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LEAF DISEASE DETECTION USING DEEP LEARNING & ML TECHNIQUES

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ABTRACT

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. These days's plant disease detection has acquired enlarging scrutiny in surveilling 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 surveilling in the large cultivation. In the premature phase we can detect the symptoms of the plant diseases since their first appearance on their leaves of the plants. 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.

The application of deep learning in plant disease recognition can avoid the disadvantages caused by artificial selection of disease spot features, make plant disease feature extraction more objective, and improve the research efficiency and technology transformation speed. This review provides the research progress of deep learning technology in the field of crop leaf disease identification in recent years. In this paper, 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. At the same time, we also discussed some of the current challenges and problems that need to be resolved.

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

1.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. However, in the rural areas of developing countries, visual observation is still the primary approach of disease identification. It also requires continuous monitoring by experts. In remote areas, farmers may need to travel far to consult an expert, which is time-consuming and expensive. Automated computational systems for the detection and diagnosis of plant diseases assist farmers and agronomists with their high throughput and precision. 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 handcrafted and deep-learning (DL)-based features. 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. If plant diseases are not discovered in time, food insecurity will increase. Early detection is the basis for effective prevention and control of plant diseases, and they play a vital role in the management and decision making of 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 begin to appear on the leaves. In most cases, agricultural and forestry experts are used to identify on-site or farmers identify fruit tree diseases and pests based on experience. This method is not only subjective, but also time-consuming, laborious, and inefficient.Farmers with less experience may misjudgement and use drugs blindly during the identification process. Quality and output will also bring environmental pollution, which will cause unnecessary economic losses. To counter these challenges, research into the use of image processing techniques for plant disease recognition has become a hot research topic.

The problem of efficient plant disease protection is closely related to the problems of sustainable agriculture and climate change. Research results indicate that climate change can alter stages and rates of pathogen development; it can also modify host resistance, which leads to physiological changes of host-pathogen interactions. The situation is further complicated by the fact that, today, diseases are transferred globally more easily than ever before. New diseases can occur in places where they were previously unidentified and, inherently, where there is no local expertise to combat them.

Inexperienced pesticide usage can cause the development of long-term resistance of the pathogens, severely reducing the ability to fight back. Timely and accurate diagnosis of plant diseases is one of the pillars of precision agriculture. It is crucial to prevent unnecessary waste of financial and other resources, thus achieving healthier production, by addressing the long-term pathogen resistance development problem and mitigating the negative effects of climate change.

In this changing environment, appropriate and timely disease identification including early prevention has never been more important. There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms, or the effect becomes noticeable too late to act, and in those situations, a sophisticated analysis is obligatory. However, most diseases generate some kind of manifestation in the visible spectrum, so the naked eye examination of a trained professional is the prime technique adopted in practice for plant disease detection. In order to achieve accurate plant disease diagnostics a plant pathologist should possess good observation skills so that one can identify characteristic symptoms. Variations in symptoms indicated by diseased plants may lead to an improper diagnosis since amateur gardeners and hobbyists could have more difficulties determining it than a professional plant pathologist. An automated system designed to help identify plant diseases by the plant's appearance and visual symptoms could be of great help to amateurs in the gardening process and also trained professionals as a verification system in disease diagnostics.

Advances in computer vision present an opportunity to expand and enhance the practice of precise plant protection and extend the market of computer vision applications in the field of precision agriculture.

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) and Support Vector Machines (SVMs). They are combined with different methods of image pre-processing in favour of better feature extraction.

In machine learning and cognitive science, ANN is an information-processing paradigm that was inspired by the way biological nervous systems, such as the brain, process information. The brain is composed of a large number of highly interconnected neurons working together to solve specific problems.

An artificial neuron is a processing element with many inputs and one output. Although artificial neurons can have many outputs, only those with exactly one output will be considered. Their inputs can also take on any value between 0 and 1. Also, the neuron has weights for each input and an overall bias.

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. The advance and novelty of the developed model lie in its simplicity; healthy leaves and background images are in line with other classes, enabling the model to distinguish between diseased leaves and healthy ones or from the environment by using deep CNN.

Implementing the appropriate management strategies like fungicide applications, disease-specific chemical applications, and vector control through pesticide applications could lead to early information on crop health and disease detection. This could facilitate the control of diseases and improve productivity.

2. AN OVERVIEW

Convolutional Neural Network

Step1: convolutional operation

The first building block in our plan of attack is convolution operation. In this step, we will touch on feature detectors, which basically serve as the neural network's filters. We will also discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and how the findings are mapped out.

