iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** IV **Month of publication:** April 2020

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IV Apr 2020- Available at www.ijraset.com

A Survey on Plant Disease Detection System

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Abstract: ***Plant diseases are a major threat to plant growth and crop yield and many researchers have expended substantial efforts on detecting plant diseases. Traditionally, visual examination by experts has been carried out to diagnose plant diseases and biological examination is the second option, if necessary. In recent years, through the development of computer technology, machine learning has been widely utilized to train and detect plant diseases and is a satisfactory alternative for the detection of plant diseases. It is easier to realize higher accuracy by using a deep learning approach that is based on convolution neural networks. In this proposed system a deep learning approach that is based on improved convolution neural networks (CNN) for the real-time detection of apple leaf diseases. The proposed deep-learning based approach can automatically identify the discriminative features of the diseased apple images and detect the types of apple leaf diseases with high accuracy.***
Keywords: Image Acquisition, Feature Extraction, Classification.

I. INTRODUCTION

The early detection of leaf disease in plants is very important to prevent serious outbreak. Early detection of plant disease has become a huge research topic. Fungi, bacteria and viruses are the major disease causing factors in plants. Once a plant is affected with a disease, it could spread to all the plants in the farm. To avoid such problems, it is important to detect the disease earlier. The process of detection of diseases in plants involves three major steps, which are image acquisition, feature extraction and classification. First, the images of a part of plant which is affected should be obtained, which can be obtained using digital camera, then the annotated dataset should be created, this dataset should include test dataset and training dataset, whenever a image is added to the dataset, it should be trained before tested. the feature extraction will be done using convolution neural network(CNN),then finally the classification is done to give the disease which has affected the plant and a remedy to overcome that issue.

II. PLANT DISEASE DETECTION RELATED METHODS

A. Image Processing

Preprocessing is the prior step which is considered to be one of the important steps in the world of image processing. It mainly deals with picture enhancement like- adjusting the brightness of pixels, applying rotation, scaling another transformation. In this paper, the concept of image processing has been explained in a generalized manner by discussing different approaches that have been used until now.

B. Image Segmentation

To understand the division and to construct different sized pixels in such a way that these segments could be used further for image analysis. Segmentation is the most important part of image processing. Fence off a whole image into several parts which are some things more meaningful and easier for further process. These several parts that are rejoined will cover the entire image. Segmentation can also depend upon various features that are contained within the image. It may be either color or texture. The main motto of segmentation is to scale back the knowledge for straightforward analysis. Segmentation is additionally useful in Image Analysis and Compression.

C. Feature Extraction

Extraction of most related data from original input data, that can be further used in different techniques as input like in the pattern recognition field. This form of extraction and representation of the features of an image are commonly called feature extraction.
Feature extraction is a type of dimensionality reduction that efficiently represents interesting parts of a picture as a compact feature vector. This approach is beneficial when image sizes are large and reduced feature representation is required to quickly complete tasks like image matching and retrieval. Feature detection, feature extraction, and matching are often combined to unravel common computer vision problems like object detection and recognition, content-based image retrieval, face detection and recognition, and texture classification. In this part Wetness and Dryness are also detected.

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D. Classification

Classification of the image is the step, that categorizes detected objects into predefined classes by using a suitable method that compares the image patterns with the target patterns. All classification algorithms are supported on the idea that the image in question depicts one or more features which each of those features belongs to at least one of several distinct and exclusive classes.

ANN Classification is the process of learning to separate samples into different classes by finding common features between samples of known classes. Artificial neural networks are relatively crude electronic networks of neurons supporting the neural structure of the brain. The process records one at a time, and learns by comparing their classification of the record (i.e., largely arbitrary) with the known actual classification of the record . Neural networks are typically organized in layers. Layers are made from a variety of interconnected 'nodes' which contain an 'activation function'. Patterns are presented to the network via the 'input layer', which communicates to at least one or more 'hidden layers' where the particular processing is completed via a system of weighted 'connections'. Then the hidden layers link to a layer called 'output layer'.

III. RELATED WORKS

In recent years, many professionals worked towards improving the disease detection system.

1) The crop loss due to diseases is approximately assessed to be ranging. Between 10 to 30% of crop production.

2) If we consider an mean crop loss of 20% and therefore the present gross value of our agriculture produces an amount of seven lakh crore, albeit we reduce the damage by 50% using plant protection, the loss may be a colossal 70,000 crore.

A. Image Processing

Arya M S et al.,[2] proposed a Disease Detection System with a thought of detecting plant diseases using image processing. The image processing toolbox of Matlab is employed for measuring the affected area of disease and to work out the differences within the color of the disease affected area.

This idea can be extended to detect the symptoms of any sort of disease that's affected by different horticulture crops. The algorithm can be used to classify the leaves and therefore the classified outcomes are separated using an Arduino based conveyor belt system. This reduces a crucial task of monitoring farm crops at a really early stage itself to detect the symptom of diseases appearing on plant leaves.

