# Plant Disease Detection system for sustainable Agriculture

## Problem Statement

Design and implement an AI system that leverages Convolutional Neural Networks (CNN) to identify and categorize plant leaf diseases from image data. The model must effectively distinguish between healthy and diseased leaves across various crops, including apple, grape, cherry, and corn. By accurately diagnosing the specific type of disease, the system will support smart agriculture practices through early disease detection and improved crop management.

## Project Pipeline

### 1. Dataset Acquisition & Preparation

A labeled dataset comprising images of healthy and diseased plant leaves is used. The dataset is organized into training, validation, and testing subsets based on crop type and disease category.

### 2. Google Drive Integration & Setup in Colab

The dataset is stored in Google Drive in a compressed format (ZIP). It is mounted to Google Colab and extracted programmatically using Python scripts to make it accessible for model training.

### 3. Image Preprocessing & Augmentation

All images are resized to a uniform dimension (e.g., 128x128). Data augmentation techniques such as rotation, flipping, zooming, and shifting are applied to enhance the diversity of the training set and reduce overfitting.

### 4. Model Building with CNN

A custom Convolutional Neural Network is built and trained on the processed dataset. The model learns spatial features to classify the input leaf images into their corresponding disease classes.

### 5. Model Evaluation & Testing

The trained model is validated and tested using unseen data. Metrics such as accuracy, precision, recall, and confusion matri x are used to assess model performance and reliability.