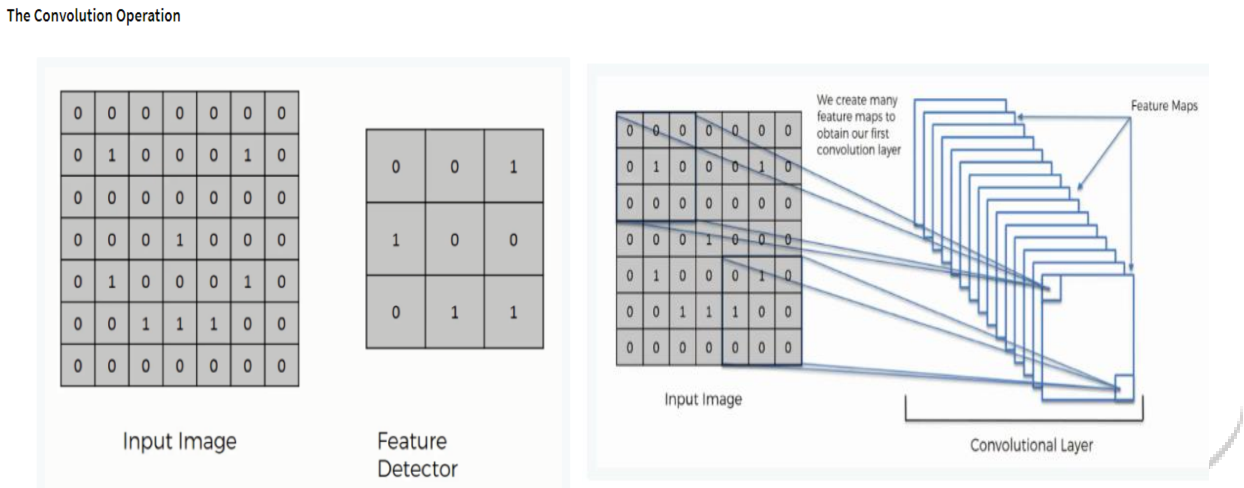

Fig:2.1 Convolutional Neural Network

Step (1b): ReLU Layer

The second part of this step will involve the Rectified Linear Unit or Relook. We will cover Relook layers and explore how linearity functions in the context of Convolutional Neural Networks.Not necessary for understanding CNN's, but there's no harm in a quick lesson to improve your skills.

Convolutional neural network (CNN):

A convolutional neural network consists of an input layer, hidden layers and an output layer. In any feed-forward neural network, any middle layers are called hidden because their inputs and outputs are masked by the activation function and final convolution.

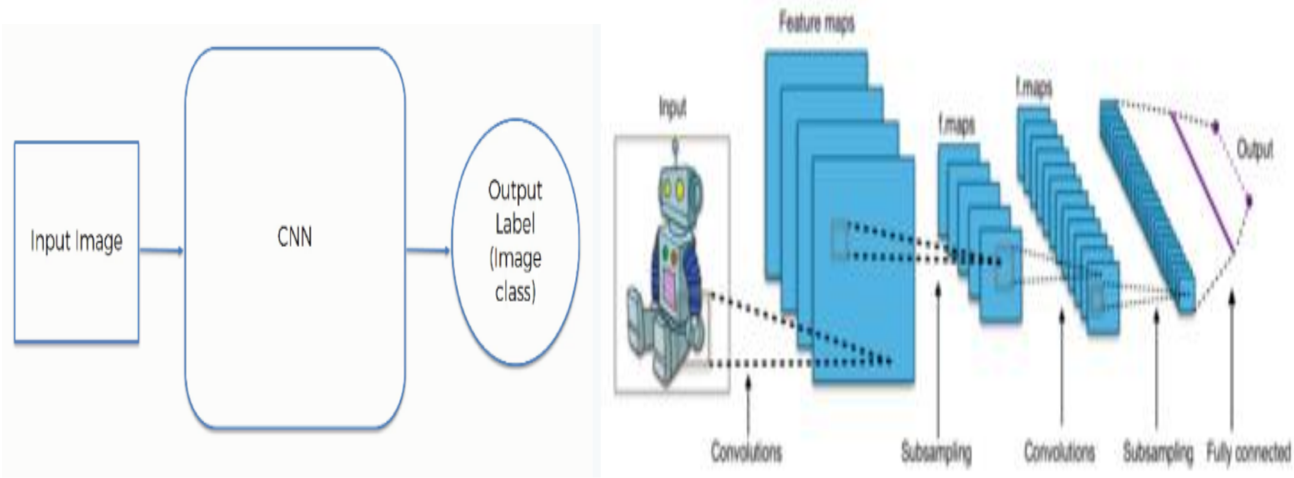

Fig:2.2 CNN Architecture

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, 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 as a training algorithm to learn the datasets. The general structure of ANN

