

Grape Disease Detection Model - Technical Report

Introduction

Grape disease detection is crucial for preventing widespread damage in vineyards, improving crop yields, and ensuring quality produce. The project aims to develop an image classification model to automatically detect grape diseases by analyzing leaf images. This approach not only reduces the need for manual inspections but also allows for early detection and efficient disease management. Using deep learning models for this task holds immense potential due to their ability to recognize complex patterns in image data. In this project, a Convolutional Neural Network (CNN) model is built to classify grape leaf images into different disease categories.

Analysis

The dataset used for this project contains grape leaf images classified into multiple disease categories, including Black rot, Esca, Leaf Blight, and healthy leaves.. Exploratory data analysis showed class imbalance, prompting the use of image augmentation to improve generalization. Random samples from each class were visualized to get a sense of how the disease manifests visually. Images were resized to 170x170 pixels to standardize their dimensions for the CNN model. Pixel values were normalized between 0 and 1 to accelerate the training process. The dataset was split into training and testing. 20% of the dataset is reserved as test data.

Methods

The core architecture of this project is a CNN, which is a deep learning model known for its effectiveness in image recognition tasks. CNNs automatically capture spatial hierarchies in images, making them suitable for disease detection. A CNN architecture was used, including two convolutional layers with ReLU activation, max-pooling, flattening, and dense layers for classification. The model was trained using categorical cross-entropy and the Adam optimizer, with early stopping to prevent overfitting.

Results

The model achieved 95% training accuracy, 97% validation accuracy.

Reflection

Challenges included data imbalance and overfitting. Future improvements could involve more balanced datasets, advanced architectures like ResNet, and improved error analysis techniques.

This project has highlighted the potential and challenges of using deep learning for agricultural disease detection. In future implementations, I plan to explore advanced architectures, experiment with transfer learning, and focus more on improving the generalization of the model across various disease categories.