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Leaf Disease Detection Using Deep Learning & Machnine Learning Techniques

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ABSTRACT

Economy contributes the most for the productivity of the agriculture. In agricultural field, the disease in plants is more common and the detection of disease in plants has become more feasible due to the above reason. This day's plant disease detection has acquired enlarging scrutiny in shrivelling crops of large and various fields. Farmers undergo significant hassles in chop and changing from one disease administer principle to a different one. We can identify or spotting the tomato leaf diseases for detection for surveillance and monitoring experts is the standard approach for detection. The plants get seriously affected if the proper control hasn't been taken and this represents the quality of the pants the production of the plants will be affected. Detection of disease through some mechanized technique and methodology is efficient and constructive because it decreases an outsized toil of shrivelling in the large cultivation. By using this paper we can identify the algorithm which is used for image segmentation and for automated classification used for the detection of diseases of leaves in the plants. It also covers distinct disease classification methods of working which is used for the detection of diseases in plants. We present the current trends and challenges for the detection of plant leaf disease using deep learning and advanced imaging techniques. We hope that this work will be a valuable resource for researchers who study the detection of plant diseases and insect pests.

Key Words: Plant leaf disease images, deep learning, Machine Learning, SVC, ANN,CNN, Resnet50.

INTRODUCTION

The automated identification of plant diseases based on plant leaves is a major landmark in the field of agriculture. Moreover, the early and timely identification of plant diseases positively impacts crop yield and quality. Due to the cultivation of a large number of crop products, even an agriculturist and pathologist may often fail to identify the diseases in plants by visualizing disease-affected leaves In order to overcome the above problems, researchers have thought of several solutions. Various types of feature sets can be used in machine learning for the classification of plant diseases. Among these, the most popular feature sets are traditional hand crafted and deep-learning (DL)-based feature, Pre-processing, such as image enhancement, color transformation, and segmentation, is a prerequisite before efficiently extracting features. After feature extraction, different classifiers can be used.

The occurrence of plant diseases has a negative impact on agricultural production. In recent years, plant disease identification has been a crucial issue. Disease-infected plants usually show obvious marks or lesions on leaves, stems, flowers, or fruits. Generally, each disease or pest condition presents a unique visible pattern that can be used to uniquely diagnose abnormalities. Usually, the leaves of plants are the primary source for identifying plant diseases, and most of the symptoms of diseases may beginto appear on the leaves.

Exploiting common digital image processing techniques such as colour analysis and thresholding were used with the aim of detection and classification of plant diseases. Various different approaches are currently used for detecting plant diseases and most common are artificial neural networks (ANNs) [1] and Support Vector Machines (SVMs). They are combined with different methods of image pre-processing in favour of better feature extraction. Detecting plant diseases using the deep convolutional neural network trained and fine-tuned to fit accurately to the database of a plant's leaves that was gathered independently for diverse plant diseases .Implementing the appropriate management strategies like fungicide applications, disease-specific chemical applications [2] , and vector control through pesticide applications could lead to early information on crop health and disease detection. This could facilitate thecontrol of diseases and improve productivity.

LITERATURE SURVEY

Table 1: Literature Review

S. No	Journal Type with year	Authors	Title	Outcomes
1	2018, ICDI3C	Maniyath, S.R. P V, V., M, N., R, P., N, P. B., N, S., & Hebbar,R.	Plant Disease Detection Using Machine Learning	First for any image we need to convert RGB image into gray scale image. This is done just because Hue moments shape descriptor and Haralick features can be calculated over single channel only. Therefore, it is necessary to convert RGB to gray scale before computing Hue moments and Haralick features.
2	2021,Electronics	Hassan, S. M., Maji A.K., Jasiński,M., Leonowicz, Z., & Jasińska, E.	Identification of Plant LeafDiseases Using CNNand Transfer-Learning Approach	Classification of plant diseases using diseased leaves of plants. However there is still no efficient and effective commercial solution that can be used to identify the diseases. In our work we used four different DL models for the detection of plant
				diseases using healthy- and diseased leaf images of plants.
3	2021, IntechOpen	MuhammadE.H. Chowdhury, Tawsifur Rahman, Amith Khandakar, Nabil Ibtehaz	Tomato Leaf Diseases Detection Using Deep Learning Technique	Infinite possibilities of machine learning for agriculture applications complete with case studies. ResNet Mobile Net, DenseNet201, and InceptionV3 are examples of state-of-the- art pre trained CNN models that do an excellent work of classifying diseases from plant leaf images When compared to other architectures, the DenseNet201 was found to be better at extracting discriminative features from images
4	2020,IEEE	Zhang, Y., Song, C., &Zhang., D	Deep Learning-Based Object Detection Improvement for Tomato	Faster RCNN algorithm to detect diseased tomato leaves, which can both recognize tomato diseases and detect tomato leaf locations. To
			Disease	make the anchors in the algorithm closer to the ground truth of our dataset, we use the k- means algorithm to cluster the bounding boxes of tomato disease images and improve the anchors based on the results.
5	Wiley Feb 2021	Wiley	Image-Based Detection of Plant Diseases:From ClassicalMachine Learning to Deep LearningJourney	Focus to clarify the details about the diseases and how to detect them promptly with artificial intelligence Discuss the use of machine learning and deep learning to detect diseases in plants automatically

SYSTEM ANALYSIS & FEASIBILITY STUDY

Existing Method:

This model emphasizes an existing method that which is designed using the some of the algorithms of deep learning. Here the process is performed using the machine learning, which is one of the transfer learning methods, but this could not get the high accuracy.

Disadvantages:

- Less feature compatibility
- Low accuracy

Proposed System:
In purposed method we are performing the classification of either the Plant Leaf Disease identification using Convolution Neural Network (CNN) of deep learning along with the machine learning methods as in fig 1. As image analysis based approaches for Leaf Disease detection [3]. Hence, proper classification is important for the Leaf disease that which will be possible by using our proposed method. Block diagram of proposed method is shown below in fig 2.

