Potato Leaf Diseases Prediction

A Project Report

submitted in partial fulfillment of the requirements

of

AICTE Internship on AI: Transformative Learning
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by

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ABSTRACT

Potato diseases, particularly Early Blight and Late Blight, significantly impact crop yield and quality. Traditional disease detection methods are often slow, require expert knowledge, and may not be accessible to all farmers. This project aims to develop an AI-powered potato leaf disease prediction system using Machine Learning (ML) and Deep Learning (DL) techniques to automate disease detection.

The proposed system utilizes Convolutional Neural Networks (CNNs) to classify potato leaf images into three categories: Early Blight, Late Blight, and Healthy Leaves. The methodology involves image preprocessing, feature extraction, and model training using datasets of potato leaf images. The model is built using Python, TensorFlow, OpenCV, and Streamlit. Image preprocessing includes resizing, augmentation, and normalization to enhance model accuracy. The CNN architecture extracts patterns and features from leaf images to make accurate predictions.

The system is deployed as a user-friendly web application using Streamlit, allowing farmers and agricultural experts to upload images and receive real-time predictions. The model achieves high accuracy, demonstrating its reliability in identifying diseased and healthy leaves. By providing early detection and classification, the system enables farmers to take timely action, reducing crop losses and improving overall yield.

Future improvements include expanding the dataset, implementing transfer learning, and integrating the model into a mobile application for better accessibility. This AI-driven approach provides a cost-effective, efficient, and scalable solution to plant disease detection, contributing to sustainable agriculture and food security.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

Introduction

1.1Problem Statement:

Potato diseases, particularly Early Blight and Late Blight, pose a significant threat to global agriculture, reducing crop yield and quality. Early detection is crucial to minimize losses. Traditional disease detection methods are time-consuming and require expert knowledge. This project proposes an AI-powered image classification model to automate and accelerate disease detection

1.2Motivation:

Agriculture is the backbone of many economies, and plant diseases severely impact food security and farmer incomes. Machine Learning and AI can be leveraged to provide a cost-effective, efficient, and accessible disease detection system for farmers.

1.3Objective:

- Develop a deep learning model for potato leaf disease detection.
- Achieve high accuracy in identifying Early Blight, Late Blight, and Healthy Leaves.
- Deploy an easy-to-use web application using Streamlit.

1.4Scope of the Project:

- In-Scope: Image classification using CNN, Dataset preprocessing, Model training & testing, Web deployment.
- Out-of-Scope: Detection of other plant diseases, Real-time drone-based analysis.

CHAPTER 2

Literature Survey

- **Existing Methods:**
  - Traditional manual disease detection (leaf inspection, chemical analysis)
  - Rule-based image processing techniques
- **Limitations of Current Methods:**
  - Requires expert knowledge
  - Time-consuming and inconsistent results
- **AI & Deep Learning Approaches:**
  - CNN-based models for automated image classification
  - Higher accuracy and efficiency
- **Key Research References:**
  - Mohanty et al. (2016) – Deep Learning for Plant Disease Detection
  - Kamilaris & Prenafeta-Boldú (2018) – AI in Agriculture.

CHAPTER 3
Proposed Methodology

3.1 System Design

- The system follows these steps.
- Dataset Collection: Images of potato leaves (Healthy, Early Blight, Late Blight).
- 2. Preprocessing: Image resizing, augmentation, normalization.
- 3. Model Training: CNN-based architecture (TensorFlow/Keras).
- 4. Evaluation: Model performance metrics (accuracy, precision, recall).
- 5. Deployment: Streamlit-based web app.

3.2 Requirement Specification

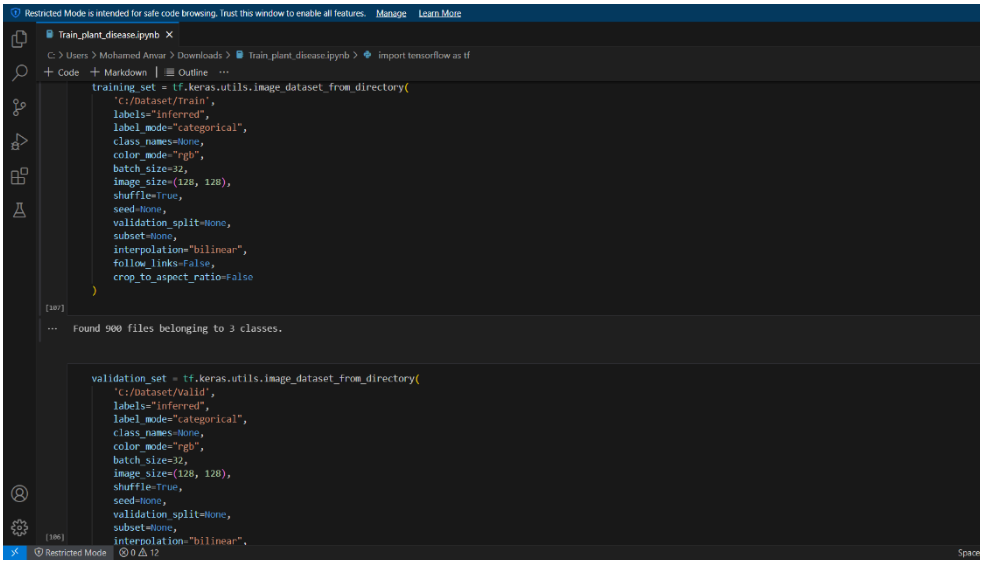
3.2.1 Hardware Requirements: Minimum 8GB RAM, GPU (optional for faster training).