3. LITERATURE REVIEW

[1] Maliyah, S. R., P V, V., M, N., R, P., N, P. B., N, S., &Heber, R: Crop diseases are a noteworthy risk to sustenance security, however their quick distinguishing proof stays troublesome in numerous parts of the world because of the non-attendance of the important foundation. Emergence of accurate techniques in the field of leaf-based image classification has shown impressive results. This paper makes use of Random Forest in identifying between healthy and diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy leaves are collectively trained under Random Forest to classify the diseased and healthy images. For extracting features of an image we use Histogram of an Oriented Gradient (HOG). Overall, using machine learning to train the large data sets available publicly gives us a clear way to detect the disease present in plants in a colossal scale.The agriculturist in provincial regions may think that it's hard to differentiate the malady which may be available in their harvests. It's not moderate for them to go to agribusiness office and discover what the infection may be. Our principal objective is to distinguish the illness introduce in a plant by watching its morphology by picture handling and machine learning.A modern approach such as machine learning and deep learning algorithm has been employed to increase the recognition rate and the accuracy of the results. Various researches have taken place under the field of machine learning for plant disease detection and diagnosis.

[2]Hassan, S. M., Maji, A. K., Jasminka, M., Leibowitz, Z., & Jasminka, E.: The timely identification and early prevention of crop diseases are essential for improving production. In this paper, deep convolutional-neural-network (CNN) models are implemented to identify and diagnose diseases in plants from their leaves, since CNNs have achieved impressive results in the field of machine vision. Standard CNN models require a large number of parameters and higher computation cost. In this paper, we replaced standard convolution with depth=separable convolution, which reduces the parameter number and computation cost. The implemented models were trained with an open dataset consisting of 14 different plant species, and 38 different categorical disease classes and healthy plant leaves. To evaluate the performance of the models, different parameters such as batch size, dropout, and different numbers of epochs were incorporated. The implemented models achieved a disease-classification accuracy rates of 98.42%, 99.11%, 97.02%, and 99.56% using InceptionV3, InceptionResNetV2, MobileNetV2, and EfficientNetB0, respectively, which were greater than that of traditional handcrafted-feature-based approaches. In comparison with other deep-learning models, the implemented model achieved better performance in terms of accuracy and it required less training time. Moreover, the MobileNetV2 architecture is compatible with mobile devices using the optimized parameter. The accuracy results in the identification of diseases showed that the deep CNN model is promising and can greatly impact the efficient identification of the diseases, and may have potential in the detection of diseases in real-time agricultural systems.

[3]Muhammad E.H. Chowdhury, Tawsifur Rahman, AmithKhandakar, Nabil Ibtehaz,: Plants are a major source of food for the world population. Plant diseases contribute to production loss, which can be tackled with continuous monitoring. Manual plant disease monitoring is both laborious and error-prone. Early detection of plant diseases using computer vision and artificial intelligence (AI) can help to reduce the adverse effects of diseases and also helps to overcome the shortcomings of continuous human monitoring. In this study, we have extensively studied the performance of the different state-of-the-art convolutional neural networks (CNNs) classification network architectures i.e. ResNet18, MobileNet, DenseNet201, and InceptionV3 on 18,162 plain tomato leaf images to classify tomato diseases. The comparative performance of the models for the binary classification (healthy and unhealthy leaves), six-class classification (healthy and various groups of diseased leaves), and ten-class classification (healthy and various types of unhealthy leaves) are also reported. InceptionV3 showed superior performance for the binary classification using plain leaf images with an accuracy of 99.2%. DenseNet201 also outperform for six-class classification with an accuracy of 97.99%. Finally, DenseNet201 achieved an accuracy of 98.05% for ten-class classification. It can be concluded that deep architectures performed better at classifying the diseases for the three experiments. The performance of each of the experimental studies reported in this work outperforms the existing literature.

[4]Zhang, Y., Song, C., & Zhang., D. To improve the recognition model accuracy of crop disease leaves and locating diseased leaves, this paper proposes an improved Faster RCNN to detect healthy tomato leaves and four diseases: powdery mildew, blight, leaf mold fungus and ToMV. First, we use a depth residual network to replace VGG16 for image feature extraction so we can obtain deeper disease features. Second, the k-means clustering algorithm is used to cluster the bounding boxes. We improve the anchoring according to the clustering results. The improved anchor frame tends toward the real bounding box of the dataset. Finally, we carry out a k-means experiment with three kinds of different feature extraction networks.

