introduction

Welcome to the exciting world of **Hands-On Machine Learning with Python: Build, Train, and Deploy!** 🎯

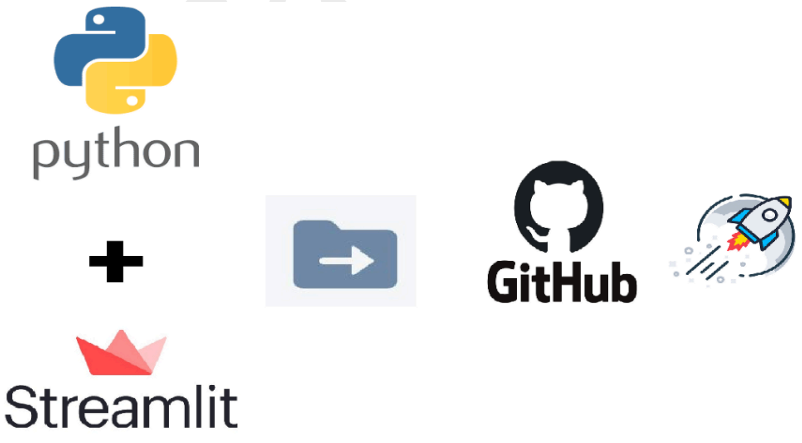
In this course, you'll embark on a journey to **learn, implement, and deploy Machine Learning models**, empowering you to **solve real-world problems with data-driven intelligence.**

We'll explore two key aspects of ML development:

🔹 **Python for ML –** Leverage powerful libraries like Scikit-Learn, Pandas, matplotlib, seaborn, and streamlit to build and train models efficiently.



🔹 **Deployment –** Learn how to deploy your models using tools like Steamlit WebApp API, and Github to make them production-ready.



Throughout this course, you will:

✅ Master **fundamentals of supervised and unsupervised learning** 📊

✅ Apply **Python-based ML techniques** for real-world data analysis 🚀

✅ Explore **model evaluation, hyperparameter tuning, and feature engineering** 🔎

✅ Build **interactive visualizations** to communicate insights effectively 📈

✅ Deploy trained models for **real-time predictions** using APIs and cloud services ☁️

Whether you're a beginner or an aspiring Data Analyst/ML engineer, this course will equip you with the **skills to build, train, and deploy ML models**, boosting your career in AI and Data Science.

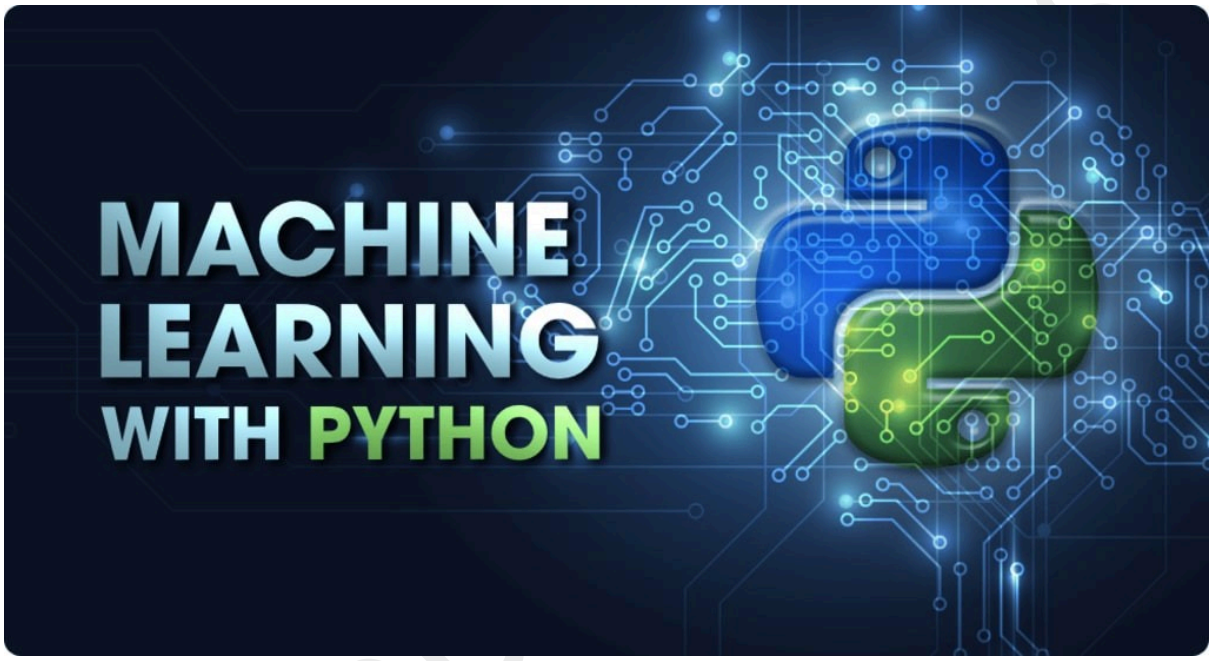
Get ready to turn data into intelligence and deploy ML solutions! 💡🔍