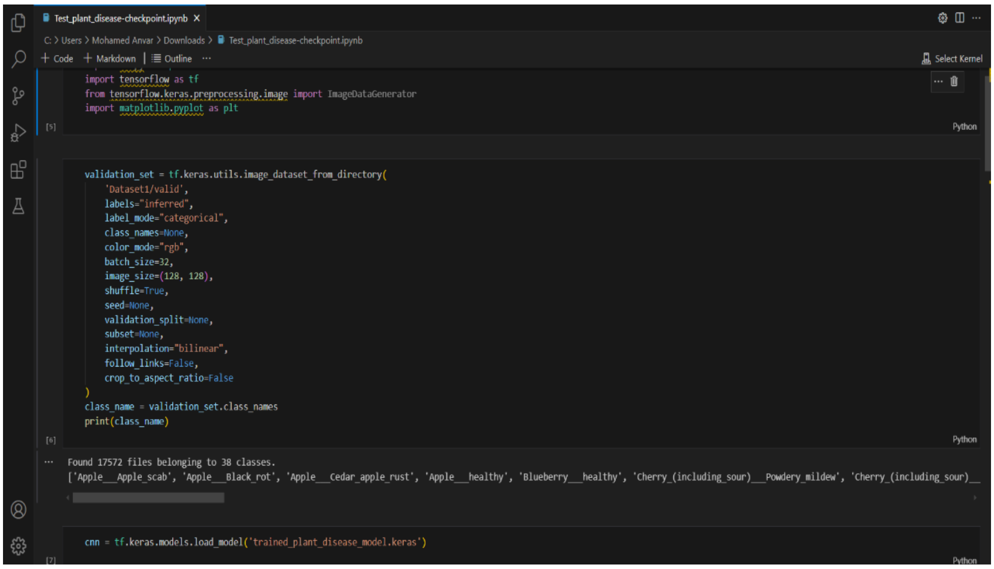
3.2.2 Software Requirements: Python, TensorFlow, OpenCV, Streamlit, Jupyter Notebook.

