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LEVEL OF INFECTION AND LEAF DISEASE DETECTION: A REVIEW

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Abstract -

Most people in India are dependent on agriculture for their livelihood. As crop diseases increase, it will affect agriculture production, which will adversely affect the economy and increase the use of pesticides. This article is an overview of different approaches for the Early detection of leaf diseases and the development of a better approach for detecting leaf disease and level of infection.

1. INTRODUCTION

About 70% of the Indian population is engaged in agriculture. However, the cultivation of these crops for quality products and optimum yields is highly technical. With technological support, it can be enhanced.

Different approaches are now available for leaf disease detection, which are the image processing technique, Machine learning techniques, different types of convolutional neural networks, and deep learning techniques (DENSENET, ALEXNET, RESNET, VGG, etc.).

To detect crop diseases traditionally, experts in the fiel d must have high levels of experience and knowledge, it can be time-consuming, ineffective, and costly.

Artificial neural networks mimic the general principles of brain function. Their main characteristic is the ability to be trained through supervised learning.

Furthermore, in this paper we investigate a method for detecting the degree of infection in leaves and the input image provided by the user undergoes several processing steps to detect the disease, and then the results are provided to the user via an Android application.

2. LITERATURE SURVEY

Researchers presented their approaches to detecting, diagnosing, and recognizing plant leaf diseases in this paper. The methods used at each stage differ according to the type of leaf and the crop being considered. It is vital to pick the most appropriate feature set for the images at hand in the feature extraction phase. This sets the tone for the classifier to produce the most accurate results. This study found that in most cases the neural network classifier is more accurate than other methods. The methods presented here have great potential to be used in the real world. CCD cameras are typically used to capture leaf images, the acquired images are resized and converted to HSI color space, then undergoes different noise reduction techniques (Erosion and dilation, Mean Filter, Median filter, Gaussian filter). The next phase is the image segmentation phase. The K-means algorithm solves the well-known clustering problem in an unsupervised way.

Artificial Neural Network: The color pixels are clustered by the unsupervised SOFM network to an obtained group of colors in the image. The backpropagation neural network is then applied to extract leaf color from the diseased part of the image. This approach has been applied for the segmentation of images of Cotton and Grape Leaves. The purpose of feature extraction is to reduce the image data by measuring certain features or properties of each segmented region such as color, shape, or texture. A classifier is a system that classifies input images of leaves according to the degree of presence of a disease in a leaf, and this classification is based on the features we evaluated in the previous step.[2]

In the image processing method, leaf area is calculated by pixel number statistics. Unit pixel in the same digital images represent the same size hence from known reference area and pixel count, unit pixel size can calculate so that it is easy to calculate leaf area by counting total pixels in the leaf area region. Matlab is a high-performance language for technical computing where problems and solutions are expressed in familiar mathematical notation. Matlab processing is a semi-automatic method to calculate leaf area for more users easily.

Algorithm

1. Read the image.
2. Convert RGB image to Gray Scale image.
3. Convert the Grayscale image into a binary image.
4. Remove noise using ― imfill‖ instruction.
5. Calculate the total green leaf area & total Leaf Area using ―Region props‖ instruction.
6. Infected area in percentage by subtracting Total Green leaf area from Total Leaf area.

The naked eye observation gives poor accuracy, & it is subjective which will vary from person to person. Hence image processing method is used to obtain high precision & accuracy whether leaf with the maximum dimensions. It will consume less time compared to any manual interference as well as it can be easy to process if images are stored. This algorithm will help to detect the amount of disease present on the leaf, using the presence of holes & changes in the color. It will be easy to go for the severity measurement of the disease.[1]

As per the survey, this paper has attempted to study machine learning methods that are used by researchers for disease identification and classification of plants. These machine learning methods help agricultural experts in the detection of disease in the plant in a timely fashion, then the experts will suggest the medicines to the farmer. As per suggestions of agricultural experts, the farmer will give the treatment for the diseased plant promptly which will increase the crop yield. following machine learning methods are used by different researchers for plant disease detection and analysis:

1. Probabilistic neural network (PNN).
2. BPNNs used for perceiving shades of the grape leaves; MSOFM & GA use for grape plant leaf malady segmentation; Gabor wavelet-based image processing technique.
3. The Otsu Method was used to segment the leaf regions and HSI color system was used for segmentation of the diseased spot. Further, the Sobel operator was taken into a function to examine the edges of the disease spots.
4. K-means-based image processing technique and neural network.
5. SVM-based Multiple Classifier System.
6. Neural network classifier.
7. Naked eye prediction and fuzzy logic.
8. Artificial neural network and RGB.
9. Image segmentation and Gaussian filter.
10. Color histograms were extracted, and transformation was from RGB to HSV and RGB to L*a*b*.
11. BPNNs.
12. Image segmentation, RGB, and K-means clustering.
13. Neural network techniques.
14. Active contour model is used for image segmentation.
15. The combination of Artificial Neural Network (ANN), Euclidean distance technique, and K means clustering technique used. [3]