Let’s begin! 🚀

Course Objectives

By the end of this course, you will be able to:

- Understand Machine Learning basic concepts and industry applications
- Equipped with Python to develop ML Models
- Learn theory and implementation of important algorithms in ML
- Learn Model Deployment on Streamlit Web App
- Practice hands-on with real-world datasets



What will you gain on the course completion?

Practical Tools and Experience:

- Gain hands-on experience with SQL and Power-BI.
- Identify patterns, trends and anomalies in data- EDA.
- Apply skills to real-world projects and case studies.

Career Advancement:

- Become a high-demand data analyst in a rapidly growing field.
- Enhance your resume with most trending skills.
- Gain upper hand in the data science market by learning the technical skills in academics.

Machine Learning Tools and ML Python Libraries

- Pandas
- Scikit-learn
- Streamlit
- Matplotlib
- Seaborn

Course Outline

Module 1: Introduction to Machine Learning and Python

- Bird's Eye view of ML
- Types of Machine Learning
- Important ML Concepts
- Introduction to Python

Module 2: Gradient Descent and Core ML Concepts
Module 3: Supervised Learning
Module 4: Un-supervised Learning
Module 5: Model Building and Validation
Module 6: Model deployment using Streamlit and Github
Module 7: End-to-end case study
Module 8: Capstone Projects

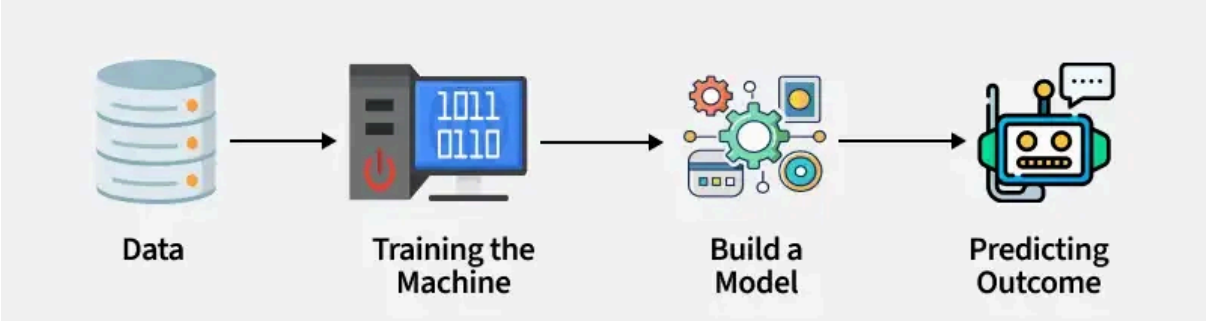
Advance Topics

Module 1: Imbalance Data Handling Techniques
Module 2: Advanced Feature Engineering
Module 3: Outliers Treatment
Module 4: Methods to Reduce Overfitting
Module 5: Hyper-parameter Tuning
Module 6: Tree Based Algorithms

