**Lab 1: Introduction to Machine Learning and Python Environment Setup**

**Objectives:**

* To understand the concept of Machine Learning and its real-world applications.
* To set up a Python-based development environment for Machine Learning projects.
* To create and activate a virtual environment to manage project dependencies efficiently.
* To install essential libraries including **NumPy**, **Pandas**, **Matplotlib**, and **Scikit-learn** for future ML tasks.

**What is Machine Learning?**

Machine Learning is a branch of Artificial Intelligence (AI) that enables computers to **learn from data** and make predictions or decisions **without being explicitly programmed**. It plays a central role in automation, intelligent systems, and modern data-driven applications.

**Types of Machine Learning:**

1. **Supervised Learning:**  
   Model is trained on labeled data (e.g., email spam detection).
2. **Unsupervised Learning:**  
   Model learns patterns from unlabeled data (e.g., customer segmentation).
3. **Reinforcement Learning:**  
   Model learns by interacting with the environment and receiving feedback (e.g., self-driving cars, game AI).

**Real-world Applications of ML:**

* **Healthcare:** Predicting diseases, drug discovery
* **Finance:** Fraud detection, credit scoring
* **E-commerce:** Recommendation systems (e.g., Amazon, Netflix)
* **Agriculture:** Crop disease prediction using images
* **Communication:** Spam filtering, speech recognition

**Required Tools:**

* Python (Recommended version: **3.10 or above**)
* Code Editor (e.g., **VS Code**, **Jupyter Notebook**, or **PyCharm**)
* **Git** (Optional – for version control)
* Stable **Internet Connection**

**Step-by-Step Procedure:**

**Step 1: Open Command Prompt**

Go to the Start Menu → Search for cmd → Right-click and select Run as Administrator.

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**Step 2: Verify Python Installation**

Check whether Python is already installed by running:

python –version

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**Step 3: Install virtualenv Package**

This allows you to create isolated Python environments:

pip install virtualenv

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**Step 4: Create a Virtual Environment**

Navigate to the folder where you want to create your environment. Use the following command to create a virtual environment named jawadhadi:

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**Step 5: Activate the Virtual Environment**

* For Windows:

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**Step 6: Install Essential ML Libraries**

Inside the activated environment, install the necessary ML libraries using pip:

pip install numpy pandas matplotlib scikit-learn

These libraries are fundamental for data processing, visualization, and machine learning.

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**Step 7: Path to the Virtual Environment**

To find the location of your virtual environment, you can use

where python

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This will return the full path to the Python executable inside the ml\_env folder.

**Diagram:**

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**Future Scope:**

This lab has prepared the necessary environment for performing advanced ML tasks like:

* Data Preprocessing
* Model Training and Testing
* Evaluation Metrics
* Hyperparameter Tuning
* Deployment of ML models

**Conclusion:**

In this lab, we were introduced to the foundational concepts of Machine Learning and explored its types and real-world applications such as recommendation systems, fraud detection, and autonomous vehicles. We then successfully set up a dedicated Python environment by installing and configuring virtualenv, ensuring an isolated workspace for our ML projects.

Additionally, we installed essential machine learning libraries, which are crucial for performing data analysis, visualization, and building ML models. This setup provides a strong foundation for upcoming labs where we will focus on data preprocessing, feature engineering, model training, testing, and evaluation using various ML algorithms.