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Leaf Disease Detection Using CNN-Deep Learning

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Abstract

To be able to Agriculture, the economy, and the effort to combat global warming all depend on plants. Consequently, it is crucial to take care of plants. Plants can contract a variety of bacterial, fungal, and viral diseases, just like people can. Early Disease The use of pets and detection are essential for improving agricultural output and quality. Due to a decline in the quality of the agricultural produce, diseased plants can cause large financial losses for individual farmers. In a nation like India, where a substantial section of the population engages in agriculture, it is imperative to recognise the disease in its earliest stages. With quicker and more precise plant disease prediction, losses might be reduced. Early disease detection and treatment are essential to preventing the destruction of the entire plant. Significant developments and improvements in deep learning have opened up the possibility of improving the effectiveness and precision of object identification and recognition systems. The main objectives of this study are the detection of plant diseases and the reduction of economic losses.Deep learning has been proposed as a method for image recognition. As the three main architectures of the neural network, we have examined the Region-based Fully CNN (R-CNN), Single shot Multibook Detector (SSD), and Faster Region-based Convolution Neural Network (Faster R- CNN). The research's suggested approach is capable of handling complex scenarios and is efficient at identifying various sickness types. The validation results outline the path ahead for an AI-based Deep Learning solution to this Complex Problem and show the viability of the Convolution Neural Network with an accuracy of 94.6%.

Keywords
Leaf disease detection, Convolutional Neural Network (CNN), Deep learning, Image processing.

I. Introduction

• As of April 2020, there were roughly 1.38 billion people living in India.It should be remembered that the agriculture sector accounts for 18% of India's GDP.One of the major sources of yield in India is the production of crops and the major reason for the decrease in the production of crops is various diseases in plants. • Production of crops diminishes due to climate change and a decline in pollinators. In the developing world, more than 80 percent pf the agricultural production is generated by smallholder farmers and reports of yield loss of more than 50 percent due to plant diseases. • Former disease detection is the suitable method to avoid further losses. • In this project we are going to use image processing to detect the disease. We can put the image into a system and a system will detect the related problems after various identifications. We will discuss the issue of crop degradation due to leaf disease in plants in India with the statistical data and its impact on food resources. Different resources from different organization are usedin this report to provide the exact data to cite this problem.

II. Literature Review

Due to its great effectiveness and accuracy, convolutional neural networks (CNNs) have attracted a lot of attention in recent years for the identification of leaf diseases. We will examine the various strategies employed in the field of leaf disease detection using CNNs in this review ofthe literature. The use of pre-trained models, such as VGG, ResNet, or Inception, to extract features from the input image is a frequent strategy for disease detection utilizing CNNs. These models have learnd to recognise general traitsthat are helpful for a variety of applications, including leaf disease detection, after being trained on big datasets. A fully connected layer is added to the network after feature extraction, and then a softmax layer is added for classification. The work of Singh et al. (2018), who employed a pre-trained VGG- 16 model to identify leaf diseases in tomato plants, provides one illustration of this strategy. On adataset of pictures of tomato leaves, the scientists adjusted the model, and they got an accuracy of 95.65% . Utilizing transfer learning is a different method for using CNNs to identify leaf disease.

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domain specific dataset, you can use pre-trained models that have been optimisedfor certain tasks using large-scale image datasets. An outline of how to use transfer learning for leaf disease detection is provided below:

Transfer learning entails taking a model that has already been trained and retraining just the topmost few layers on a fresh dataset. When the fresh dataset is short and insufficient for completely training a deep neural network, this method may be helpful.

A strategy called transfer learning was utilized in the research by Khan et al. (2020) to identify leafdiseases in maize plants. The final layers of the pre-trained network were adjusted using a dataset of photos of maize leaves by the authorsusing the Inception V3 model as a pre-trained network. 94.52% accuracy was attained using the suggested method.

Researchers have suggested novel CNN architectures for the detection of leaf disease in addition to pre-trained models and transfer learning. A network with four convolutional layers, four pooling layers, and three fully connected layers is what Zhu et al. (2021) termed Plant Disease Net, for instance. An accuracy of 99.14% was achieved by the authors after they trained the network on a sizable collection of photos of plant diseases.