Block Diagram:

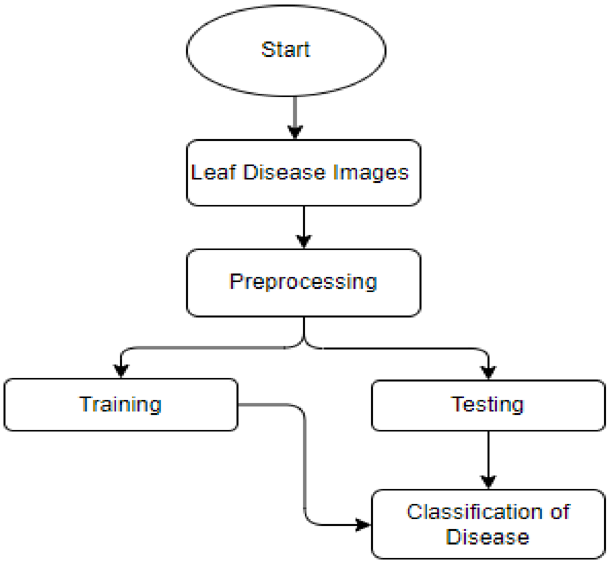

Fig 1. Block diagram of proposed method

Architecture

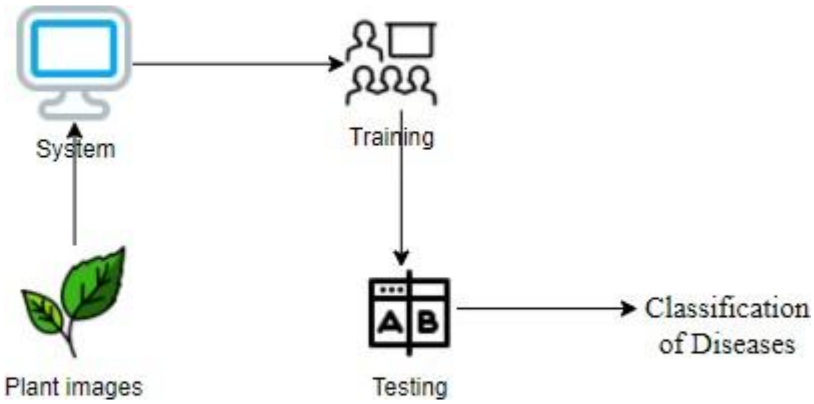

Fig 2.Architecture of proposed system

METHODOLOGY AND ALGORITHMS

Convolutional Neural Network
A convolutional neural network consists of an input layer, hidden layers and an output layer. In any feed-forward neural network, any middle layers [14] are called hidden because their inputs and outputs are masked as in fig 3 by the activation function and final convolution.

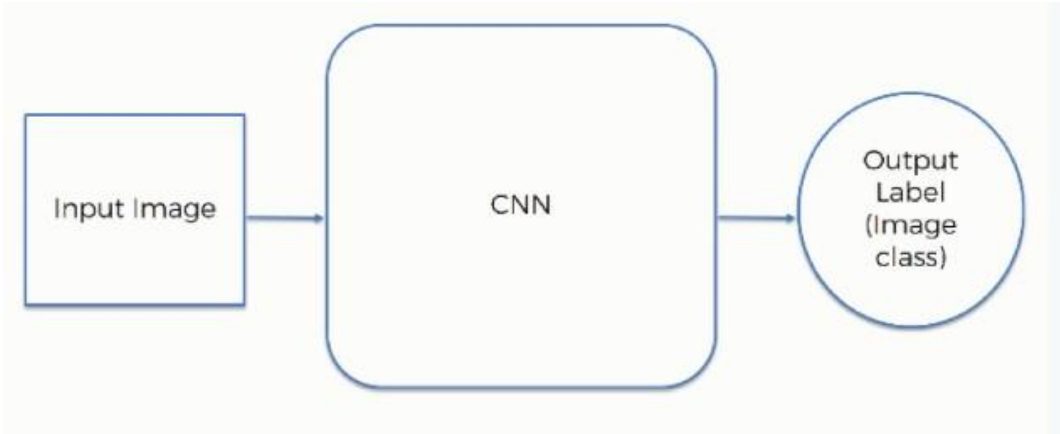

Fig 3.CNN

CNN has mainly 4 steps:

- Step1: convolutional operation
- Step 2: Conv2D
- Step 3: Flattening
- Step 4: Full Connection

Artificial Neural Network (ANN):
ANN architecture is based on the structure and function of the biological neural network. Similar to neurons in the brain, ANN also consists of neurons which are arranged in various layers. Feed forward neural network is a popular neural network which consists of an input layer to receive the external data to perform pattern recognition [4], an output layer which gives the problem solution, and a hidden layer is an intermediate layer which separates the other layers. The adjacent neurons from the input layer to output layer are connected through acyclic arcs. The ANN uses a training algorithm to learn the datasets which modifies the neuron weights depending on the error rate between target and actual output. In general, ANN uses the back propagation algorithm [13] as a training algorithm to learn the datasets. The general structure of ANN is shown in Fig 4.

