Plant Disease Detection System for Sustainable Agriculture

# Problem Statement

Develop a CNN-based model capable of detecting and classifying plant diseases from images of leaves of crops such as apple, cherry, grape, and corn. The model should accurately identify healthy and diseased leaves while predicting the specific type of disease. This system will aid in precision agriculture by enabling early detection and effective disease management.

# Aim

To design and implement a CNN-based model that accurately detects and classifies plant diseases from leaf images, identifying healthy and diseased conditions. The system supports precision agriculture by enabling early diagnosis and improving crop management practices.

# Learning Objectives

The objectives of this project are to:

**Pipeline:**

**1. Data Collection & Data Loading**

* Gather images of different categories (e.g., Category 1, Category 2).
* Structure the dataset into three parts:
  + **Train**
    - category1
    - category2
  + **Validation**
    - cat1
    - cat2
  + **Test**
    - category1
    - category2

**2. Dataset Preparation**

* Zip the dataset.
* Upload the zip file to **Google Drive**.
* Use **Google Colab** to mount the drive.
* In Python code:
  + Unzip the file.
  + Load the dataset for processing.

**3. Image Preprocessing & Augmentation**

* Resize images to a common dimension (e.g., 128x128).
* Apply preprocessing techniques such as:
  + Grayscale conversion
  + Normalization
  + Data augmentation (rotation, flipping, zooming)

**4. CNN Model Development**

* Use a Convolutional Neural Network (CNN) architecture.
* Feed preprocessed and augmented images into the model.
* Train using the training set and validate using the validation set.

**5. Model Testing and Evaluation**

* Evaluate the model’s performance using the **test dataset**.
* Metrics used:
  + Accuracy
  + Precision
  + Recall
  + F1-score

**6. Deployment & Operation**

* Use the trained model to make predictions on new images.
* Integrate with a Python-based application or system.
* Perform operations based on model predictions.