In this paper, respectively, the applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of diseases that affect plant leaves. Recognizing the disease is mainly the purpose of the proposed approach. Thus, the proposed algorithm was tested on five diseases that influence the plants; they are Early scorch, Cottony mold, ashen mold, late scorch, tiny whiteness. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of leaf diseases in a little computational effort. Basic steps for describing the algorithm are RGB image acquisition, Creating the color transformation structure, Convert the color values in RGB to the space specified in the color transformation structure, Applying K-means clustering, Masking green-pixels, Remove the masked cells inside the boundaries of the infected clusters, Convert the infected (cluster/clusters) from RGB to HSI Translations Matrix Generation for H and S, Call the GLCM function to calculate the features, Texture Statistics Computation, Configuring Neural Networks for Recognition.[4]

In this paper, convolutional neural network models were developed to perform plant disease detection and diagnosis using simple leaves images of healthy and diseased plants, through deep learning methodologies. Training of the models was performed with the use of an open database of 87,848 images, containing 25 different plants in a set of 58 distinct classes of [plant, disease] combinations, including healthy plants. Several model architectures were trained, with the best performance reaching a 99.53% success rate in identifying the corresponding [plant, disease] combination (or healthy plant). The significantly high success rate makes the model a very useful advisory or early warning tool, and an approach that could be further expanded to support an integrated plant disease identification system to operate in real cultivation conditions.[5]

From the analysis, grayscale images are easy to process and implement. They have better clarity and suit for analysis than RGB images. Histogram equalization is used to enhance the contrast of the images and provide a clear image to human eyes. So, these types of images will be used to analyze and diagnose the plant leaves diseases and determine the diseases level of the plant leaves. The mobile phone has become available at the grassroots level providing different social and economic benefits. This proposal aimed to develop a user-friendly automated system for the farmers that will help them in determining the detection diseases of leaves without bringing an expert to the field.[6]

The system consists of the following blocks:

Web Socket: Web Socket is a computer communications protocol, providing full-duplex communication channels over a single TCP connection. Send the Acquired Image by using a mobile camera to the web socket server. In this project, we used a Local Server.

Python: Python is an interpreted high-level programming language for general-purpose programming. In python, OpenCV is to be installed. 'Open-source computer vision library' initiated by some enthusiast coders in '1999' to incorporate Image Processing into a wide variety of coding languages. It has C++, C, and Python interfaces running on Windows, Linux, Android, and Mac. It is one of the libraries used for image processing in python. On python web framework by using leaf Identification algorithm, it detects and identifies the Leaf and diseases. By using a Database, it sends the result back to the sender farmer. [7]

In this study, DenseNet is used to detect and classify various leaf diseases in three plants i.e., tomato, potato, and bell pepper. The identification is done for the dataset obtained from plant village, real-time data captured through the mobile camera, and also live detection. The identification of leaf disease is performed in MATLAB. The proposed method is found to be better as compared to existing studies since the detection of diseases for real-time images is involved. Our results show that deep models particularly CNN's outperform the previously used models.[8]

The image processing technique is very much essential to observe the intensity of the disease. As the open eye observation may result from poor accuracy and it may vary from person to person. In this paper with the help of video image frame processing, the infected leaf has been scanned and analyzed. By counting the disease-affected area and unaffected area, the percentage of the disease-affected area has been calculated. According to the percentage of disease-affected areas, the severity of the disease can be understood; consequently, an appropriate measure can be taken to stop the spreading of the disease.[9]

The proposed work uses tomato leaf images for disease

classification as tomato is one of the most important vegetable plants in the world and hence early detection of tomato leaf disease is required. Diseases of the tomato plant include Bacterial leaf Spot, Yellow Curved, Late Blight, Tomato Mosaic, and Septoria Leaf Spot. The dataset is taken online from the plant village project. The idea of this paper is to take a dataset of the tomato leaf images with different leaf diseases and train it on the best model Convolutional Neural Network (CNN) and then use the obtained weights from the CNN for testing new tomato leaf images. The hybrid approach VGG16 with the attention model is taken to achieve the best weights possible for testing and validation in the proposed model. The model showed an accuracy of 95.90 percent with the hybrid approach. Performance analysis is done to identify the best model with good accuracy and also overcome the problem of overfitting.[10]

The comparative study of different approaches for doing leaf image detection We understand that deep convolutional neural networks give better results than the traditional approaches. Among the deep convolutional neural network VGG models have the greatest accuracy. VGG 19 is the latest VGG deep convolutional neural network Which has 19 layers, which gives more accurate results than the VGG 16. Proposed a new approach to leaf disease detection by using VGG19model. [11]

3. CONCLUSION

In this article, we did a comparative study of different approaches for leaf disease detection, from this work understood that a deep convolutional network performs very better than other methods. By using WebSocket Can be sent the result of an analyzed image to the user's mobile. By Using color-blob detection, we were able to identify the color code and the levels of infection of the leaves. Using the surface area covered, we computed to establish the percentage covered by the contours (spots of infected parts) which when compared to the whole surface area gives the level of infection.

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