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Plant Disease Detection Using Leaf Images

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Abstract: Identification of the plant diseases is that the key to prevent the losses within the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is incredibly critical for sustainable agriculture. It's very difficult to watch the plant diseases manually. It requires tremendous amount of labor, expertise within the plant diseases, and also require the excessive quantity. Hence, image processing is used for the detection of plant diseases by capturing the pictures of the leaves and comparing it with the data sets. The data sets comprise of different plant within the image format. Except detection users are directed to an e-commerce website where different pesticides with its rate and usage directions are displayed. This website is efficiently used for comparing the MRP's of varied pesticides and buy the desired one for the detected disease. This paper aims to support and help the green house farmers in an efficient way.

Keywords: disease detection, Tensor flow, Green house, Convolution neural network, Data model, image to byte

I. INTRODUCTION

India maybe a cultivated country and about 70% of the population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant. Disease on plant finishes up within the numerous reduction in both the quality and quantity of agricultural products. The studies of disease seek advice from the studies of visually observable patterns on the plants. Monitoring of health and disease on plant plays a very important role in successful cultivation of crops within the farm. In period of some time, the monitoring and analysis of plant diseases were done manually by the expertise person during this field. This needs tremendous amount of labor and also requires excessive quantity. The image processing techniques are visiting use within the disease detection. In most of the cases disease symptoms are seen on the leaves, stem and fruit. The plant leaf for the detection of disease is taken into consideration which shows the disease symptoms. This paper gives the introduction to image processing technique used for disease detection. Inconsistency and delay within the identification of diseases cause a reduction within the number and quality of yield. Losses because of diseases or other pest accounts for 20 to 40% of worldwide annual productivity [1]. Studies are applied to assess the estimated loss caused by different diseases [1]. Yield loss also contributes toward increased consumer prices and a visit the earnings for crop producers. Accurate and timely identification of plant diseases is crucial for ensuring maximum yield and is helpful for farmlands in remote areas. Advancements in machine vision have made it possible to perform the tasks of visual identification and these visual recognition methods are employed for successful identification of plant diseases [2]. Image-based disease management and surveys have a protracted history of over 90 years when aerial images were accustomed study crop disease [3]. Disease detection and identification have improved since then and informative and complicated analysis is being carried administrated[4].

II. LITERATURE REVIEW

Alternia leaf spot, Brown spot, Mosaic, Grey spot, and Rust are five common varieties of apple disease that severely affect apple yield. However, the current research lacks an accurate and fast detector of apple disease for ensuring the healthy development of the apple industry. Object detection algorithms like SSD, DSSD and R-SSD are often considered consisting of two parts: The primary part is that the pre-network model, which is employed as a basic features extractor. The other is an auxiliary structure that utilizes multi-scale feature map for a detection. [1]. Enhanced images have top of the range and clarity than the initial image. Color images have primary colors red, green and blue. It's difficult to implement the applications using RGB thanks to their range i.e. 0 to 255. Hence they convert the RGB images into the grey images. Then the histogram equalization which distributes the intensities of the pictures is applied on the image to strengthen the disease images. Monica Jhuria et al uses image processing for detection of disease and also the fruit grading in [3]. They have used artificial neural network for detection of disease. They have created two separate databases, one for the training of already stored disease images and other for the implementation of the query images. Back propagation is used for the load adjustment of coaching databases. They consider three feature vectors, namely, color, textures and morphology [3]. They have found that the morphological feature gives better result than the alternative two features.

III. METHODOLOGY

1) *Convolutional Neural Network Models:* Artificial neural networks are mathematical models that mimic the principles of brain function with their neurons and synapses that interconnect them. Their main characteristic is their ability to be trained through the tactic of supervised learning. During that process, neural networks are "trained" to model some system with the employment of existing data that contain specific matchings of inputs and outputs of the system to be modelled. CNNs (LeCun et al., 1998) are an evolution of traditional artificial neural networks, focused mainly on applications with repeating patterns in different areas of the modeling space, especially image recognition. Their main characteristic is that, with the methodology employed in their layering, they drastically reduce the desired number of structural elements (number of artificial neurons) in comparison to traditional feedforward neural networks. For image recognition applications, several baseline architectures of CNNs are developed, which are successfully applied to complicated tasks of visual imagery.
2) *Training:* During this step, training the deep convolutional neural network for creating an image classification model are done. CaffeNet architecture are used and adjusted to support our different categories (classes). Rectified Linear Units (ReLU) will subsequently be used as substitute for saturating nonlinearities. This activation adaptively will learn the parameters of rectifiers and improve accuracy at negligible extra computational cost.
3) *Testing:* In this phase, the test set for prediction of leaf as healthy/Unhealthy with its disease name are going to be wont to evaluate the performance of the classifier.

