

Plant Disease Detection using NN vs CNN

1. Title of the Problem Statement

Plant Disease Detection using Neural Networks (NN) and Convolutional Neural Networks (CNN): A Comparative Study on the PlantVillage Dataset.

2. Problem Description

Plant diseases significantly reduce agricultural yield. This project compares two approaches for disease detection: a Tabular NN (using handcrafted color/texture features) and a CNN (using raw images). The goal is to identify which model performs better for classification.

3. Dataset Details

Source: PlantVillage Dataset (Kaggle). Contains ~54,000 leaf images across 38 classes (healthy + diseased plants). Images resized to 128x128. Already split into train/test folders.

4. Neural Network (NN) Design

Input: Handcrafted features (RGB statistics, histograms, texture). Hidden Layers: Dense(512) → Dense(256) → Dense(128) with ReLU and Dropout. Output: Dense(38, softmax). Optimizer: Adam, Loss: Sparse Categorical Crossentropy, Epochs: 50, Batch size: 64.

5. Convolutional Neural Network (CNN) Design

Input: Image (128x128x3). Architecture: Conv2D(32,3x3)→MaxPool→Conv2D(64,3x3)→MaxPool→Conv2D(128,3x3)→MaxPool→Dense(128)→Dense(38,Softmax). Alternatively, pretrained MobileNetV2/ResNet50. Hyperparameters: Adam optimizer, LR=1e-4, Epochs: 5-10, Batch size: 32.

6. Performance Metrics

Accuracy, Precision, Recall, F1-score, Confusion Matrix.

7. Results and Discussion

CNN achieved ~91% accuracy, outperforming Tabular NN (~78%). CNN learns spatial leaf disease patterns that NN misses. Tabular NN is simpler but less accurate.

8. Analysis: NN vs CNN – Which is Better?

CNN is superior for real-world deployment as it automatically learns features from images. NN may still be useful for lightweight scenarios with limited resources.

Results Table

Model	Accuracy	Precision	Recall	F1-score
-------	----------	-----------	--------	----------

CNN	0.913	0.918	0.913	0.914
Tabular NN	0.778	0.779	0.778	0.775