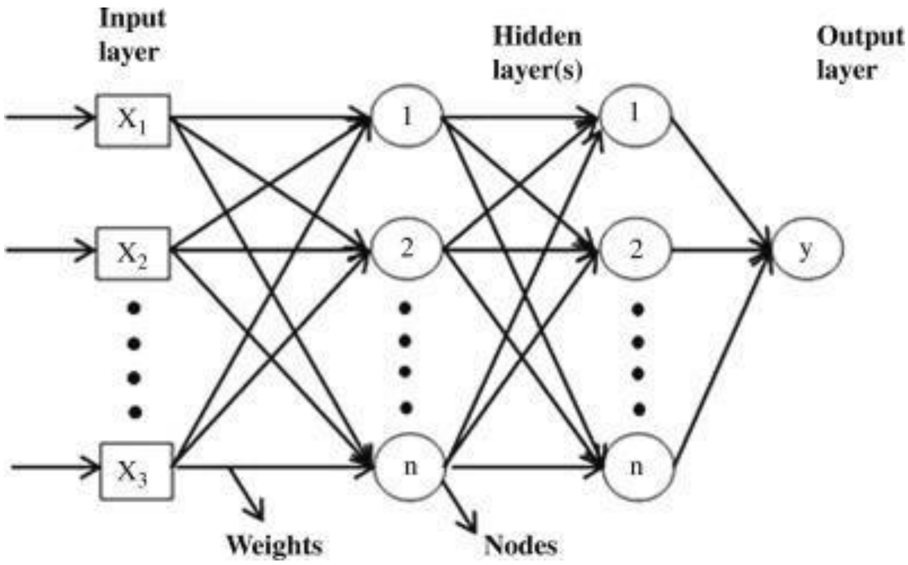

Fig 4: ANN Architecture

ResNet50:
ResNet50 is a convolutional neural network which has a depth of 50 layers. It was build and trained by Kaiming He, Xiangyu Zhang, ShaoqingRen, and Jian Sun in their 2015 [5] and you can access the model performance results on their paper, titled Deep Residual Learning for Image Recognition. This model is also trained on more than 1 million images from the Image Net database. Just like VGG- 19, it can classify up to 1000 objects and the network was trained on 224x224 pixels colored images. Here is brief info about its size and performance as shown in fig 5.

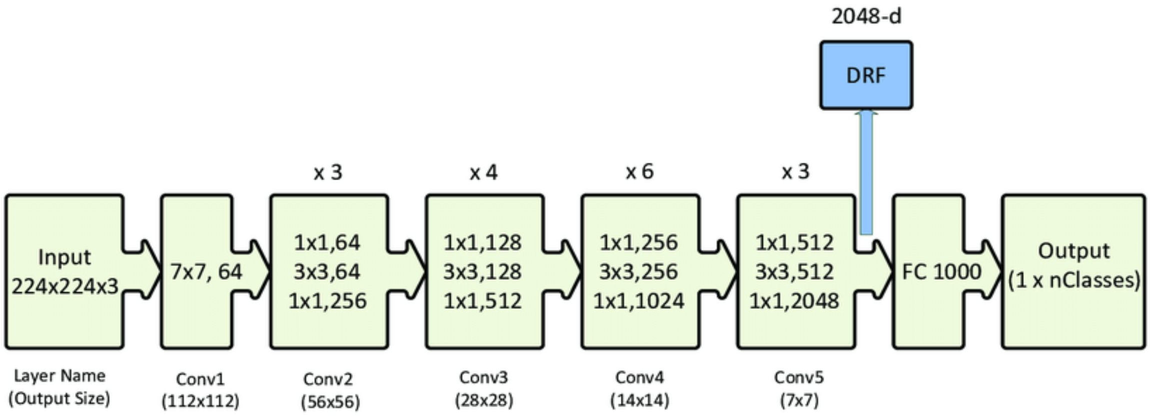

Fig 5. ResNet50 Architecture

To sum up, residual network or ResNet was a major innovation that has changed the training of deep convolutional neural networks for tasks related to computer vision. While the original Resnet had 34 layers and used 2-layer blocks, other advanced variants such as the Resnet50 made the use of 3-layer bottleneck blocks [6] to ensure improved accuracy and lesser training time. Keras is a deep learning API that is popular due to the simplicity of building models using it. Keras comes with several pre-trained models, including Resnet50, that anyone can use for their experiments. Therefore, building a residual network in Keras for computer vision tasks like image classification is relatively simple. You only need to follow a few simple steps.

Support vector machine (SVM):

Generally, Support Vector Machines [15] is considered to be a classification approach, it but can be employed in both types of classification and regression problems. It can easily handle multiple continuous and categorical variables. SVM [7] constructs a Hyper plane in multidimensional space to separate different classes. SVM generates optimal Hyper plane in an iterative manner shown in below fig 6, which is used to minimize an error. The core idea of SVM is to find a maximum marginal Hyper plane (MMH) [8] that best divides the dataset into classes.

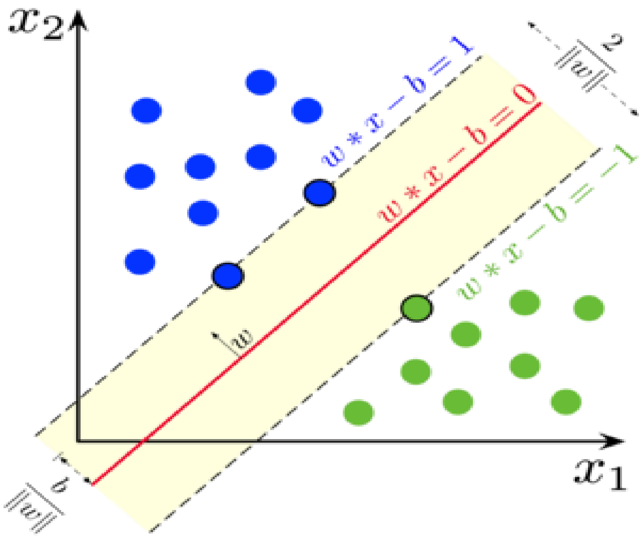

Fig 6 .SVM Plane

SYSTEM DESIGN

Input Design:

In an information system, input is the raw data that is processed to produce output. During the input design [9], the developers must consider the input devices such as PC, MICR, OMR, etc.