In general, recent years have seen encouraging results for the application ofCNNs for the

identification of leaf disease. While transfer learning and pretrained models continue to be common options, work is still being done to createnew CNN architectures specifically for this task

A. Transfer Learning

Transfer learning is a potent method for detecting leaf disease. With a smaller, domain-specific dataset, you can use pre-trained models that have been optimized for certain tasks using large-scale image

datasets. An outline of how to use transfer learning for leaf disease detection is provided below: Pick a model that has already been trained using a sizable image dataset, like VGG, ResNet, Inception, or MobileNet.Take Off the Upper Layers: The convolutional layers of the pre-trained model should be left alone, however, thefully connected layers or classification layer(s) should be eliminated. Creating the data set: Create training and testing subgroups for your dataset on leaf disease. With the top layers eliminated, feed your leaf photos through the pre-trained CNN model to extract the feature representations. Educate a ClassifierAdd more layers on top of the feature extractor layers, including completely connected layers. Evaluation of the Model: Using the testing dataset, assess the effectiveness of your model. The model can be deployed to make predictions on fresh, previously unobserved leaf images if you arepleased with its performance.

B. VGG Annotation

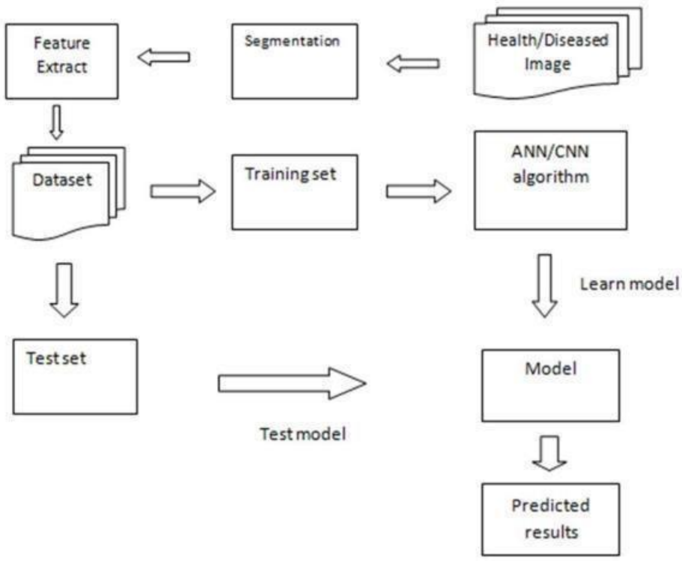
An easy-to-use standalone manual annotation program for images, audio, and videos is called VGG Image Annotator.

Without any setup or installation, VIA operates within a web browser. In most current web browsers, the entire VIA software can be launched as an offline application on a single self- contained HTML page that is under 400kilobytes in size.

No external libraries are required for the open Source project VIA, which is built entirely from HTML, JavaScript, and CSS.
The BSD-2 clause license allows VIA, which is created by the Visual Geometry Group (VGG) and distributed, to be used for both commercial and academic enterprises.

III. Related work

A neural network model for image classification is being developed. This model will be implemented on the Android website for real-time plant leaf disease diagnosis using the camera of an android phone. Additionally, we'll refine and submit an application



List of modules

Step1. Image Acquisition:

Our techniqu Data collection from a publicly accessible repository is the initial stage. The image serves as an input for additional processing. We have selected the most widely used image domains so that our approach may handle any input format, including bmp , jpg, and gif .

Step2.Image pre-processing:

The use of computer algorithms to performimage processing on digital images is known as image pre-processing. We can detect the leaf by analysing the image witha special algorithm. We use a similar approach for image processing and detection with a special algorithm.

Step3. Image Enhancement:

The process of modifying digital images so that the effects are more appropriate for display or further image further processing is known as image enhancement.

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Step.4 Image segmentation:

The method of segmenting a digital image into multiple segments is known as image segmentation. Image segmentation is used to make image identification and analysis simpler by dividing the image into several segments and analyzing each segment individually.

