Grapevine Disease Classification - Deep CNN Report

Introduction

Problem: Classify grapevine leaf diseases using image data.

We classify grapevine leaves into four categories using a Deep Convolutional Neural Network (CNN):
- Black Rot
- ESCA
- Healthy
- Leaf Blight

The model was built from scratch using TensorFlow/Keras without transfer learning, recurrent layers, or generative models.
Images were captured under field and laboratory conditions.

Analysis

The dataset was inspected for structure and balance across classes.
Sample images from each class were visualized.
Image size distributions and RGB histograms were analyzed to better understand the data.

Methods

Images were resized to 150x150 pixels.
Data augmentation techniques (rotation, zoom, shift, shear, horizontal flip) were applied to increase model robustness.
The CNN architecture included 5 convolutional layers, 3 pooling layers, Dropout, and BatchNormalization layers.
Adam optimizer and categorical crossentropy loss were used.

Results

Model training included EarlyStopping and ModelCheckpoint callbacks.
Training and validation accuracy/loss curves were plotted.
Classification report and confusion matrix were generated for performance evaluation.

Reflection

Training a CNN from scratch allowed full control over the model structure but required careful regularization to prevent overfitting.
Data augmentation and Dropout layers significantly improved generalization.
Future improvements could include leveraging pre-trained models (transfer learning) to enhance performance on similar-looking disease categories.