CYCLE 6: Plant disease detection system for Sustainable Agriculture

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**Problem Statement**:

Plant diseases are a major challenge for farmers, often leading to reduced crop yield and quality. Traditional detection methods rely heavily on manual observation, which can be slow, inconsistent, and impractical on a large scale. To address this, our project proposes a deep learning-based solution using Convolutional Neural Networks (CNNs) to automatically detect and classify plant diseases from leaf images.

By enabling early and accurate detection, this system helps farmers take timely action, reduce unnecessary pesticide use, and improve crop health—ultimately supporting more sustainable and efficient farming practices.

**Pipeline Employed:**

We train,validate and test the model and have a corresponding folder of images in this case for each

1. ***Data Collection*:** Gather a large set of labeled plant leaf images, including healthy and diseased samples, from open datasets (https://t.me/plant\_disease\_detection).
2. ***Data Loading*:** Load the dataset using tools like TensorFlow with appropriate data generators for training, validation, and testing splits.
3. ***Image Processing*:** Resize images to a consistent shape (e.g.,400\*400), convert color channels if needed, and normalize pixel values to a [0, 1] scale for better model convergence.
4. ***Image Augmentation*:** Apply transformations such as rotation, flipping, zooming, brightness adjustment, and shifting to artificially expand the dataset and improve model robustness.
5. ***Data Preprocessing*:** Resize images to a uniform size, normalize pixel values, and apply data augmentation to improve model generalization.
6. ***Model Building*:** Design a CNN architecture to extract features and classify plant diseases.
7. ***Model Training*:** Train the model on the preprocessed dataset using a suitable optimizerand loss function while monitoring accuracy and loss.
8. ***Model Evaluation*:** Evaluate model performance using validation data through metrics like accuracy, precision.
9. ***Model Testing*:** Test the final model on unseen data to assess its real-world performance and ensure it can generalize well to new leaf images.