Hughes et al. [8] has released a comprehensive dataset of plant diseases, expertly curated for leaf image-based disease disease identification. The dataset is thought as PlantVillage and contains 54,309 images of diseased and healthy plant leaves and contain 38 class labels. These images cover 14 crop species: tomato, strawberry, squash, soybean, raspberry, potato, bell pepper, peach, orange, grape, corn, cherry and apple. These leaf images are stricken with fungal, bacterial and viral disease. The dataset also contains images of 12 healthy species: apple, bell- pepper, blueberry, cherry, corn, grape, peach, potato, raspberry, soybean, strawberry and tomato. The leaf images are of 256×256 pixels' dimension with RGB colors.

IV. MODELING AND ANALYSIS

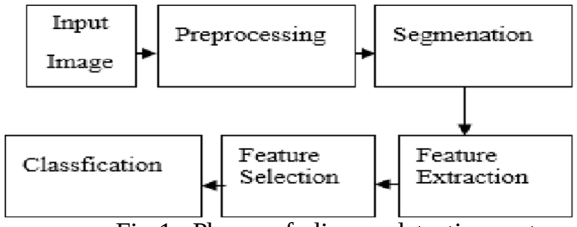

Fig.1 : Phases of disease detection system

The process of disease detection system basically involves four phases as shown in Fig 1. The primary phase involves acquisition of images either through photographic camera and itinerant or from web. The second phase segments the image into various numbers of clusters that different techniques are often applied. Next phase contains feature extraction methods and also the last phase is about the classification of diseases. The Leaf Localization. Aiming at the localization of disease-plant leaves, the paper manipulates the leaf dataset under complex background to coach the RPN algorithm and integrates boundary regression neural network and classification neural network to perform localization and retrieval. As for the classification neural network, the core task is to differentiate whether the image within the boundary box is an object or a background

1) *Image Pre-processing:* To get rid of noise in image or other object removal, different pre-processing techniques is taken into account. Image clipping i.e. cropping of the leaf image to induce the interested image region. Image smoothing is finished using the smoothing filter
2) *Image Segmentation:* Segmentation means partitioning of image into various part of same features or having some similarity. The segmentation will be done using various methods like otsu' method, k-means clustering, converting RGB image into HIS model etc.
3) *Classification:* The classification phase implies to see if the input image is healthy or diseased. If the image is found to be diseased, some existing works have further classified it into a variety of diseases.

4) *Feature Extraction:* Hence, during this step the features from this area of interest must be extracted. These features are needed to see the meaning of a sample image. Features will be supported colour, shape, and texture. Recently, most of the researchers are assuming to use texture features for detection of plant diseases. There are various methods of feature extraction that may use for developing the system like gray-level co-occurrence matrix (GLCM), color co-occurrence method, spatial grey- level dependence matrix, and histogram based feature extraction. The GLCM method could be a statistical procedure for texture classification.

V. RESULTS AND DISCUSSION

Existing studies have used feature-based or CNN-based classification to categorize the leaves of PlantVillage dataset into one of 38 categories. The proposed approach mainly relied on texture features extracted through statistics of GLCM applied on segmented diseased region of the leaf. As the segmentation stage of diseased leaf area is automated, when applied on healthy leaves it extracts some leaf area and confuses the classifier. The confusion matrix of the diseased or healthy plant classification stage is provided in Table 1

Table 1 Confusion Matrix of Healthy and Diseased Plant classes

	Healthy	Diseased
Healthy	99.7848	0.2152
Diseased	0.8280	99.1720

VI. CONCLUSION

This paper shows that the disease recognition model supported deep learning has the characteristics of unsupervised, high accuracy, good universality, and high training efficiency. However, there are many challenges in accuracy practicability of disease detection within the complex Thus an application built for the identification of disease affected plants and healthy plants is completed and this proposed work is focuses on the accuracy values during the 000 field conditions, and this work is implemented by having several disease images. The accurately detection and classification of the disease is extremely important for the successful cultivation of crop and this could be done using image processing. This paper discussed various techniques to segment the disease a part of the plant.

