RESEARCH AND DEVELOPMENT OF PLANT DISEASE DETECTION SYSTEM

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What ?

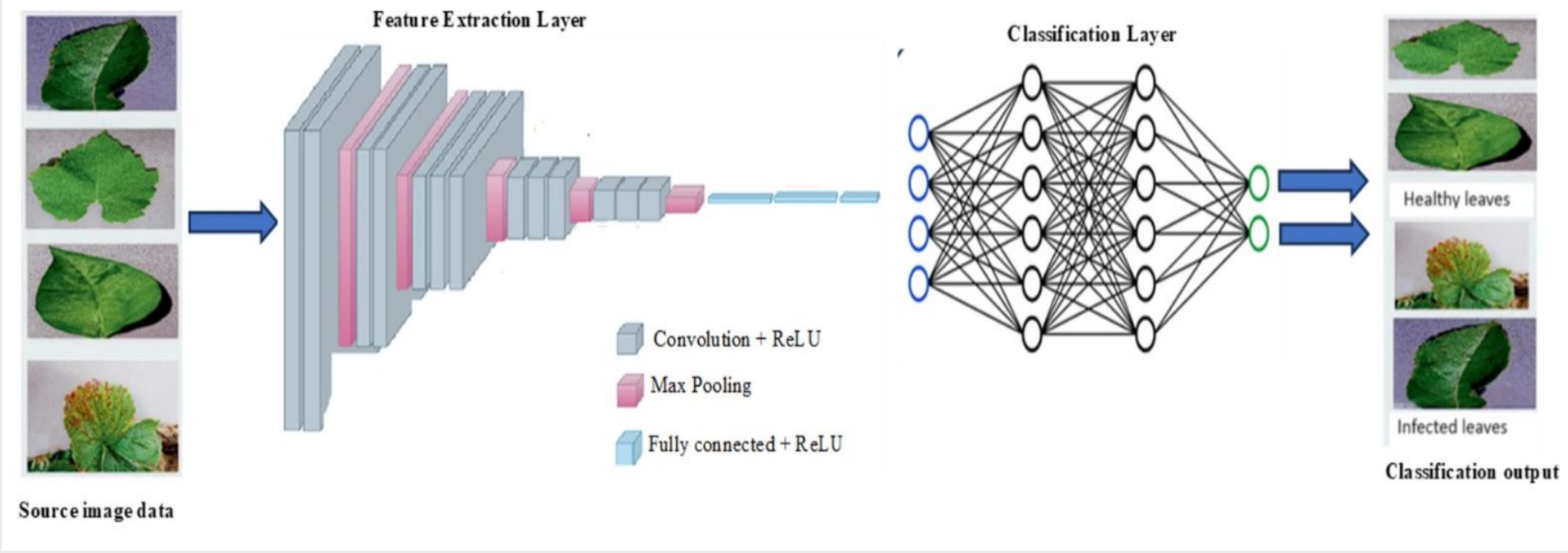
We introduce a system to detect and classify diseases on plant leaves, in which we have:

- Identify the diseased area of the leaf
- Built the evaluation model based on the pre-prepared data.
- Evaluated results by several methods.

Why ?

The condition of plant leaves is one of the most critical indicators in agriculture, as it provides valuable information for identifying diseases and assessing plant health. Therefore, detecting and classifying diseases on plant leaves are essential tasks in precision agriculture and crop management applications.

Overview



Description

1. Preprocessing of Plant Leaf Images

- Data Collection: Images are gathered from farms and nurseries, with the PlantVillage dataset used as a base.
- Preprocessing Steps: Standardizing image sizes, adjusting brightness, and removing noise or blurred images to enhance data quality.

2. Building a Multi-Branch Deep Learning Architecture

- EfficientNet Backbone: Used for feature extraction due to its balanced performance in accuracy and processing speed.
- Attention Mechanism: Designed to focus on diseased regions of the leaf, combined with Grad-CAM to generate heatmaps for interpretability.

3. Model Optimization and Evaluation

- Loss Function: A combination of cross-entropy and focal loss to address imbalanced data:

$$L = \alpha CE(y, \hat{y}) + \beta FL(y, \hat{y})$$

- Evaluation Metrics: Accuracy, precision, recall, F1-score, and inference time
- Comparative Analysis: Model performance compared with existing methods to validate effectiveness.

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