Step.6 Image analysis:

Here image segmentation is used to locate the region of interest. The technique used in segmentation is region-based segmentation, which uses the color of the leaf to distinguish between healthy and diseased regions of the leaf. Step.7 Feature extraction.

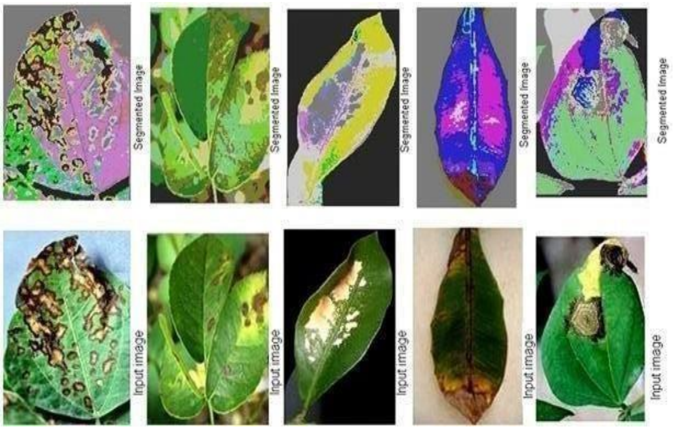
Step7. Disease classification:

It is a method of using our qualified deep learning model to recognize plant disease. Use a digital camera or equivalent system should be used to take an image of the contaminated leaf. It determines what kind of leaf disease is present in the leaf.

IV. Result

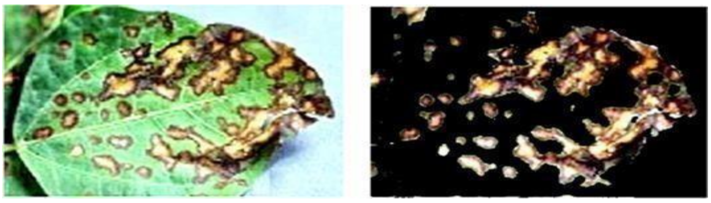
Using CNN deep learning, leaf disease detection has shown excellent results in a variety of plant species. Depending onthe kind of dataset and pre-processing methods employed, the performance of the models differs across various research investigations. In general, studies have shown accuracy rates of over 90%, while some have shown accuracy rates of over 99%. For instance, the pre-trained VGG-16 model used in Singh et al.'s (2018) study on detecting tomato leaf diseases has a 95.65% accuracy rate. The proposed method'saccuracy was 94.52% in the study of Khan et al. (2020) on detecting maize leaf diseases using transfer learning with the Inception V3 model. The accuracy ofthe model was 99.14% in the study of Zhu et al. (2021) on detecting plant illnesses using their suggested Plant Disease Net architecture. It is important to note that the accuracy of the results issignificantly influenced by the amount and calibre of the dataset used for training the models. Therefore, to increase the precision of the models for leaf disease detection using CNN deep learning, future research should concentrate on developing larger and more diverse datasets.

This image shows the original images which are followed by outputsegmented images. Segmented image can be classified into different.



This image shows the input and output image where input image is a banana leaf with **Early scorch disease** and output image shows the classification of disease using feature extraction method.

This image shows Input and output image of beans leaf and output diseases is **Bacterial leaf spot.**



V. Future Scope

This thesis or piece of work is restricted to leaf disease detection using a single scanned image. We can expand our research to examine numerous scanned photos concurrently. Additionally, in the future, new factors could be taken into account, including increasing the amount and quality of pixels. Due to the fact that this job can be expanded for an endless number of users. Additional novel formulae or methods for the improvement of parameters can be used to speed up leaf detection. The suggested algorithm can be used with various tools.

VI. Conclusion

It might be difficult to identify plant diseases and classify them using digital photos. In order for farmers and plant pathologists to take the appropriate action, quick detection of the plant disease is crucial. The suggested work serves this aim by utilising a total of 27 different types of plant leaf photos. The photos of the plants that were taken into consideration were varied and included both lab- view and live field images of the plants from several categories with inherent diversity.

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