4. ARCHITECTURE

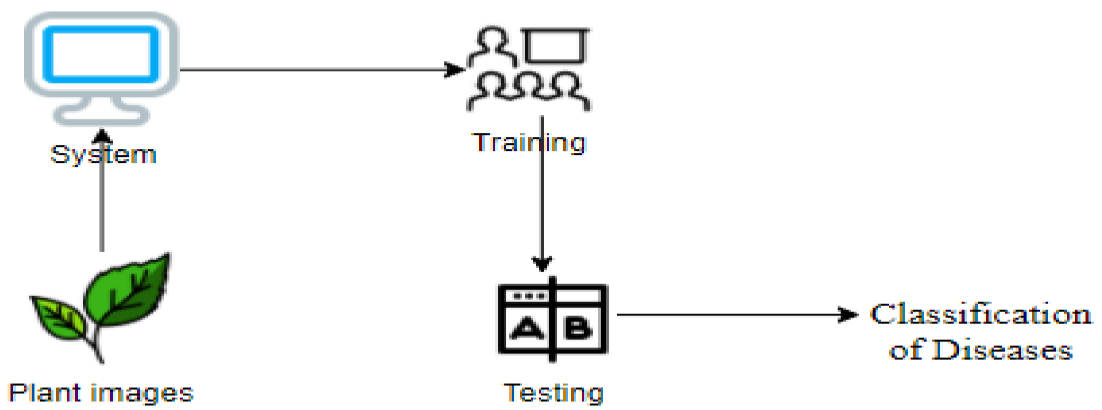

Fig 4.1 Architecture

Use the pre-processed training dataset is used to train our model using CNN Deep learning and machine learning algorithms along with Resnet50 transfer learning methods.

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 image analysis based approaches for Leaf Disease detection. 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.