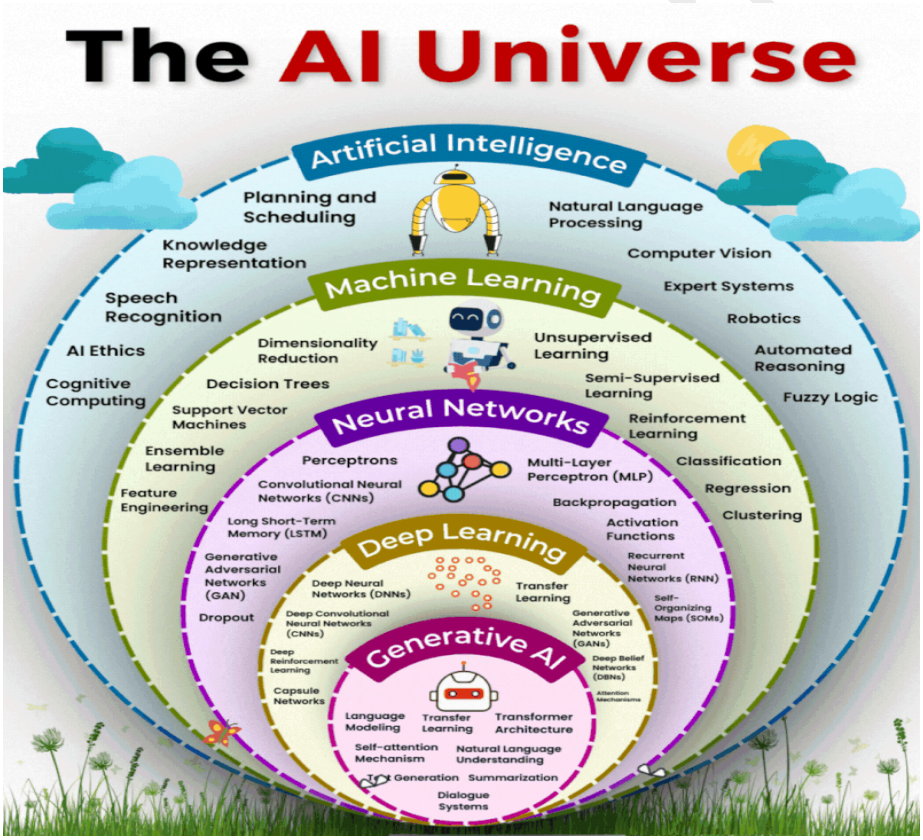
Module 1: Introduction to Machine Learning and Python

What is Machine Learning?

Machine Learning (ML) is a branch of Artificial Intelligence (AI) that enables computers to **learn from data** and make predictions or decisions **without being explicitly programmed**. Instead of following fixed rules, ML models improve their performance by identifying patterns in data.



Bird's Eye View of the AI Universe



- **Artificial Intelligence (AI):**

AI is the broadest field that enables machines to **simulate human intelligence**

to solve problems, recognize patterns, and make decisions (e.g., chatbots, self-driving cars).

🔹 **Machine Learning (ML):**
A subset of AI that **learns from data** without being explicitly programmed. It improves performance over time using patterns (e.g., fraud detection, recommendation systems).

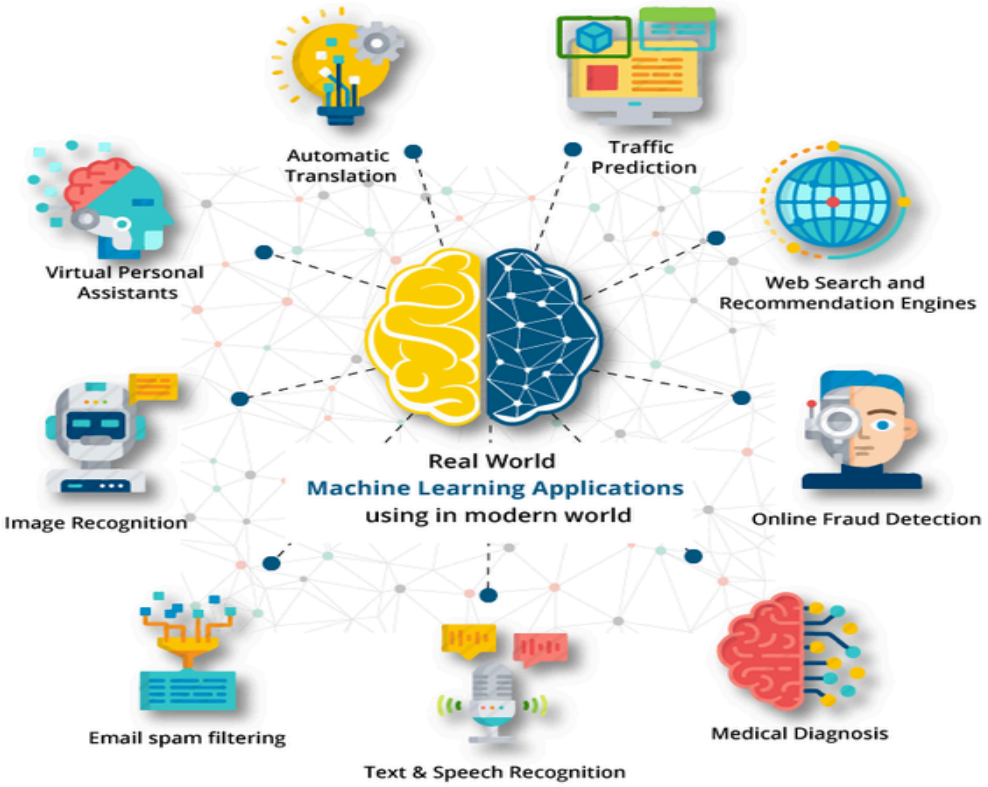
🔹 **Neural Networks (NN):**
Inspired by the human brain, NNs consist of **layers of interconnected nodes (neurons)** that process data and identify patterns. They are the foundation of deep learning.