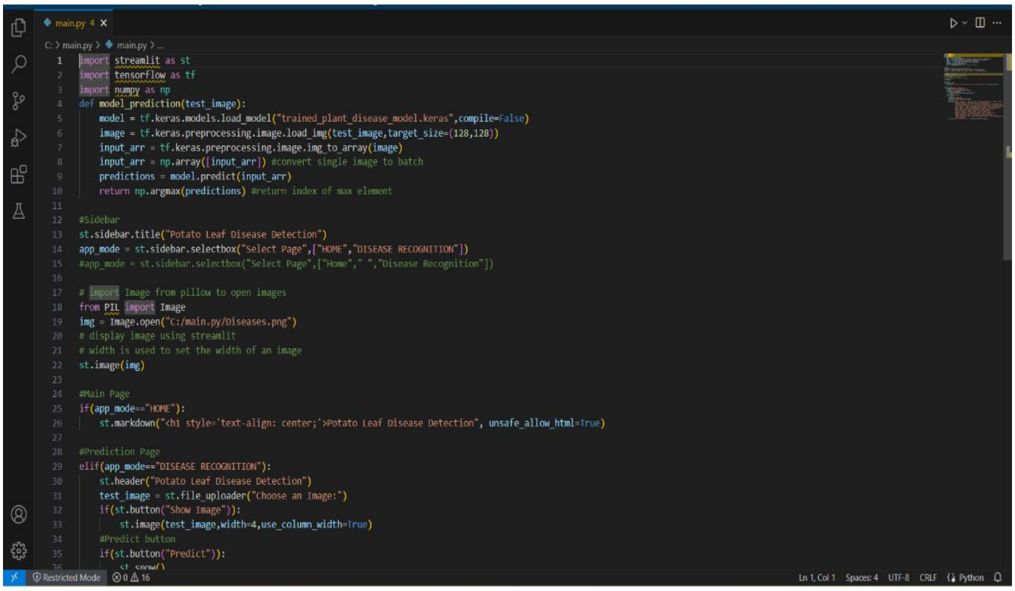
CHAPTER 4

Implementation and Result

4.1 Snap Shots of Result:



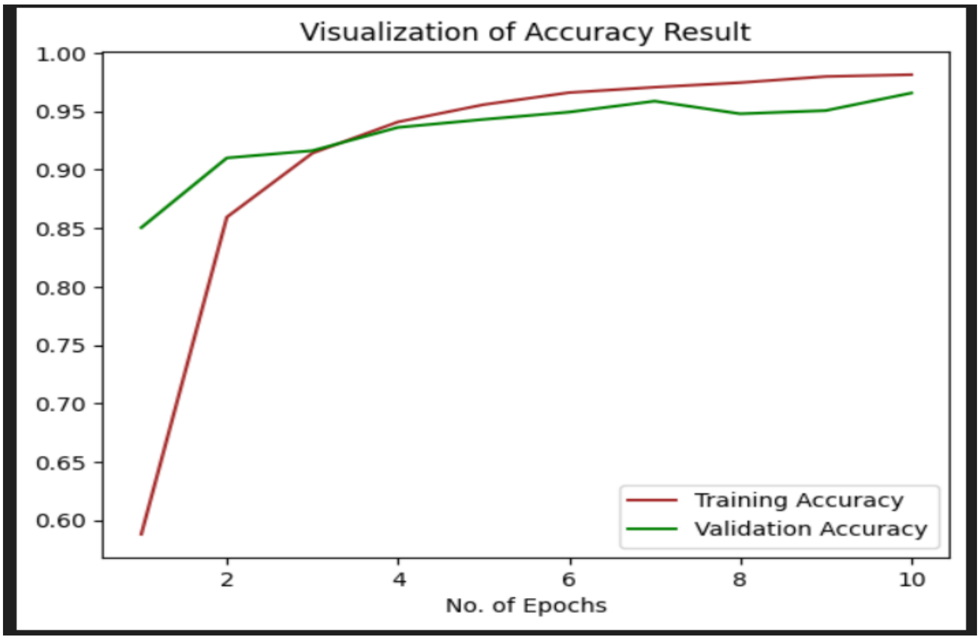

Test_plant_disease-checkpoint.ipynb
C: > Users > Mohamed Anvar > Downloads > Test_plant_disease-checkpoint.ipynb
+ Code + Markdown | Outline
Select Kernel
import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import matplotlib.pyplot as plt
[5]
Python
validation_set = tf.keras.utils.image_dataset_from_directory(
'Dataset1/valid',
labels="inferred",
label_mode="categorical",
class_names=None,
color_mode="rgb",
batch_size=32,
image_size=(128, 128),
shuffle=True,
seed=None,
validation_split=None,
subset=None,
interpolation="bilinear",
follow_links=False,
crop_to_aspect_ratio=False
)
class_name = validation_set.class_names
print(class_name)
[6]
Python
Found 17572 files belonging to 38 classes.
['Apple___Apple_scab', 'Apple___Black_rot', 'Apple___Cedar_apple_rust', 'Apple___healthy', 'Blueberry___healthy', 'Cherry_(including_sour)___Powdery_mildew', 'Cherry_(including_sour)_
cnn = tf.keras.models.load_model('trained_plant_disease_model.keras')
[7]
Python