6. Results

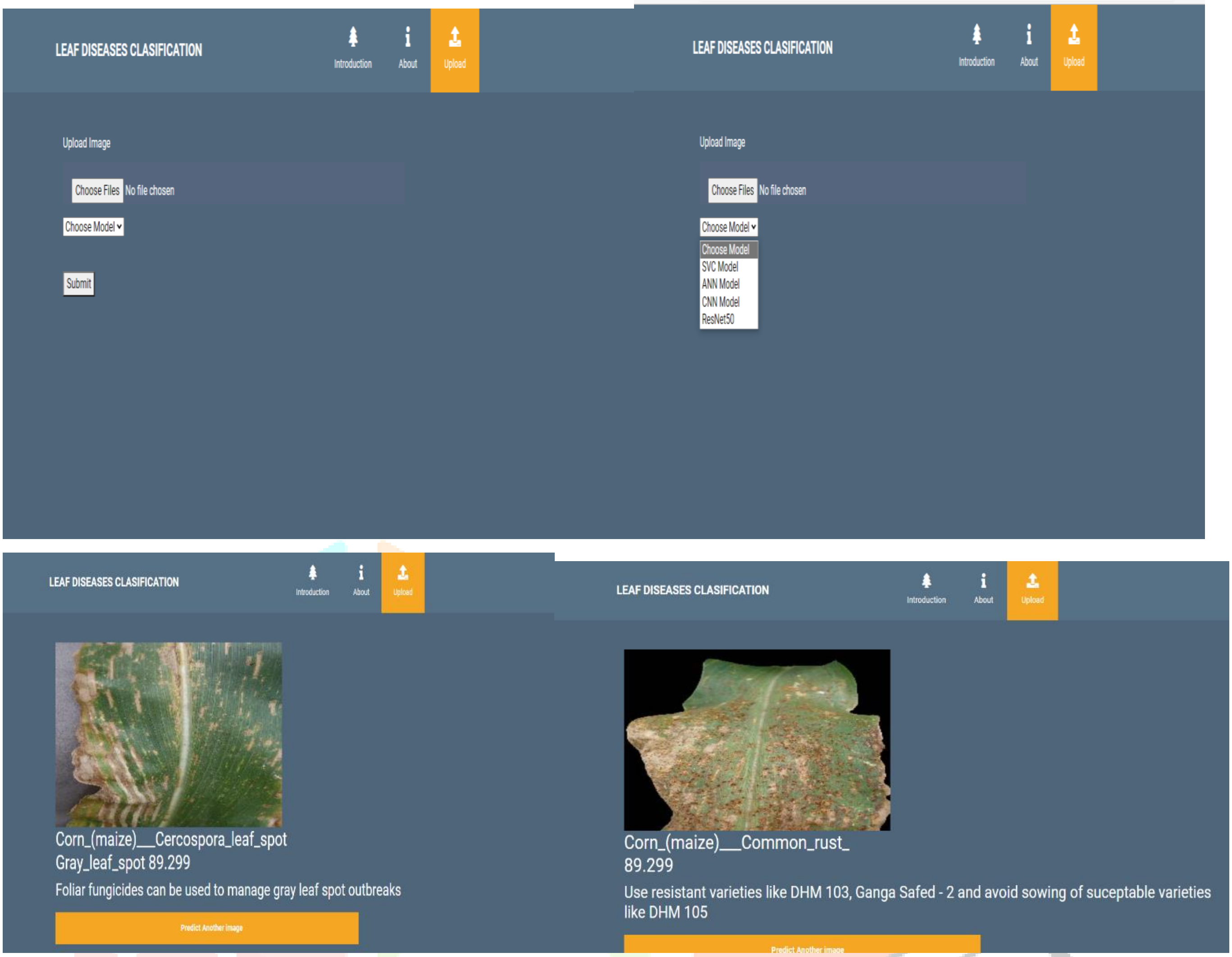

Fig:6.1 **Input Screen**

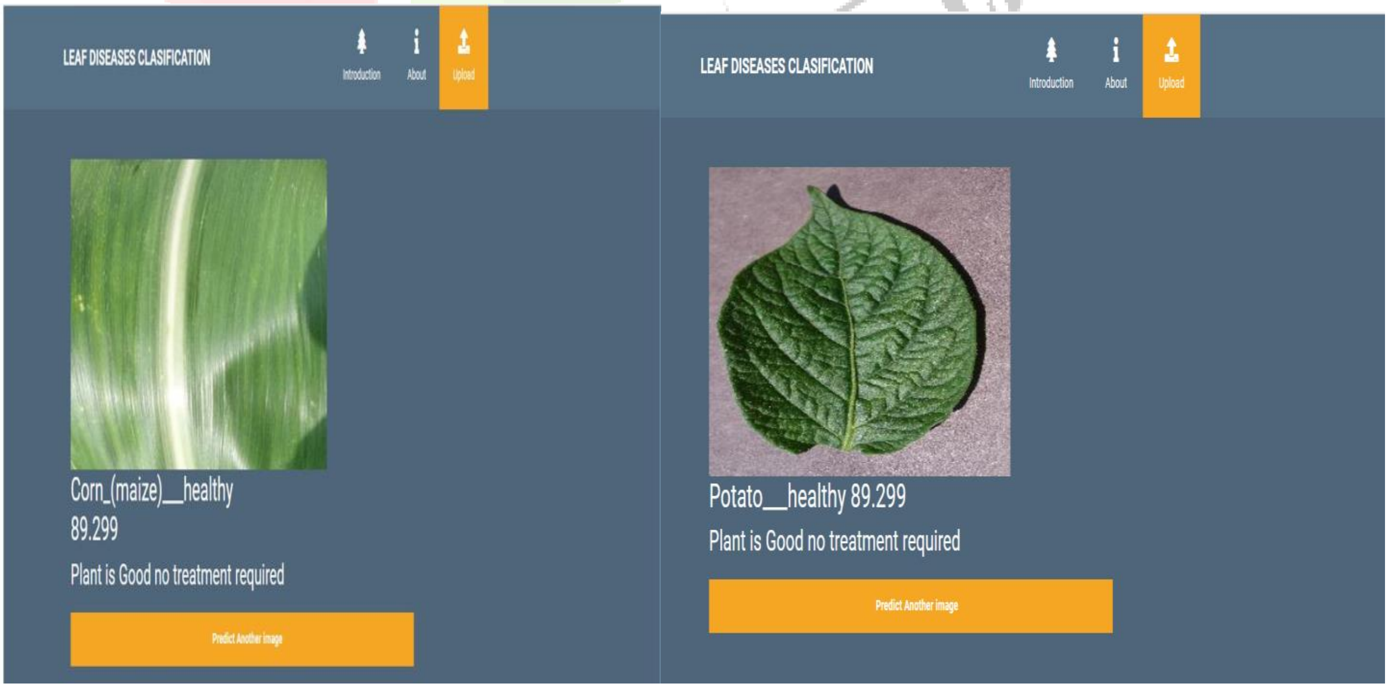

Fig:6.2 Gray & Uploaded image Screens

7. CONCLUSION

In this project 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, ANN along with some Resnet50 transfer learning method. After the training we have tested by uploading the image and classified it.

8. 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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