

Crop and Fertiliser Recommendation System using Machine Learning

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1. What is Machine Learning (ML)?

A. Machine Learning (ML) is a branch of Artificial Intelligence (AI) that focuses on developing systems that can learn from and make decisions based on data. Instead of being explicitly programmed to perform a task, ML algorithms use patterns and inference to improve their performance over time. ML is widely used in various applications such as recommendation systems (like Netflix or Amazon), speech recognition, image classification, fraud detection, and autonomous vehicles.

□ **Data-Driven Decisions:** ML models are trained on historical data and can generalize to make predictions on unseen data.

□ **Types of Learning:** ML is broadly categorized into Supervised Learning, Unsupervised Learning, and Reinforcement Learning, depending on the nature of the data and task.

□ **Automation of Tasks:** ML automates analytical model building and is capable of performing complex tasks such as voice assistants (e.g., Siri, Alexa), chatbots, and facial recognition.

□ **Real-World Applications:**

- **Finance:** Credit scoring, algorithmic trading, fraud detection.
- **Healthcare:** Disease prediction, medical image analysis, personalized treatment.
- **Retail:** Customer segmentation, recommendation engines, inventory forecasting.
- **Transportation:** Self-driving cars, traffic predictions, route optimization.

□ **Scalability and Adaptability:** ML systems can adapt as new data becomes available, making them ideal for dynamic environments.

Real-Life Examples of Machine Learning:

1. Spam Email Detection

ML algorithms are trained on email data labeled as “spam” or “not spam.” Over time, the

model learns what features (e.g., keywords, sender address, formatting) are common in spam emails and automatically filters them out.

2. **Movie Recommendation (e.g., Netflix, Amazon Prime)**

ML models analyze your watch history, ratings, and user behavior to recommend movies or shows tailored to your preferences.

3. **Self-Driving Cars (e.g., Tesla Autopilot)**

ML is used to detect lanes, traffic signs, and pedestrians through camera and sensor data. The model continuously improves its driving performance with more real-world data.

2. What is a Supervised Machine Learning Algorithm?

A. Supervised Machine Learning is a type of ML where the model is trained on a labeled dataset. This means that each training example includes both the input features and the correct output (target). The goal of the algorithm is to learn a mapping function from the inputs to the outputs so that it can make accurate predictions on new, unseen data. Examples of supervised algorithms include Linear Regression, Decision Trees, Random Forests, Support Vector Machines (SVM), and Neural Networks.

Supervised learning is commonly used in:

- Spam detection: Classify emails as spam or not spam.
- Medical diagnosis: Predict whether a patient has a particular disease.
- Stock price prediction: Forecast future prices based on historical data.

3. What is Regression and Classification?

A. Regression

Regression is a supervised learning technique used when the output variable is a continuous value. It tries to predict "how much" or "how many." The algorithm finds relationships between the independent variables (inputs) and the dependent variable (output).

Examples:

- Predicting house prices based on size, location, and number of rooms.
- Forecasting sales revenue for a future month.

- Estimating temperature based on weather conditions.

Common algorithms: Linear Regression, Lasso Regression, Ridge Regression.

Classification

Classification is a supervised learning technique used when the output variable is categorical. The goal is to assign input data into one or more predefined categories or classes.

Examples:

- Classifying emails as spam or not spam.
- Identifying whether a tumor is benign or malignant.
- Recognizing handwritten digits (0–9) in images.

Common algorithms: Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Random Forest, Naive Bayes.