Therefore, the quality of system input determines the quality of system output. Well-designed input forms and screens have following properties –

- It should serve specific purpose effectively such as storing, recording, andretrieving the information.
- It ensures proper completion with accuracy.

- It should be easy to fill and straightforward.
- It should focus on user's attention, consistency, and simplicity.
- All these objectives are obtained using the knowledge of basic designprinciples regarding −What are the inputs needed for the system?
- How end users respond to different elements of forms and screens.

Objectives for Input Design:
The objectives of input design are

- To design data entry and input procedures
- To reduce input volume
- To design source documents for data capture or devise other data capturemethods
- To design input data records, data entry screens, user interface screens, etc.
- To use validation checks and develop effective input controls.

Output Design:
The design of output is the most important task of any system. During output design, developers identify the type of outputs needed, and consider the necessary output controls and prototype report layouts [10].

Objectives of Output Design:
The objectives of input design are:

- To develop output design that serves the intended purpose and eliminates theproduction of unwanted output.
- To develop the output design that meets the end user's requirements.
- To deliver the appropriate quantity of output.
- To form the output in appropriate format and direct it to the right person.
- To make the output available on time for making good decisions.

MODULES

System User
System:

Create Dataset:
The dataset containing images of the plant disease classification images with the Plant health or not i.e., normal are to be classified is split into training and testing dataset with the test size of 30-20%.

Pre-processing:
Resizing and reshaping the images into appropriate format to train our model. 1.3Training: Use the pre-processed training dataset is used to train our model using CNN Deep learning and machine learning algorithms [11] along with Resnet50 transfer learning methods.

Classification:
The results of our model are display of plant disease classification images are either with different labels [12]

User:
Upload Image
The user has to upload an image which needs to be classified.2.2View Results
The classified image results are viewed by user.

OUTPUT SCREEN SHOTS WITH DESCRIPTION.

Home: In our project, we are classifying the presence of Plant Leaf DiseasesClassification, with the help of deep learning and machine learning seen in fig 7.

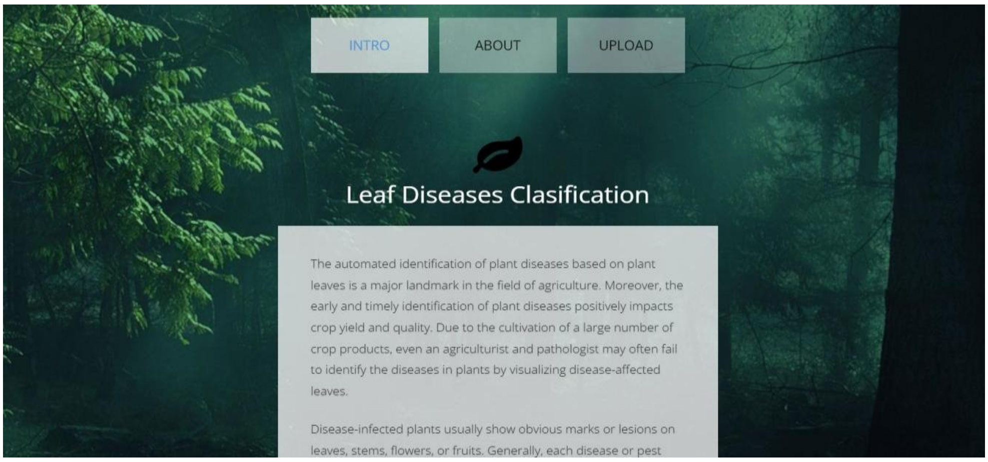

Fig 7: Home

About Project: Here the user will get a breif idea in fig 8 about the project.

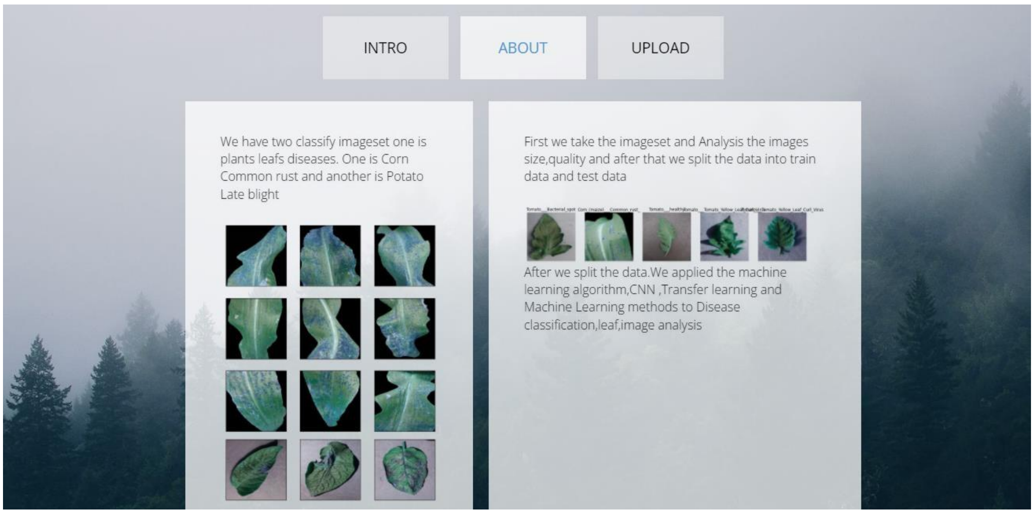

Fig 8: **About Project**

Upload Image:
Here the images can be uploaded those which are to be classified.

