**What is Machine Learning?**

Machine Learning (ML) is a branch of Artificial Intelligence (AI) that enables systems to learn and make decisions from data without being explicitly programmed. Rather than following fixed instructions, ML algorithms analyze patterns, relationships, and trends within datasets and make predictions or decisions based on that learning.

ML is used in countless applications today—from recommendation systems (like Netflix and Amazon) to voice assistants, fraud detection, and even in agriculture, where it's used for predicting crop yield or suggesting the right fertilizers.

The machine learning process involves:

* Collecting data
* Preparing and cleaning data
* Choosing a model
* Training the model
* Evaluating performance
* Making predictions on new data

**What is Supervised Machine Learning?**

Supervised learning is the most commonly used type of ML. In this method, the algorithm is trained on a labeled dataset, which means each training example includes the input and the desired output. The model tries to learn the mapping between the inputs and outputs.

It can be used for:

* **Classification tasks** – where the output is a category (e.g., healthy crop vs. diseased crop).
* **Regression tasks** – where the output is a continuous value (e.g., estimated fertilizer quantity).

### **Examples of supervised ML algorithms:**

* Linear Regression
* Logistic Regression
* Decision Trees
* Random Forest
* Support Vector Machines (SVM)

This type of learning is useful in agricultural domains—for example, predicting the best fertilizer based on soil and crop data.

**What is Regression?**

Regression is a supervised learning task that deals with predicting a continuous output variable. It tries to estimate the relationship between input variables (features) and a numerical output.

### **Example:**

Predicting the **amount of fertilizer needed** based on crop type, soil pH, and nitrogen levels.

### **Types of regression:**

* **Linear Regression**: Assumes a linear relationship between inputs and output.
* **Polynomial Regression**: Models nonlinear relationships.
* **Ridge/Lasso Regression**: Add regularization to linear models for better performance.

**What is Classification?**

Classification is another form of supervised learning where the output variable is categorical. The model assigns input data to one of several predefined classes or categories.

### **Example:**

Classifying a **crop type** based on features like temperature, humidity, and soil type.

### **Common classification algorithms:**

* Logistic Regression
* K-Nearest Neighbors (KNN)
* Decision Trees
* Random Forest
* Naive Bayes