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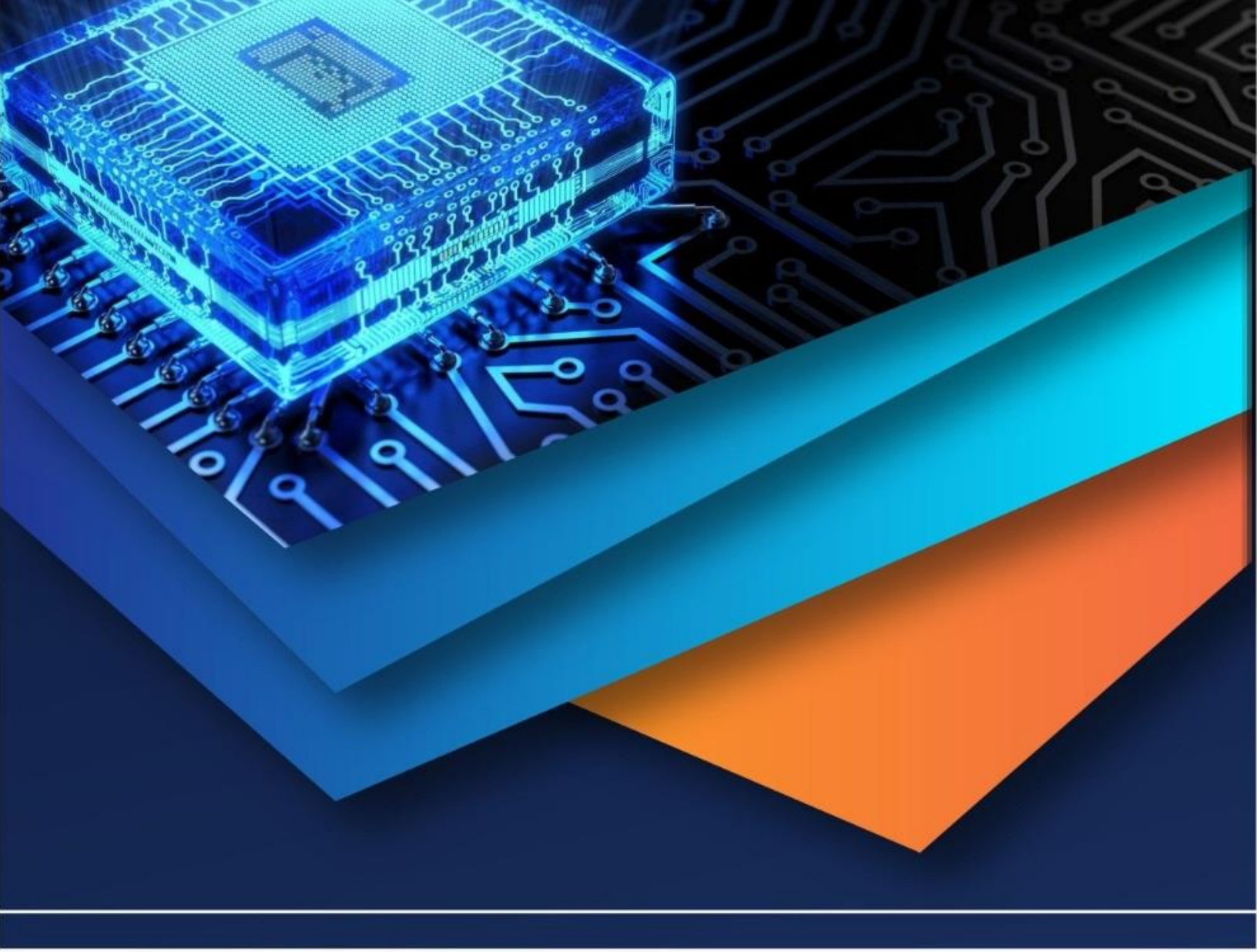

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