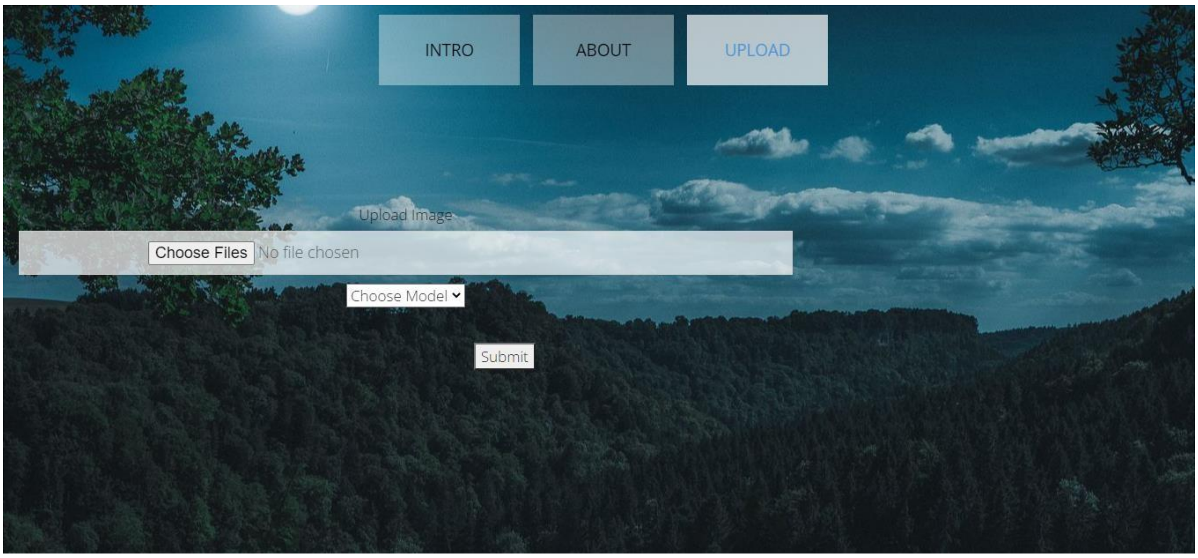

Fig 9: Image Uploading

Model choosing:
Here the model can be selected, by which the image is to be classified as in fig 10.

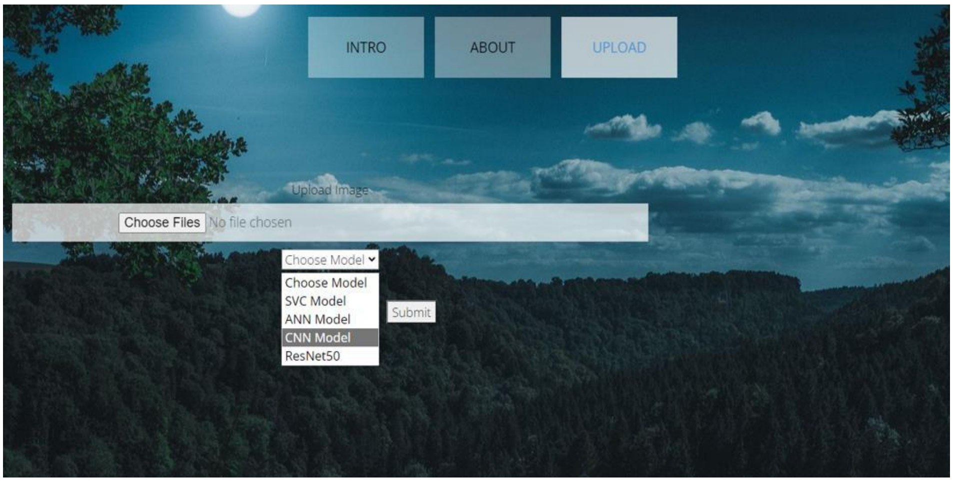

Fig10: Model choosing

Classified output:
The uploaded image shown in fig 11 is classified as theCorn_(maize)___Cercospora_leaf_spot Gray_leaf_spot.

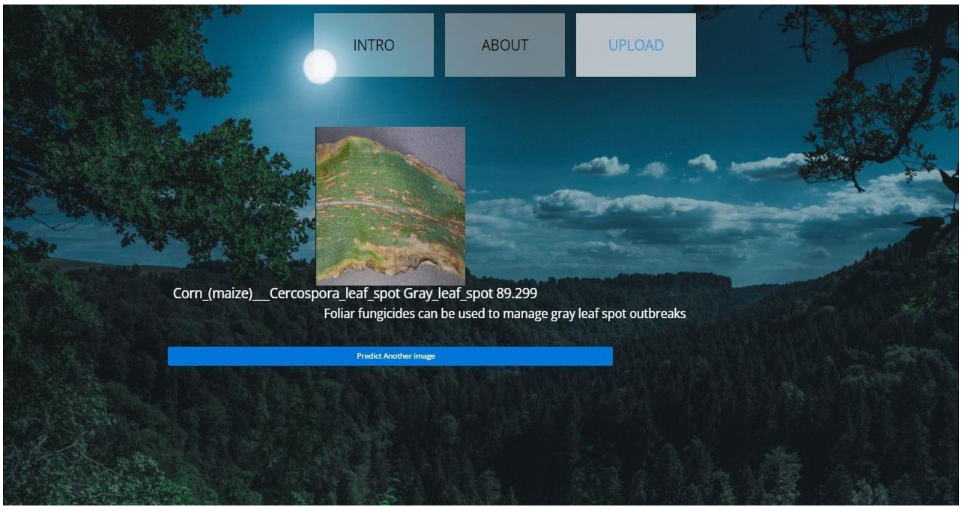

Fig11: Classified output

Classified output:
The uploaded image is classified as the Corn_(maize)___Common_rust_.

