iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XII **Month of publication:** December 2022

DOI: https://doi.org/10.22214/ijraset.2022.48000

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

Leaf Diseases Detection System Using Machine Learning

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Abstract: ***Agriculture supports living beings and nature in many ways, such as food and habitat. All humans as well as animals depend on the agriculture sector for their basic needs of food and nutrients. Thus, the importance of agriculture and the ways it can be improved further should be taken into account. While discussing agriculture, the topic of related diseases is not far behind. Crop disease is the most common threat that falls upon agricultural harvest. To address the issue at hand, firstly, farmers must figure out the situation on time. Then only the chance of saving the crops exists. We are aware of how the various types of diseases affect the yield badly and in turn affect the quantity. In this paper, we will detect such diseases and identify them. We will use image processing, Machine Learning Algorithms, and sample datasets to get the resulting detection.***
Keywords: Machine Learning, Plant Disease, Image Processing

I. INTRODUCTION

In India, where 80% of the population is dependent on agriculture, agribusiness has emerged as a key driver of economic development. Ranchers determine the best harvest based on the soil type, climate, local condition, and economic value. Most often, farmers who cannot repay bank loans they took out for farming purposes commit suicide as a result of production losses. We've seen that the climate is constantly changing today, which harms the crops and pushes farmers into debt and suicide. When various mathematical or statistical techniques are applied to data, these risks can be reduced, and using these techniques, we can inform the farmer about plant diseases affecting his agricultural land.

Due to governmental shortcomings, the agricultural industry started looking for new ways to increase food production. Researchers are working to create innovative, strong, and special technologies that can produce outcomes with high efficacy. A large harvest can be produced using a variety of techniques in the agricultural sector.Based on the data gathered, farmers using the precision agricultu re technique can learn how to increase farm yield.

This methodology uses machine learning to classify plant diseases and image processing to detect them. Supervised learning and unsupervised learning are the two main classifications of machine learning. The label values in the supervised learning method are known. Regression and classification are two examples of supervised learning techniques. The label values in the unsupervised learning approach are unknown. Building a model that can be used to categorize healthy and unhealthy harvest leaves and, if the crop has any disease, predict which disease it is, is the primary goal of this research.

II. LITERATURE REVIEW

A review of machine learning classification techniques for plant disease detection was proposed by Shruth et al. [1] and mainly described the overall plant disease detection system, which can be broken down into five significant stages, including image acquisition, annotated datasets, image processing, feature extraction, and classification.

Image acquisition, image processing, image segmentation, feature extraction, detection, and classification of plant disease are the five steps that make up Sehgal et al" Plant .'s disease classification using soft computing and supervised machine learning" [2]. Data collection or data gathering processes use image acquisition. Some image features can be improved through image processing. The extraction of diseased areas from a plant's leaf uses image segmentation.

The color of the plant's diseased part is extracted using feature extraction.

Different machine learning techniques are used to identify plant diseases using detection and classification techniques.

The article "Image processing techniques for detecting and classifying plant disease: a review" was proposed by Hungilo et al. To identify and classify disease on plant leaves in this proposed system, image processing, and machine learning techniques are used.

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There are two different approaches to dealing with the classification of plant diseases. The first is "training from the ground up," and the second is "transfer learning." When working with small datasets for deep learning tasks, the transfer learning method is used, and when working with sufficient datasets, the training from the scratch method. This research paper discusses the convolution neural network technique and the conventional technique for image processing.

III. METHODOLOGY

Leaf diseases can be identified by observing leaf of plants. Image processing is performed on the images of leaves from the dataset. The image processing technique involves five basic steps and a data flow diagram is shown below in Fig 1.

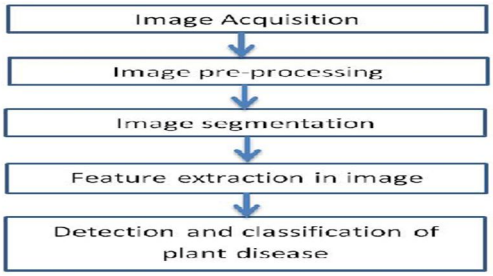


Fig 1. Leaf disease detection system

1) *Image Acquisition:* This dataset contains high-quality RGB (red, green, and blue) leaf images that include healthy leaf images and diseased leaf images. The first stage of the leaf disease identification and classification system is loading the database for use in the Leaf Dataset
2) *Image Pre-processing:* The second stage of the leaf disease detection and classification system is pre-processing. This involves some techniques like image resizing, image smoothing, image enhancement, etc. In this stage, noisy and inconsistent data is removed from the dataset to extract useful information.
3) *Image Segmentation:* Images are partitioned into RGB (red, green, blue), HSV (hue, saturation, value), and LAB (luminosity, green/red, blue/yellow) stages. This is the third stage of the leaf illness identification and classification framework.
4) *Feature Extraction in Image:* In-leaf disease classification uses features like color, texture, morphology, edges, etc. This approach has tracked down that morphological outcomes give preferable outcomes over different features. It tends to be identifying the infected leaf of the image that is most important.
5) *Detection and Classification of Plant Disease:* The fifth stage of the leaf disease recognition and classification system is the classification technique. This stage performs any of the machine learning techniques for classifying the various diseases in leaves. This is the final outcome stage of our proposed system. In this stage, users can identify and characterize leaf diseases.

