Pipeline for Plant Disease Prediction Using AI

The pipeline for developing an AI-based plant disease prediction system consists of several key steps. Each step is crucial for ensuring accurate and reliable disease detection. Here is the typical workflow:

**1. Data Collection**

* Collect a large and diverse set of images of plant leaves, including both healthy and diseased samples.
* Images can be sourced from public datasets or captured using smartphones and cameras in real agricultural environments.

**2. Data Preprocessing**

* Clean the collected images to remove noise and irrelevant backgrounds.
* Resize and normalize images to ensure uniformity for model training.
* Augment the dataset by applying transformations such as rotation, flipping, and scaling to increase data diversity and improve model robustness.

**3. Image Segmentation**

* Segment the leaf from the background using image processing techniques.
* This step ensures that the model focuses on the relevant part of the image (the leaf) for disease detection.

**4. Feature Extraction**

* Extract important features from the segmented images, such as color, texture, shape, and patterns.
* These features help the model distinguish between healthy and diseased leaves.

**5. Model Selection and Training**

* Choose appropriate machine learning or deep learning algorithms (e.g., Convolutional Neural Networks - CNNs).
* Split the dataset into training and validation sets.
* Train the model using the training data, allowing it to learn the patterns and features associated with different diseases.

**6. Model Evaluation**

* Test the trained model on the validation set to evaluate its performance using metrics like accuracy, precision, recall, and F1-score.
* Fine-tune the model parameters to improve its predictive capability.

**7. Prediction and Deployment**

* Use the trained and validated model to predict diseases on new, unseen leaf images.
* Deploy the model as a web or mobile application for real-time disease detection in the field.

| **Step** | **Description** |
| --- | --- |
| Data Collection | Gather leaf images (healthy and diseased) |
| Data Preprocessing | Clean, resize, normalize, and augment images |
| Image Segmentation | Isolate the leaf from the background |
| Feature Extraction | Extract key features (color, texture, shape) |
| Model Training | Train ML/DL models on labeled data |
| Model Evaluation | Assess model accuracy and performance |
| Prediction/Deployment | Apply model to new data and deploy as an application |

**Summary Table of the Pipeline**

**This pipeline ensures a systematic and effective approach to building an AI-powered plant disease prediction system, enabling early detection and timely intervention for improved crop health and yield.**