🔹 **Deep Learning (DL):**
A specialized branch of ML using **multi-layered neural networks** to analyze large amounts of data. It powers advanced AI applications like **image recognition and speech processing** (e.g., Siri, facial recognition).

🔹 **Generative AI (GenAI):**
A type of AI that **creates new content** (text, images, code) based on learned patterns, using models like **GPT and DALL·E** (e.g., ChatGPT, AI art generators).

Each of these technologies builds on the other, making AI smarter and more powerful! 🚀

Some Real World Applications of ML



1️⃣ **Fraud Detection** – Banks use ML to detect suspicious transactions and prevent fraud.

2️⃣ **Recommendation Systems** – Netflix, Amazon, and Spotify suggest movies, products, and songs based on user behavior.

3️⃣ **Self-Driving Cars** – ML helps autonomous vehicles recognize objects, predict movement, and navigate roads.

4️⃣ **Healthcare Diagnosis** – AI-powered models assist doctors in diagnosing diseases like cancer and heart conditions.

5️⃣ **Speech Recognition** – Virtual assistants like Siri, Alexa, and Google Assistant understand and process voice commands.

6️⃣ **Customer Support (Chatbots)** – AI chatbots handle customer queries, improving response time and support efficiency.

7️⃣ **Stock Market Prediction** – ML analyzes financial data to predict stock prices and market trends.

8️⃣ **Spam & Malware Detection** – Email providers use ML to filter spam and detect cyber threats.

9️⃣ **Supply Chain & Demand Forecasting** – Businesses predict product demand and optimize inventory using ML models.

🔟 **Personalized Marketing** – Advertisers use ML to target the right audience with personalized ads.

ML is revolutionizing industries by automating tasks, improving decision-making, and enhancing user experiences! 🚀

Types of Machine Learning:

1. **Supervised Learning** – The model learns from labeled data (e.g., spam detection, house price prediction).

Definition: The model learns from **labeled data**, meaning each input has a corresponding correct output.

How it works:

- The model is trained on **input-output pairs**.
- It makes predictions and adjusts based on errors.
- The goal is to **map inputs to correct outputs** accurately.

Examples:
✅ Spam Detection – Classify emails as "spam" or "not spam."
✅ House Price Prediction – Predict prices based on features like size and

location.
✅ Medical Diagnosis – Identify diseases based on symptoms.

Algorithms:

1. Linear Regression, Logistic Regression
2. Decision Trees, Random Forest
3. Support Vector Machines (SVM), Neural Networks

2. Unsupervised Learning – The model identifies patterns in unlabeled data (e.g., customer segmentation, anomaly detection).

Definition: The model learns from **unlabeled data**, finding hidden patterns or structures without predefined outputs.