IV. EXPERIMENTAL RESULT

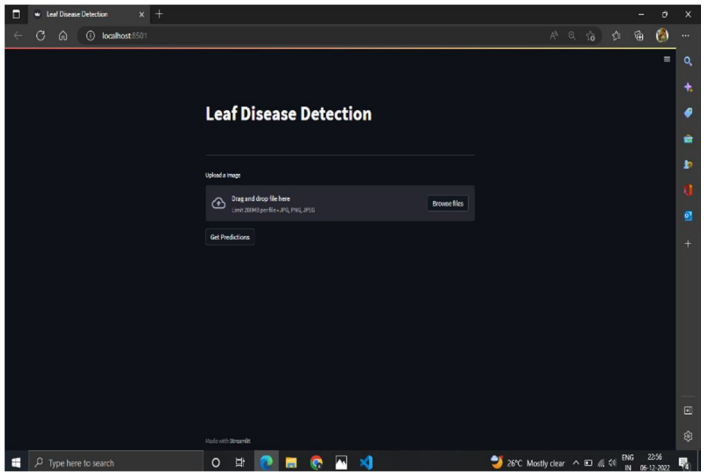
The experiment made use of a Kaggle data set. The RGB images of healthy and unhealthy leaves in this dataset are arranged into different classes. 20% of the ratio is used for the testing task on this dataset, and 80% of the ratio is used for training. Another index that was later created for prediction purposes is present in test images.

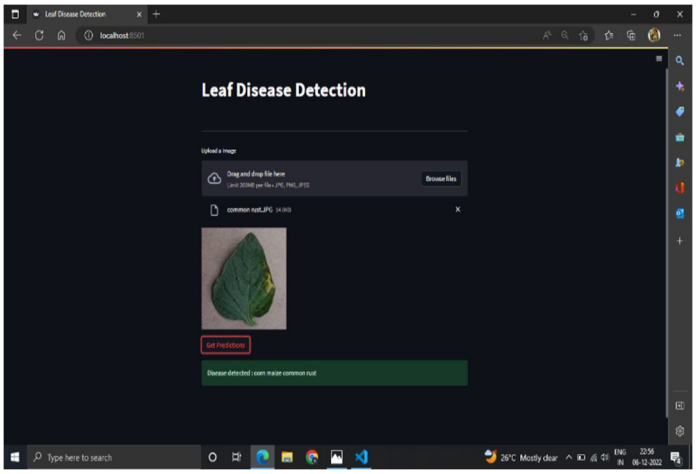
main.py

```
import streamlit as st
import tensorflow as tf
import os
import numpy as np
from PIL import Image



class_names = ["apple apple scab", "apple black rot", "apple cedar apple rust", "apple healthy",
"blueberry healthy", "cherry including sour powdery mildew", "cherry including sour healthy", "corn maize
cercospora leaf spot gray leaf spot", "corn maize common rust", "corn maize northern leaf blight", "corn
maize healthy", "grape black rot", "grape esca black measles", "grape leaf blight isariopsis leaf spot",
"grape healthy", "orange haunglongbing citrus greening", "peach bacterial spot", "peach healthy", "pepper
bell bacterial spot", "pepper bell healthy", "potato early blight", "potato late blight", "potato
healthy", "raspberry healthy", "soybean healthy", "squash powdery mildew", "strawberry leaf scorch",
"strawberry healthy", "tomato bacterial spot", "tomato early blight", "tomato late blight", "tomato leaf
mold", "tomato septoria leaf spot", "tomato spider mites two spotted spider mite", "tomato target spot",
"tomato tomato yellow leaf curl virus", "tomato tomato mosaic virus", "tomato healthy"]


## Page Title
st.set_page_config(page_title="Plant Disease Detection")
st.title("Plant Disease Detection")
st.markdown("---")

tflite_interpreter = tf.lite.Interpreter(model_path="./model.tflite")
tflite_interpreter.allocate_tensors()

```

```python
def set_input_tensor(interpreter, image):
    """Sets the input tensor."""
    tensor_index = interpreter.get_input_details()[0]["index"]
    input_tensor = interpreter.tensor(tensor_index)()[0]
    input_tensor[:, :] = image


def get_predictions(input_image):
    output_details = tflite_interpreter.get_output_details()
    set_input_tensor(tflite_interpreter, input_image)
    tflite_interpreter.invoke()
    tflite_model_prediction = tflite_interpreter.get_tensor(output_details[0]["index"])
    tflite_model_prediction = tflite_model_prediction.squeeze().argmax(axis=0)
    pred_class = class_names[tflite_model_prediction]
    return pred_class


## Input Fields
uploaded_file = st.file_uploader("Upload a Image", type=["jpg", "png", "jpeg"])
if uploaded_file is not None:
    img = Image.open(uploaded_file)
    img = img.resize((224, 224))
    st.image(img)
    img_array = tf.keras.preprocessing.image.img_to_array(img)
    img_array = tf.expand_dims(img_array, 0)

