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Plant Disease Detection

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Abstract: ***Plant growth is major requirement for framers, as it creates a path for their living, plants getting affected and their growth is related hand in hand. Framers strive to cultivate healthy crops; in spite of it plants getting affected are the major cause of crop failure. Plant disease is now the risk factor not only for framers but also to customers, environment and global economy. Immoderate pesticide usage is the cause for major health issues in plants. Plant disease detection using image processing can be the best way to predict and get accurate results. This project is based on deep convolutional neural networks which enhances the accuracy and training efficiency. This application will help many farmers who are uneducated to get correct information about diseases and help increase their yield. We are fostering a web application that can distinguish plant infection. The objective is to distinguish different plant infection by checking picture out. By utilizing CNN Algorithm we can identify the plant disease precisely. By the results of accuracy it shows this model is better than any traditional framing.***
Keywords: Plant Diseases, Deep Learning, Convolutional Neural Networks

I. INTRODUCTION

Plant disease is linked to agricultural sustainability problems. Bacteria may get clogged as a result of unfamiliar farming practices, significantly restricting their opportunity to respond. The ideal and definite finding of plant diseases is one of the backbones of accuracy in agribusiness. It is important to prevent pointless abuse of monetary and various assets, hence leading to better construction in this growing greenhouse medium, adequate and effective plant/leaf infection identification including immediate aversion is never really been huger.

A few diseases have no apparent side effects, or the impact becomes observable past time to act, and in those circumstances, a refined investigation is compulsory. In any case, most diseases produce an appearance in the apparent range of some sort or another; hence an excellent way for plant infection identification is sight examination of a prepared competent. A plant scientist must have exceptional insight abilities so one can distinguish trademark side effects in order to perform an accurate plant infection diagnosis. Assortments in incidental reactions demonstrated from infected leaves might lead to a hasty conclusion, as inexperienced groundskeepers and experts may have more difficulty to determine than a specialized plant scientist. Taking advantage of digital image processing techniques for example colour thresholding and analysis was utilized to determine plant infections.

II. RELATED WORK

1) In research paper [1] titled A Review of Image Processing and Soft Computing Algorithms for Plant Disease Prediction dated in the year 2021, a review on prediction of plant diseases are done using image processing and soft computing algorithms by the authors. Image processing here is used to diagnose the problems occurring in plants.
2) In research paper [2], according to research journal in 2019 plant disease detection is done using machine learning and canny edge detection algorithm.
3) In research paper [3], a clear-up assessment of identification of plant diseases is done using convolutional neural networks on pictures by the authors. Their drawbacks and successful use cases were explained in the paper.
4) Paper [5] investigates the identification of plant illnesses as well as the detection of contaminated plant parts. The input photographs are taken first, and then the image processing begins. The major goal of this research is to progress and improve the computational filters of a neural network technique in order to get better outcomes. This research includes a task that will calculate the percentage of infected plant area.

III.PROPOSED SYSTEM

We are fostering a web application that can distinguish plant infection. The objective is to distinguish different plant infection by checking picture out. We are using deep learning for this project because here we are working with image data. Deep learning has a Convolution neural network that is used to find features from the leaf of the plant. By utilizing CNN Algorithm we can identify the plant disease precisely.

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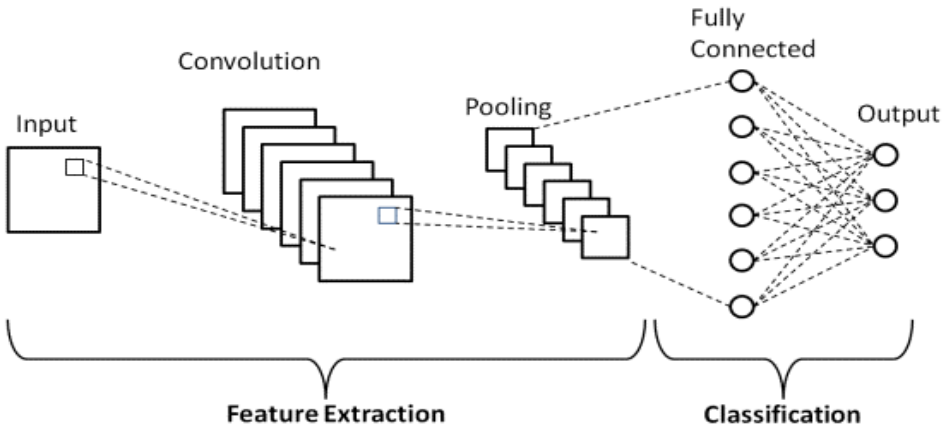


Figure1: CNN architechture

The objective is to distinguish different plant disease by checking picture out.
In the web application

1) Client should be able to upload an image of an infected plant leaf from there device
2) CNN Model should be able to detect plant infection.
3) Finally client will get the plant disease name and also some suggestions on preventing the disease and it also suggests some supplements and fertilizers.