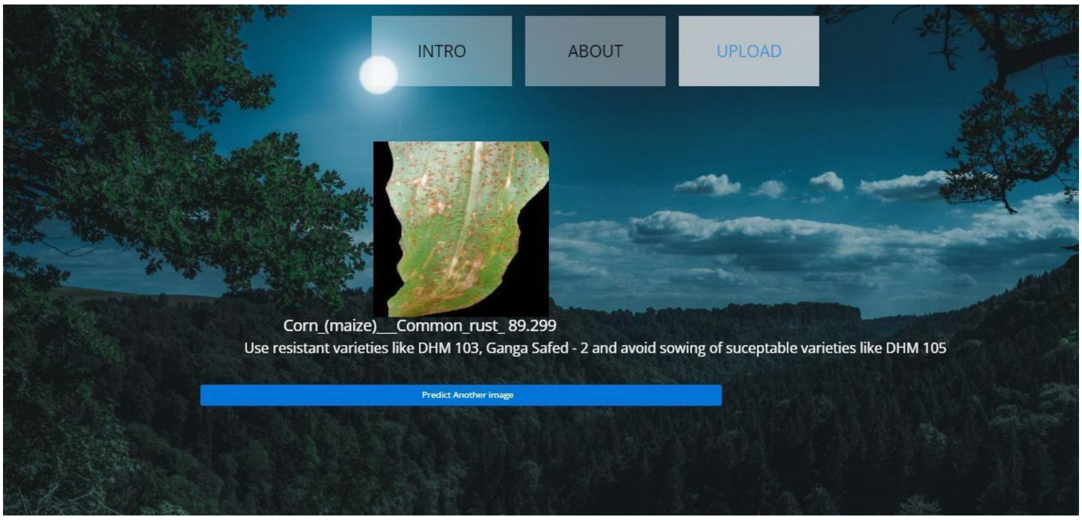

Fig 11(a): Classified output

Classified output:
The uploaded image is classified as the Corn_(maize)___healthy.

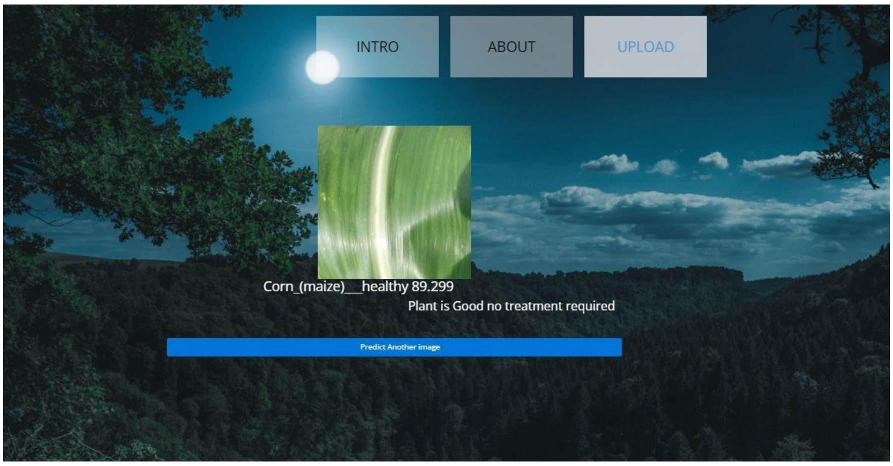

Fig 11(b): Classified output

Classified output:

The uploaded image is classified as the Corn_(maize)___Northern_Leaf_Blight.

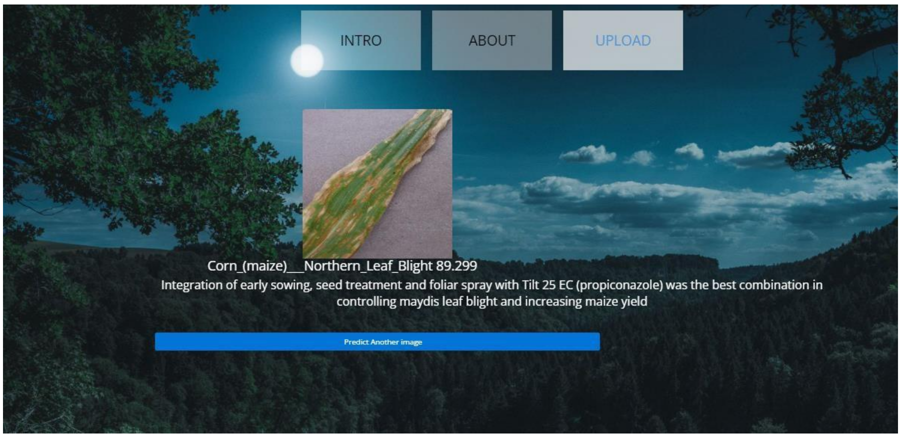

Fig 11(c): Classified output

Classified output:
The uploaded image is classified as the Potato_________________Early_blight.

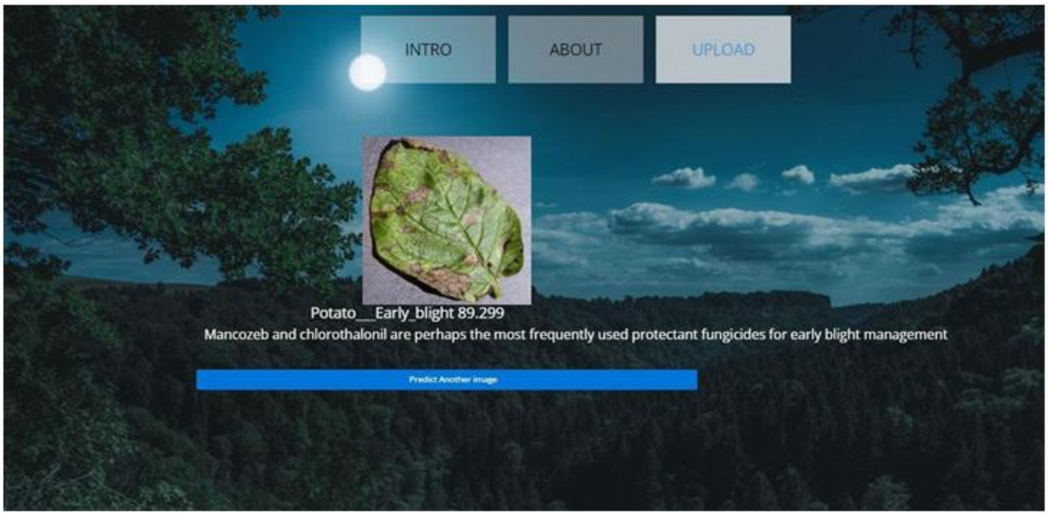

Fig 11(d) : Classified output

Classified output:
The uploaded image is classified as the Potato_______________healthy.