```

```python

## Input Fields
uploaded_file = st.file_uploader("Upload a Image", type=["jpg", "png", "jpeg"])
if uploaded_file is not None:
    img = Image.open(uploaded_file)
    img = img.resize((224, 224))
    st.image(img)
    img_array = tf.keras.preprocessing.image.img_to_array(img)
    img_array = tf.expand_dims(img_array, 0)

if st.button("Get Predictions"):
    suggestion = get_predictions(input_image=img_array)
    if(suggestion == 'no disease'):
        st.success(suggestion)
    else:
        st.success(f"Disease detected : {suggestion}")

```





V. CONCLUSION

The paper mainly focuses on leaf disease detection in various plants. We have used machine learning techniques to train the dataset and also used image processing for the detection and classification of images of both healthy and unhealthy leaves. Thus, various diseases are identified successfully as a result of the proposed system.

VI. FUTURE WORK

A. In the future we can also suggest Solutions for the detected diseases.
B. Future work can focus on improving. More datasets may be used in future work.
C. In the future we can work on raising the accuracy of the results.

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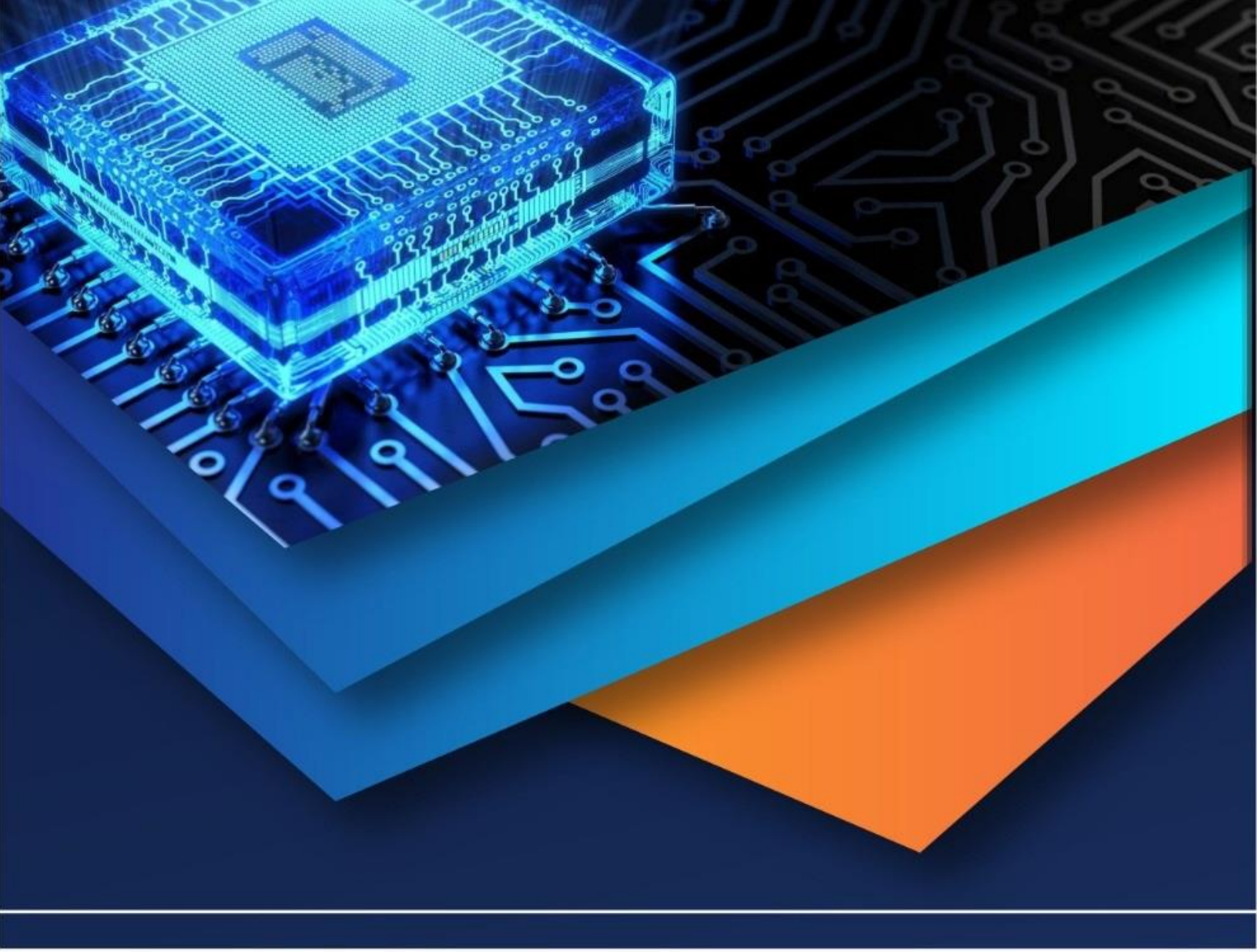

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