**Problem Statement**  
In agriculture, plant diseases can severely impact crop production, resulting in lower yields and financial losses for farmers. Early detection of these diseases is crucial. However, traditional inspection methods are often slow, prone to errors, and not easily accessible—especially in remote or rural regions.

With the widespread availability of smartphones and rapid advancements in artificial intelligence, there is a valuable opportunity to improve the speed, accuracy, and accessibility of disease detection. Our objective is to create a **Plant Disease Detection System** that leverages deep learning and image processing techniques to automatically identify plant diseases through leaf images.

This system will enable farmers to simply capture a photo of a leaf with their smartphone and receive an instant diagnosis—whether the plant is healthy or affected by a specific disease. By making early diagnosis more accessible, we aim to support better farming decisions, minimize the overuse of pesticides, and encourage sustainable agricultural practices.

**Development Pipeline**   
To build our Plant Disease Detection System, we follow a structured and effective step-by-step process:

**1. Data Collection and Organization**  
We start by collecting a dataset consisting of images of plant leaves. These images are classified into various categories—each representing either a particular disease or a healthy condition. We divide the dataset into three subsets:

* **Training Set**: Used to train the model.
* **Validation Set**: Used to fine-tune and enhance model performance during training.
* **Test Set**: Used to evaluate the model’s accuracy on new, unseen data.

**2. Dataset Upload**  
After preparing the dataset, we compress it into a zip file and upload it to Google Drive. Using Google Colab, we mount the drive and write a short Python script to unzip and access the dataset for use in our project.

**3. Image Preprocessing and Augmentation**  
With our images ready, we preprocess them by:

* Resizing them to a uniform dimension (e.g., 128×128 pixels) for consistency.
* Applying augmentation techniques such as image flipping and rotation to help the model learn from various perspectives and lighting conditions.

**4. Creating the CNN Model**  
We design and implement a **Convolutional Neural Network (CNN)**—a powerful deep learning architecture especially suited for image analysis. The CNN learns to recognize visual features in leaves that correspond to different diseases.

**5. Model Evaluation and Testing**  
After training, we use the test dataset to assess how accurately the model performs on new data. This step ensures the model is reliable and effective before real-world deployment.

**6. Real-World Application**  
Lastly, we integrate the trained model into a simple Python-based application. This allows users—such as farmers—to upload a photo of a plant leaf and receive an instant prediction. The system provides a practical, user-friendly solution for real-time plant disease detection in the field.