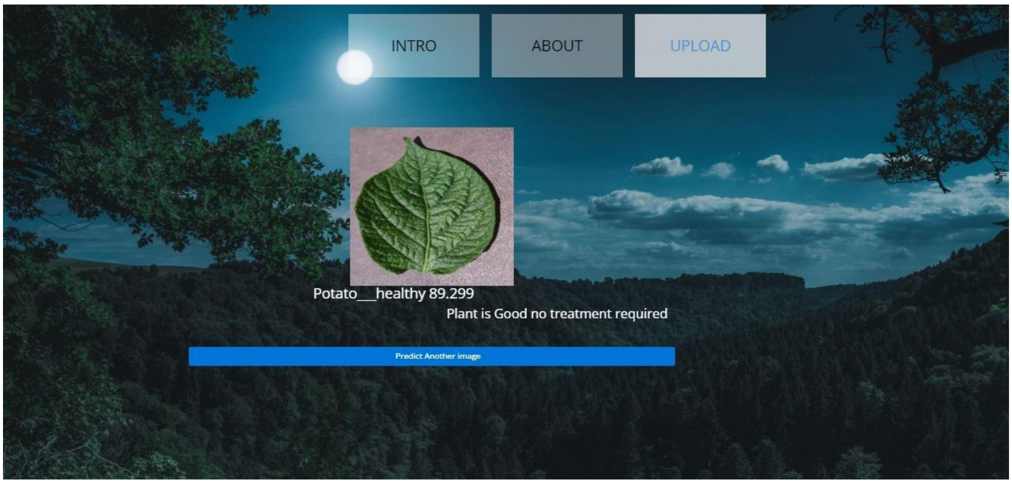

Fig 11(e): Classified output

Classified output:
The uploaded image is classified as the Potato_________________Late_blight.

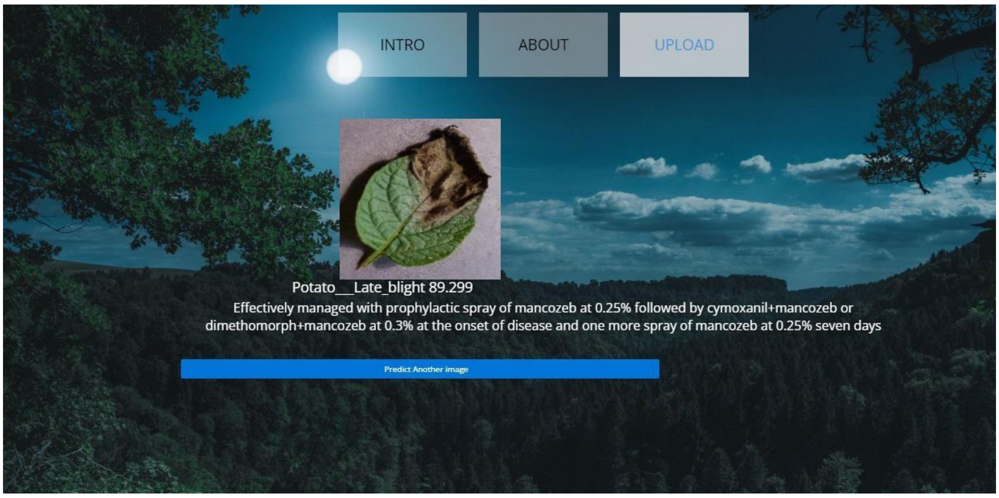

Fig 11(f): Classified output

Classified output:
The uploaded image is classified as the Tomato_______________Bacterial_spot.

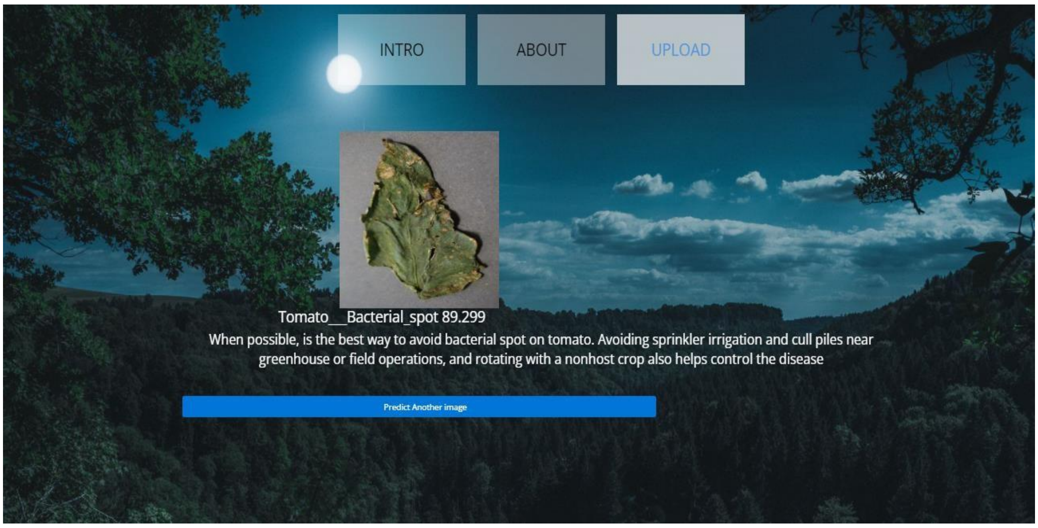

Fig 11(g): **Classified output**

Classified output:
The uploaded image is classified as the Tomato__________________healthy.