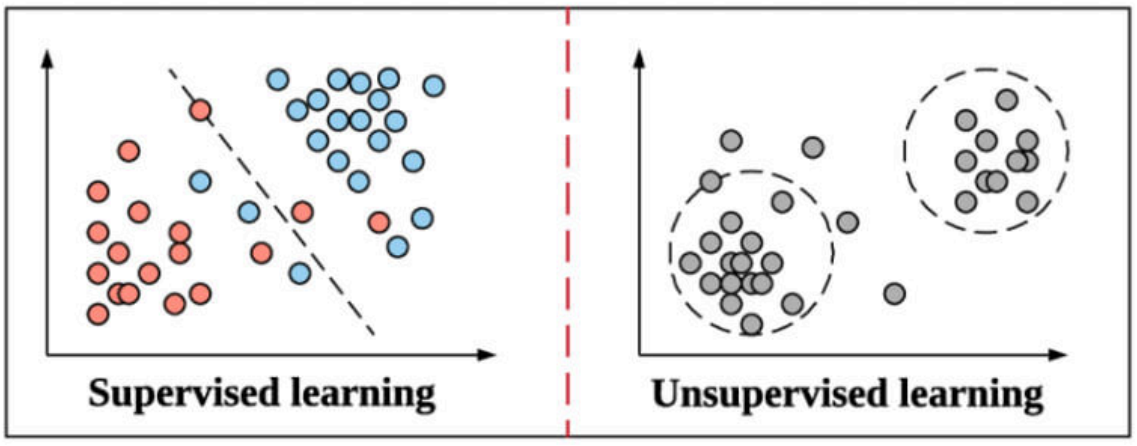
How it works:

- It analyzes data to **group similar items** or **reduce dimensions**.
- Used for **clustering and pattern recognition**.

Examples:
✅ Customer Segmentation – Group customers based on shopping behavior.
✅ Anomaly Detection – Detect fraud or unusual activity in financial transactions.
✅ Market Basket Analysis – Find product associations in shopping carts.

Algorithms:

1. K-Means Clustering
2. Hierarchical Clustering
3. Principal Component Analysis (PCA)



3. **Reinforcement Learning** – The model learns by trial and error to maximize rewards (e.g., self-driving cars, game-playing AI).

Definition: The model learns by **interacting with an environment** and receiving rewards or penalties.

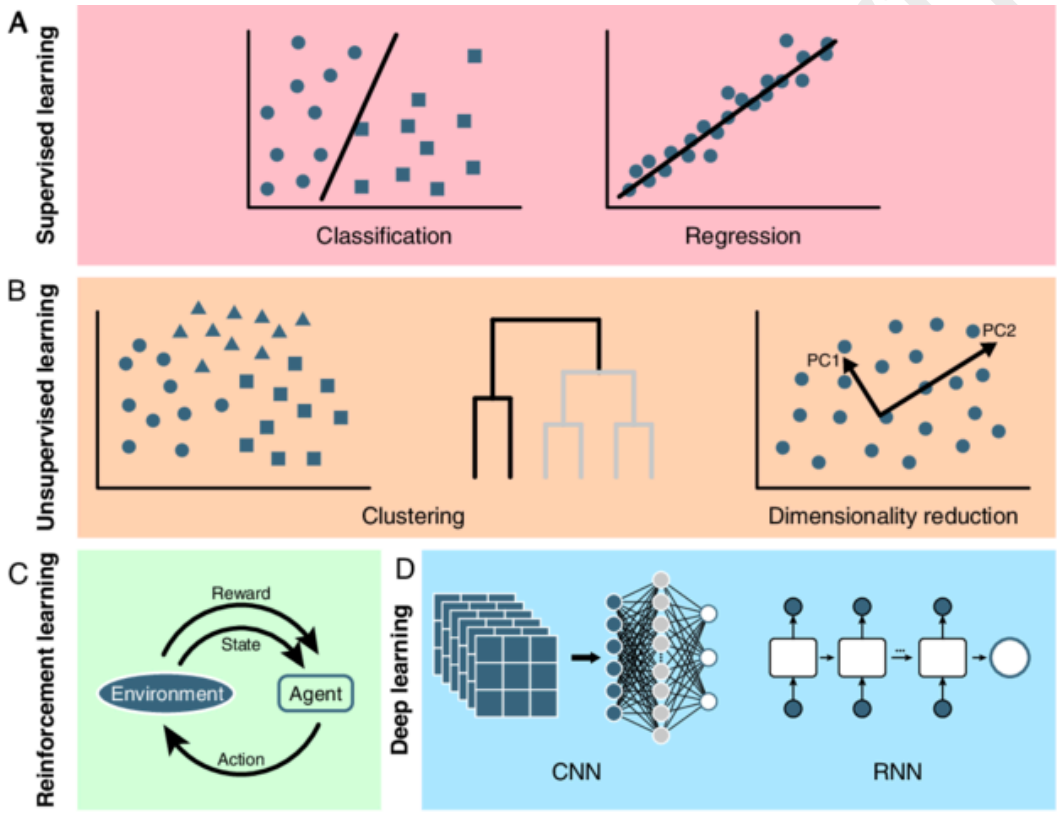
How it works:

