PLANT DISEASE DETECTION.

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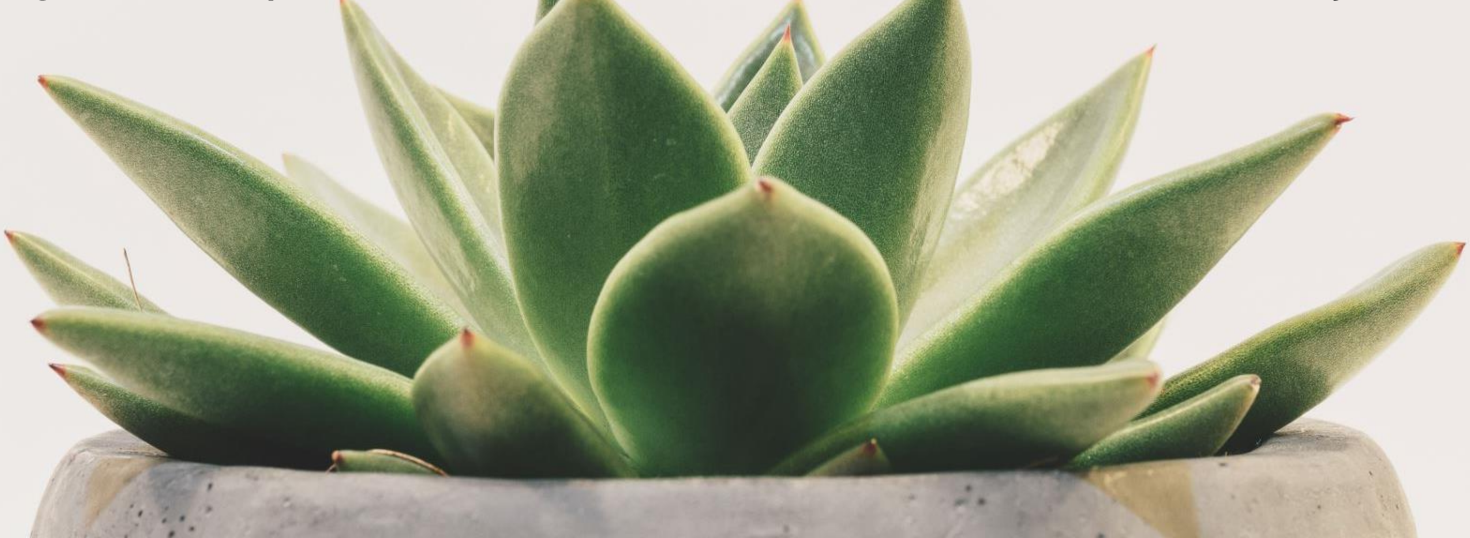
Problem statement.

- Identification of the plant diseases is important in order to prevent the losses within the yield.
- It's terribly troublesome to observe the plant diseases manually, which needs tremendous quantity of labor, expertise within the plant diseases.
- So we recommend a machine learning model to detect the disease of plant with the picture of diseased plant leaves.
- In this project we have analyzed different image parameters or features to identifying different plant leaves diseases to achieve the best accuracy.



Technical Stack

Our technical stack, comprising OpenCV, CNNs, TensorFlow, Keras, and Scikit-Learn, enables us to develop a robust and accurate plant disease detection system.

OpenCV

We utilize OpenCV for tasks such as image acquisition, enhancement, restoration, color image processing, and image segmentation.

CNN

We employ CNNs to build a robust and accurate model for classifying plant leaf images as healthy or infected with a disease.

Tensor Flow

We utilize TensorFlow to implement and train our CNN model for plant disease classification.

Keras

We leverage Keras to define and configure our CNN architecture and facilitate model training.

Data Pre-processing techniques

For this project the data we collected mainly involves the images of healthy ,diseased and semi diseased leaves. So we preprocessed the images with the following steps:

- Image Acquisition:
  - Collecting a large dataset of plant leaf images, including infected, good, and seemingly infected leaves.
  - The dataset should cover various plant species and disease types.
- Image Enhancement:
  - Improving the quality and clarity of the acquired images through techniques like noise reduction, contrast adjustment, and histogram equalization.
- Image Restoration:
  - Removing noise, artifacts, or imperfections from the images using restoration algorithms.

- Enhancing image details and reducing blurring effects caused by factors like motion or low-quality sensors. Color Image Processing:
  - Analyzing color properties of the plant leaf images, such as color space conversions, color normalization, or color feature extraction.
  - Color analysis can provide valuable insights into disease symptoms and visual patterns.
- Image Segmentation:
  - Separating the plant leaf images into meaningful regions or objects of interest, such as leaves, lesions, or healthy/unhealthy regions.
  - Segmentation aids in feature extraction and localized analysis.

Types of Models

In our plant disease detection project, we employ various types of models to accurately classify plant leaf images as healthy or infected with a disease. Each model type offers unique advantages and caters to specific requirements of the task.

- Convolutional Neural Networks (CNNs):
    - CNNs are the primary type of model used in our project due to their exceptional performance in image analysis tasks.
    - CNNs are specifically designed to capture spatial dependencies in images through convolutional layers, pooling layers, and fully connected layers.
- Transfer Learning:
    - Transfer learning is another model type we used in our project to improve the performance of our CNN models.
    - Transfer learning allows us to utilize pre-trained CNN models that have been trained on vast image datasets like ImageNet.
    - By using the learned features from these pre-trained models, we can benefit from their knowledge and adapt them to our plant disease detection task with smaller training datasets.

Hyperparameter Tuning

- Hyperparameter tuning is a critical step in optimizing model performance.
- Hyperparameters are parameters that are not learned from the data but rather set manually before training a machine learning model.
- Techniques such as Grid Search, Random Search, Bayesian Optimization, and automated tools can be employed to find the optimal hyperparameter configurations for our plant disease detection model.

Model Evaluation

- Model evaluation involves assessing performance using metrics such as accuracy, precision, recall, F1-score, AUC-ROC, and examining the confusion matrix.
- Cross-validation helps evaluate the model's generalization capabilities across different subsets of the data.

THANK YOU