

Groundnut Leaf Disease Classification using Deep Transfer Learning

Subtitle: One step towards sustainable and precision agriculture
Internship: AI-ML Internship – IBM SkillsBuild

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Introduction

Groundnut is a major oilseed crop.
Leaf diseases significantly affect yield.
Traditional methods of diagnosis are slow or manual.
Deep learning offers efficient, image-based diagnosis.

Problem Statement

Farmers face challenges in identifying diseases early.
Manual observation is error-prone and delayed.
Need for an automated, accurate system for early detection of groundnut leaf diseases.

Objective

Develop and evaluate a deep transfer learning model to classify leaf diseases from groundnut images.
Support sustainable agriculture through early detection.
Reduce crop losses and pesticide misuse.





Why This Problem?

Leaf diseases like early/late leaf spot, rust are common in Indian agriculture.
Smallholder farmers lack access to expert agronomists.
Early AI-powered detection empowers timely decision-making.

Solution Overview

Use a deep CNN-based transfer learning model (e.g., ResNet50, MobileNetV2).
Trained on thousands of labeled groundnut leaf images.
Deploy model via mobile or web app for farmers.

Features of the Solution

-  Early Detection: Identify leaf diseases before major damage.
-  Reduce Chemical Use: Minimize excess pesticide usage.
-  Deployable: Easy-to-use app for farmer access.
-  Data-Driven Decisions: Supports agricultural sustainability.






Technical Implementation

Dataset: 6000+ annotated images.
Preprocessing: Resizing, normalization, augmentation.
Model: Transfer learning (MobileNetV2 / ResNet50).
Training: Optimized using Adam optimizer.
Evaluation: Metrics like accuracy, precision, recall, F1-score.

Tools and Resources

IBM Watson Studio / Google Colab
TensorFlow / Keras
LabelImg / Roboflow for annotation
Flask / Streamlit for deployment

Evaluation Metrics

-  Accuracy: % of correct classifications
-  Precision: How many predicted diseases were correct
-  Recall: How many actual diseases were identified
-  F1-score: Balance between precision and recall
-  ROC-AUC: Area under the classification curve

Results

Achieved high test accuracy
Successfully classified multiple leaf diseases
Model performance validated with robust metrics

Deployment

Web-based GUI using Flask/Streamlit
Farmer uploads a leaf image
Model predicts disease name
System provides actionable suggestions

Conclusion

Developed a reliable deep learning model for crop disease detection.
Supports smallholder farmers in sustainable agriculture.
Helps reduce yield losses and enhances precision farming.

Future Scope

Include more disease categories
Extend model for other crops (e.g., paddy, potato)
Multilingual farmer interface
Add GPS + weather integration for real-time advisories