IV. REQUIREMENTS

a. SOFTWARE REQUIREMENTS	b. HARDWARE REQUIREMENTS
1. Backend : python 3.7	1. RAM : 4GB and Higher
2. Frontend : HTML, CSS	2. Processor : Intel i3 and above
3. Framework : Flask	3. Hard Disk : 500GB (Minimum)

Table 1: Requirements

V. METHODOLOGY

1) *Image Dataset Acquisition:* The Dataset was taken from Kaggle of Plant Village dataset. In this data-set, 39 different classes of plant leaf and Background images are available. The data-set containing 61,486 images. There is a total of 35 Classes that we have to predict using the CNN Model.

NAME	NO OF CLASSES	NAME OF CLASS
Apple	04	Apple: 'scab', 'Black_rot', 'Cedar_apple_rust', 'healthy'
Blueberry	01	Blueberry: 'healthy'
Cherry	02	Cherry: 'Powdery_mildew', 'healthy'
Corn	04	Corn: 'Cercospora_leaf_spot', 'Common_rust', 'Northern_Leaf_Blight', 'healthy'
Grape	03	Grape: 'Black_rot', 'Esca', 'Leaf_blight', 'healthy'
Orange	01	Orange: 'Haunglongbing'
Peach	02	Peach: 'Bacterial_spot', 'healthy'
Bell Pepper	02	Bell_pepper: 'Bacterial_spot', 'healthy'
Potato	03	Potato: 'Early_blight', 'Late_blight', 'healthy'
Rasberry	03	Raspberry: 'healthy'
Soyabean	01	Soybean: 'healthy'
Squash	01	Squash: 'Powdery_mildew'
Strawberry	02	Strawberry: 'Leaf_scorch', 'healthy'
Tomato	05	Tomato: 'Bacterial_spot', 'Early_blight', 'Late_blight', 'Leaf_Mold', 'Septoria_leaf_spot'

Table2: Dataset Description

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2) *Pre-processing of Images:* Transforms are used for Data Augmentation like cropping the image, resize the image, convert the image to tensor, rotate the image, and many more. Transforms work as a filter for all images.
3) *Train and Test Split:* Split the data into train, test and validation data. Total 36584 for train, 15679 for validation and remaining images for testing.
4) *Model Creation:* We use a convolutional neural network for model creation. We also specified filter size for the Conv layer and Pool layer and the shape on each layer.
5) *Web Application Creation:* After Creating this Model, We create on web application using Flask.

In the web application user will be able to upload a plant image and detect what kind of disease it has and app also suggest some supplements and fertilizers and also ways to prevent the disease.

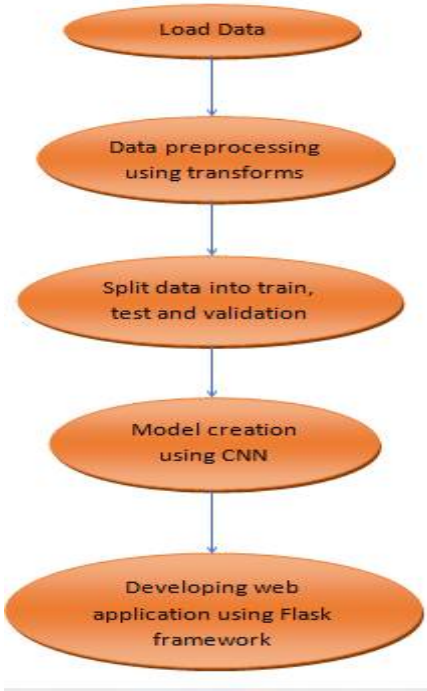


Figure2: Disease Detection Steps

VI. RESULTS

The Results introduced in this segment are connected with preparing with entire data set as we know that CNN can learn highlights when used on bigger datasets. Results accomplished when prepared with just unique pictures won't be investigated. After adjusting the boundaries, a general precision of 96.7% was accomplished.

```
In [ ]:
train_acc = accuracy(train_loader)
test_acc = accuracy(test_loader)
validation_acc = accuracy(validation_loader)

In [38]:
print(
    f"Train Accuracy : {train_acc}\nTest Accuracy : {test_acc}\nValidation Accuracy : {validation_acc}"
)

Train Accuracy : 96.7
Test Accuracy : 98.9
Validation Accuracy : 98.7
```