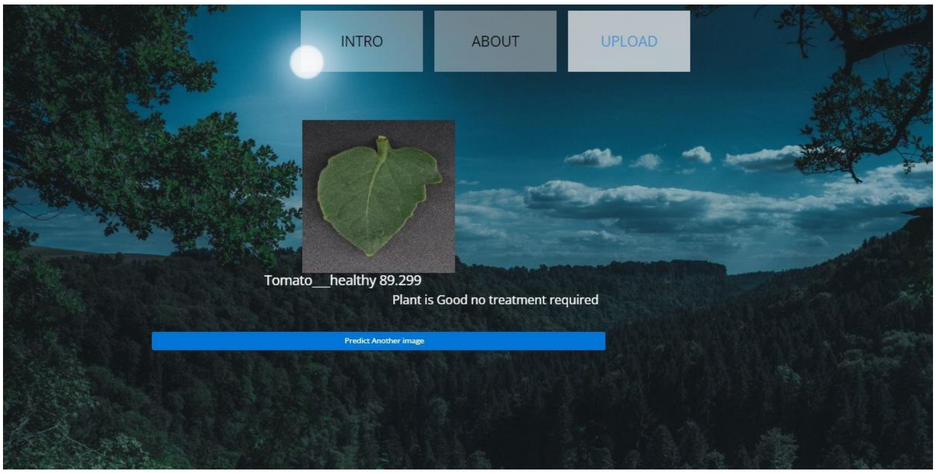

Fig 11(h): Classified output

Classified output:
The uploaded image is classified as the Tomato__________________Late_blight.

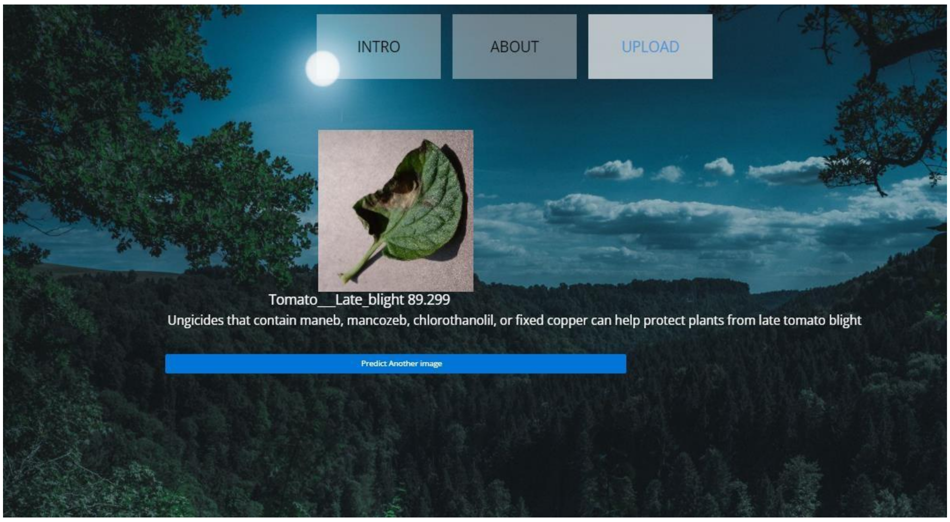

Fig 11(i): Classified output

Classified output:
The uploaded image is classified as the Tomato_______________Tomato_Yellow_Leaf_Curl_Virus.

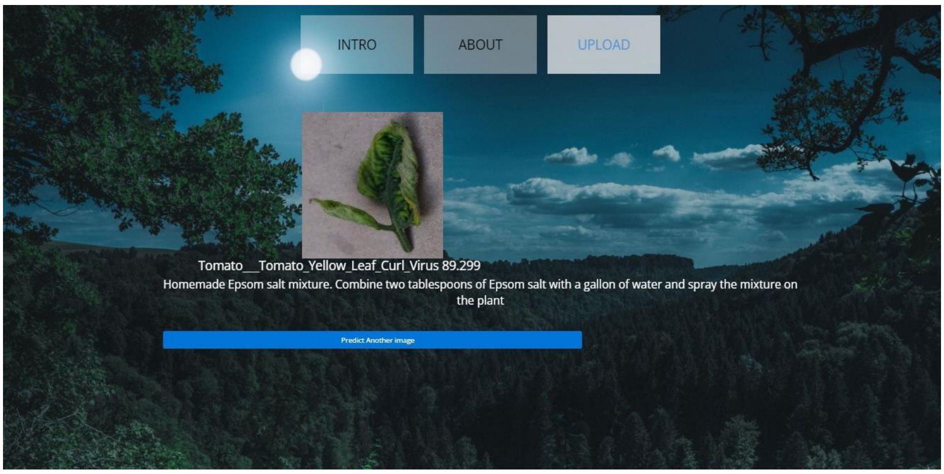

Fig 11(j): Classified output

CONCLUSION

In this paper, we have successfully classified the images of Identification of Plant Leaf Diseases Classification, are either affected with the Plant Leaf diseases using the deep learning and machine learning. Here, we have considered the dataset of Plant Leaf Diseases Classification images which will be of different types and different plants (healthy or unhealthy) and trained using SVC, CNN and ANN along with some Resnet50 transfer learning method. After the training we have tested by uploading the image and classified it.

FUTURE SCOPE

This can be utilized in future to classify the types of different Diseases easily that which can tend to easy to Predicated the treatment for plant in early stages and can take the initial curing of plants and take measures to not affect other plants.

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