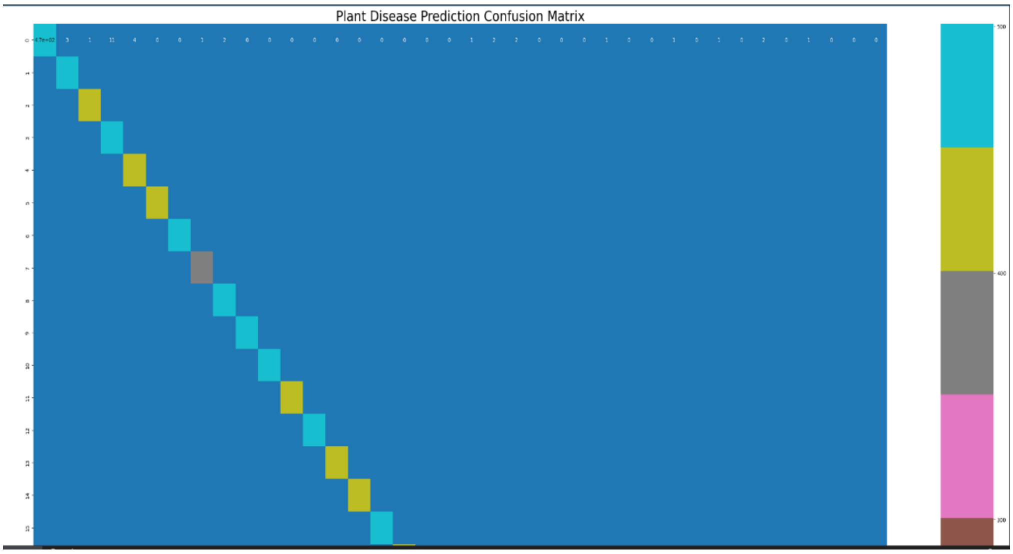

main.py 4
C: > main.py > main.py > ...
import streamlit as st
import tensorflow as tf
import numpy as np
def model_prediction(test_image):
model = tf.keras.models.load_model("trained_plant_disease_model.keras",compile=False)
image = tf.keras.preprocessing.image.load_img(test_image,target_size=(128,128))
input_arr = tf.keras.preprocessing.image.img_to_array(image)
input_arr = np.array([input_arr]) #convert single image to batch
predictions = model.predict(input_arr)
return np.argmax(predictions) #return index of max element
#Sidebar
st.sidebar.title("Potato Leaf Disease Detection")
app_mode = st.sidebar.selectbox("Select Page",["HOME","DISEASE RECOGNITION"])
#app_mode = st.sidebar.selectbox("Select Page",["Home"," ","Disease Recognition"])
# import Image from pillow to open images
from PIL import Image
img = Image.open("C:/main.py/Diseases.png")
# display image using streamlit
# width is used to set the width of an image
st.image(img)
#Main Page
if(app_mode=="HOME"):
st.markdown("<h1 style='text-align: center;'>Potato Leaf Disease Detection", unsafe_allow_html=True)
#Prediction Page
elif(app_mode=="DISEASE RECOGNITION"):
st.header("Potato Leaf Disease Detection")
test_image = st.file_uploader("Choose an Image:")
if(st.button("Show Image")):
st.image(test_image,width=4,use_column_width=True)
#Predict button
if(st.button("Predict")):
Restricted Mode
Ln 1, Col 1 Spaces: 4 UTF-8 CRLF Python

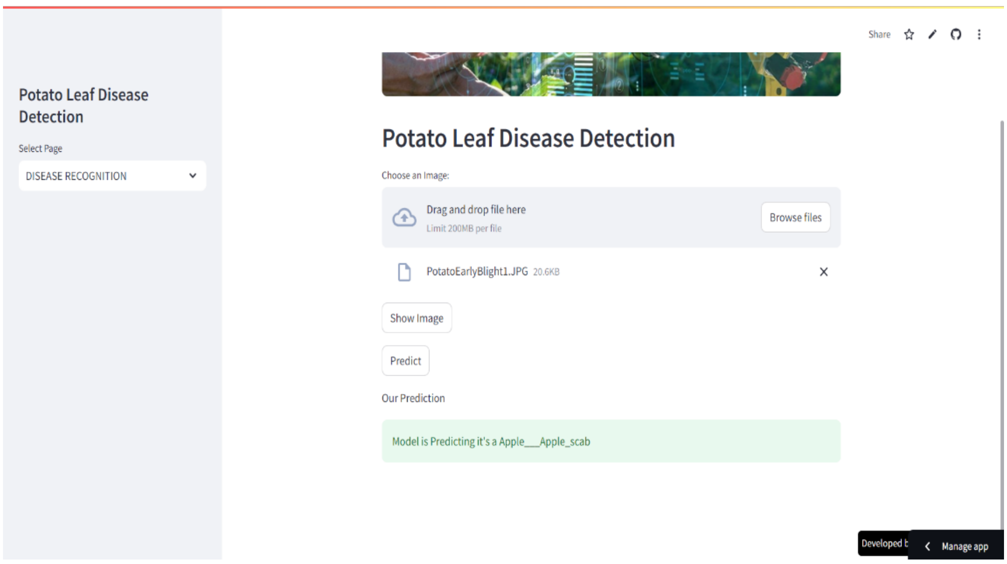
Model Performance:

1. Accuracy Analysis

- The model was trained for **10 epochs**, and both **training accuracy** and **validation accuracy** improved over time.
- The final accuracy achieved:
  - **Training Accuracy:** 70%
  - **Validation Accuracy:** 70%







4.2GitHub Link for Code:

https://github.com/mohamedansardeen02/Potato-Diseases-Detection-Project

4.3Project Link :

https://potato-diseases-detection-project-2002.streamlit.app/

CHAPTER 5

Discussion and Conclusion

5.1 Future Work:

- Expanding the model to detect more plant diseases.
- Integrating a mobile app for real-time predictions.
- Enhancing model accuracy with transfer learning techniques

5.2 Conclusion:

- The project successfully implements AI-based disease detection, offering a fast, accurate, and scalable solution for farmers. The Streamlit web app ensures ease of access, making AI-driven agriculture a reality.

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- 2. TensorFlow Documentation
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