Figure3 (a) : Accuracy Statistics from analysing the data

```
In [8]:
def single_prediction(image_path):
    image = Image.open(image_path)
    image = image.resize((224, 224))
    input_data = TF.to_tensor(image)
    input_data = input_data.view((-1, 3, 224, 224))
    output = model(input_data)
    output = output.detach().numpy()
    index = np.argmax(output)
    print("Original : ", image_path[12:-4])
    pred_csv = data["disease_name"][index]
    print(pred_csv)

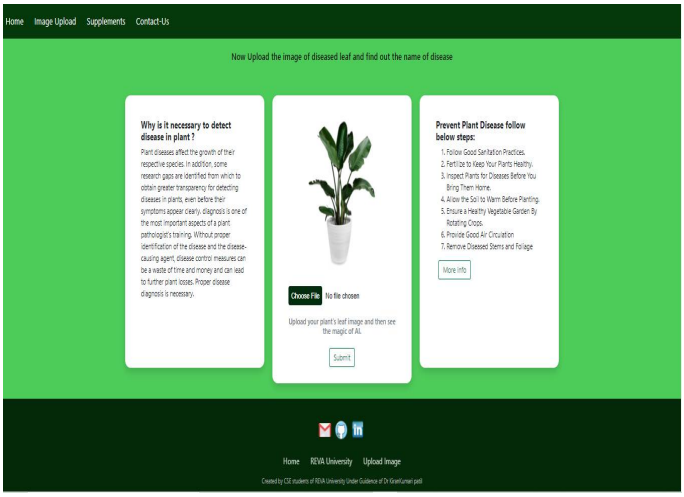
In [53]:
single_prediction("test_images/Apple_ceder_apple_rust.JPG")

Original :  Apple_ceder_apple_rust
Apple : Cedar rust
```

Figure3 (b) : Model Testing

The final results achieved after the development of the frontend application after incorporating the model is as show in the figures below.





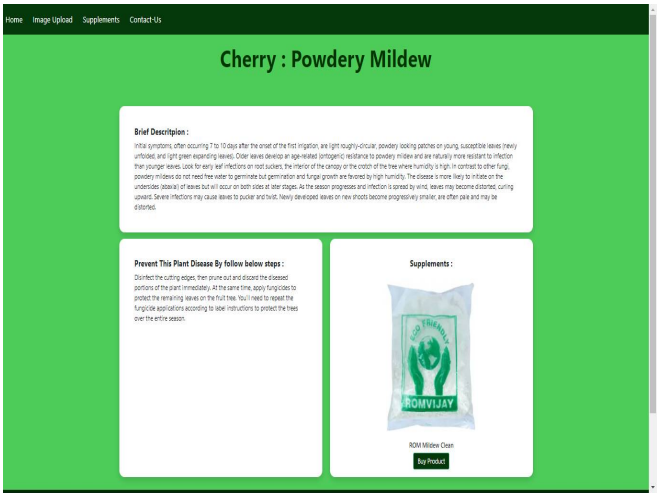


Figure4: Web application

VII. APPLICATIONS

A. Farmers in certain nations lack adequate facilities or even the knowledge of how to contact professionals. As a result, consulting specialists is both expensive and time-consuming.
B. In this situation, the recommended approach proved to be useful for monitoring huge agricultural fields. It is also easier and less expensive to identify illnesses automatically by simply looking at the signs on the plant leaves.
C. Plant disease detection by sight is a more time-consuming and inaccurate process that can only be performed in restricted locations.
D. Automatic detection, on the other hand, requires less work, quicker, and is more accurate.
E. It also has important academic research value.
F. This project is important in agriculture to increase the yield.

VIII. CONCLUSIONS

Contrasted and conventional image processing techniques, which manage plant disease recognition undertakings in a few stages and connections, plant disease/infection identification systems utilizing profound deep learning bind together them from start to finish including extraction, which has a wide advancement possibilities. This application will help many farmers who are uneducated to get correct information about diseases and help increase their yield.