- It makes a decision, receives **feedback (reward or penalty)**, and improves over time.
- Used in **robotics, gaming, and automation**.

Examples:
✅ Self-Driving Cars – Learn to navigate by trial and error.
✅ Game AI – AI playing chess, Go, or video games (e.g., AlphaGo).
✅ Robotics – Robots learning to walk or grasp objects.

Algorithms:

- Q-Learning
- Deep Q Networks (DQN)
- Proximal Policy Optimization (PPO)



Difference Between Supervised and Unsupervised Learning

Feature	Supervised Learning	Unsupervised Learning
Definition	Learn from labeled data (input-output pairs).	Learn patterns from unlabeled data.

Types	Classification, Regression.	Clustering, Association, Dimensionality Reduction.
Labels	Requires labeled data (X → Y).	No labels, only input data (X).
Goal	Predict output based on past examples.	Find hidden patterns & relationships.
Example Algorithms	Linear Regression, Decision Trees, Random Forest	K-Means, PCA, Clustering
Use Cases	Spam detection, fraud detection, loan approval, price prediction.	Customer segmentation, anomaly detection, topic modeling, recommendation systems.

Quizzes

1. What is Machine Learning?

a) A programming technique that does not require data
b) A subset of AI that enables computers to learn from data
c) A hardware component for faster computing
d) A method to manually program all possible outcomes

✅ **Answer:** b) A subset of AI that enables computers to learn from data

2. Which of the following is NOT a type of Machine Learning?

a) Supervised Learning
b) Unsupervised Learning
c) Reinforcement Learning
d) Static Learning

✅ **Answer:** d) Static Learning

3. Which of the following is an example of supervised learning?

a) Spam email classification
b) Customer segmentation
c) Market basket analysis
d) Anomaly detection

✅ **Answer:** a) Spam email classification

4. What is the key difference between supervised and unsupervised learning?

a) Supervised learning uses labeled data, while unsupervised learning uses unlabeled data.
b) Unsupervised learning requires human intervention, while supervised learning does not.
c) Both require labeled data.
d) Supervised learning is used only for clustering.

✅ **Answer:** a) Supervised learning uses labeled data, while unsupervised learning uses unlabeled data.

5. Which of the following is an example of a regression problem?

a) Predicting whether an email is spam or not
b) Predicting the price of a house based on its features
c) Identifying handwritten digits
d) Classifying animals into different species

✅ **Answer:** b) Predicting the price of a house based on its features

6. What is the primary goal of Unsupervised Learning?

a) To find patterns in data without predefined labels
b) To predict continuous values
c) To classify data into known categories
d) To memorize data points

✅ **Answer:** a) To find patterns in data without predefined labels

Why Python for Machine Learning?

Python is widely used for ML due to:
✅ **Ease of use** – Simple and readable syntax
✅ **Rich libraries** – Powerful ML tools like **Scikit-Learn, Pandas, Matplotlib, Seaborn, Streamlit**
✅ **Strong community** – Extensive support and resources

Basic Python Libraries for ML:

📌 **NumPy & Pandas** – Data handling and manipulation
📌 **Matplotlib & Seaborn** – Data visualization
📌 **Scikit-Learn** – ML model building and evaluation
📌 **Streamlit** – Web Apps API

Getting Started:

1. Learn Python basics (variables, loops, functions).
2. Explore data using Pandas and Matplotlib.
3. Build simple ML models using Scikit-Learn.
4. Evaluate and fine-tune models for better accuracy.

By mastering ML with Python, you can solve real-world problems and build intelligent applications! 🚀💡