In spite of the fact that plant disease discovery innovation is growing quickly, it is transitioning from scientific study to farming application; nevertheless, there is still a distinct distinction between experienced applications in genuine common habitat, and there are a few challenges to be resolved.

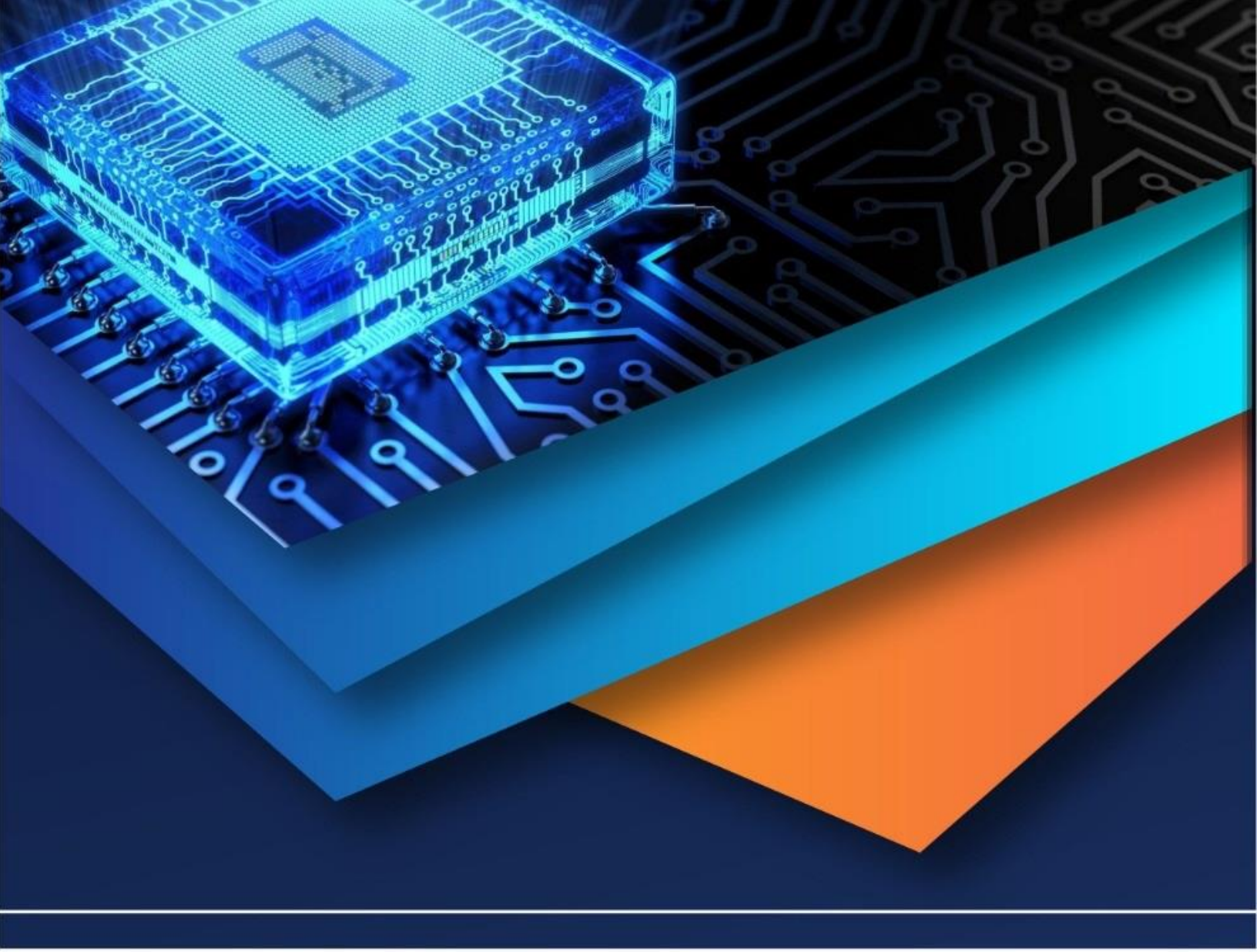
IX. FUTURE SCOPE

Advancements that can be done to the project is with detecting plant disease it should be able to locate where the picture of leaf is taken so we can understand what type of crops should be grown or should not be grown in that particular area.

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