Similarly Norfarahin Mohd Yusoff et al.,[3] Proposed a system of Real-time image processing which is related to a typical frame rate that needs processing all the frames as soon as the image is captured. Fast processing time is required for edge detection since it is needed to be administered in real-time. This paper proposes a real-time edge detection technique for identifying Hevea leaves diseases (rubber tree leaves) in images and its hardware implementation. This technique involves Real-time image processing

Santhosh Kumar.S et al.,[7] also proposed a Disease Detection System which involves various Image Processing techniques for efficient, reliable, and fast detection of all types of diseases automatically

Ramesh.K et al.,[4] involves the image processing technique where captured multi Angle images of both oblique aerial and portrait direction were cropped to possess an equivalent dimension and suits having uniform data size. The images are captured at the daylight brightness with none gloom or lighting noise. All the aerial and portrait images are converted into grayscale using the command. Images were then subjected for singular value calculations using Modified Singular Value Decomposition (MSVD) technique for further processing

B. Image Segmentation

Abirami Devaraj et al.,[8] used image segmentation techniques where conversion of the digital pictures into many segments and rendering of an image into something for easier analysis. using image segmentation is employed for locating the objects and bounding lines of that image. In segmentation, we tend to use the K-means cluster technique for the partitioning of images into clusters during which a minimum of 1 part of the cluster contains a picture with a serious space of the unhealthy part. The k-means cluster algorithm is applied to classify the objects into K sort of categories per set of features.

Amogh Jayaraj Rau et al.,[5] proposed a identical way for image segmentation where The input image is segmented into three clusters, and therefore the cluster containing the Region Of Interest (ROI) is chosen. The above-mentioned properties of this chosen image are calculated. The disease is detected on the idea of the value of the parameters which match with those within the database, and feedback is going to be given to the user to take the required measures to cleanse the plant.

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C. Feature Extraction

Peng Jiang et al.,[1] proposed a system to detect apple leaf diseases where the Extraction of features of diseased part of a apple leaf can be done using deep Convolutional Neural Network(CNN).The proposed approach can automatically identify the discriminative features of the diseased apple leaf with high accuracy. The proposed model exhibits strong detection performance and robustness. The proposed model is additionally capable of Real-Time detection of Apple leaf diseases.

Tanya Makkar et al.,[6] use Feature Extraction during which the Extraction of most related data from original input data, which will be further utilized in different techniques as input like within the pattern recognition field. This type of extraction and representation of the features of a picture are commonly called feature extraction. This presents a special set of features which are displayed which came out as a result of selecting any desired segment.

D. Classification

Trimi Neha Tete et al.,[9]. Involves the ANN classification algorithm. ANN Classification is the process of learning to separate samples into different classes by finding common features between samples of networks that are typically organized in layers Artificial neural networks are relatively crude electronic networks of neurons based on the neural structure of the brain. The process records one at a time, and learns by comparing their classification of the record (i.e., largely arbitrary) with the known actual classification of the record. Neural Layers are made up of a number of Patterns are presented to the network via the 'input layer', which communicates to at least one or more 'hidden layers' where the particular processing is completed via a system of weighted 'connections'. The hidden layers then link to an 'output layer'.

Table: Recent Research Works In Plant Disease Detection

Title	Author	Contribution	Disadvantages
[1] Real-Time Detection of Apple leaf diseases using deep learning approach based on Improved Convolutional Neural Networks	Peng Jiang et al.,[1]	The proposed system can automatically identify the discriminative features of the diseased apple leaf with high accuracy.The proposed model also exhibits strong detection performance and robustness.	The initialization of the network weights are important,since bad initialization can stall learning due to the instability of gradient in deep nets.
[2]Detection of unhealthy plant leaves using Image Processing and Genetic Algorithm with Arduino	Arya M S et al.,[2]	Detects diseases using very less computational efforts and also obtains optimal results. This also helps in identifying the plant diseases at an early stage.	The recognition rate of plant diseases is low and needs other algorithms like ANN, Fuzzy Logic for better recognition rate.
[3]Real-time Hevea Leaves Diseases Identification using Sobel Edge Algorithm on FPGA: A Preliminary Study	Norfarahin Mohd Yusoff et al.,[3]	They use FPGA as the detection algorithm. The generation time between FPGA and MATLAB shows that FPGA is quicker and more efficient, enabling to detect the diseases in faster time	The Sobel edge detection algorithm on Hevea leaves using FPGA needs improvement in terms of accuracy
[4]Weed growth and intrusion detection by multi-angle images of vegetable plants using modified SVD	Ramesh.K et al.,[4]	The differences within the portrait images in the place all images also are calculated and of and identified that the aerial images are better in identifying the plants and therefore the portrait images are better in identifying the intrusions.	Using Modified SVD The intrusion detection is completed but one among the limitations is it involves more computations for detection

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[5]IoT Based Smart Irrigation System and Nutrient Detection with Disease Analysis	Amogh Jayaraj Rau et al.,[5]	With the nutrient deficiency detection and disease analysis, which can be automated, will enable the farmers to increase their output, without much effort	The project can be made more efficient by calculating the fertilizer amount from the nitrogen deficiency that's calculated.
[6]A Computer Vision-Based Comparative Analysis of Dual Nutrients (Boron, Calcium) Deficiency Detection System for Apple Fruit	Tanya Makkar et al.,[6]	The proposed method uses GUI implementation which mainly focuses on the classification of boron and calcium deficient images. The approach came out to be an easy, neat and versatile system predicting results accurately.	It involves various implementation techniques for detection and isn't the fastest among the available systems.
[7]Diseases Detection of Various Plant Leaf Using Image Processing Techniques: A Review	Santhosh Kumar.S et al.,[7]	It helps in preventing the plants from different types of diseases in altogether seasons using automation by applying image processing practices.	The paper depicts the importance of image processing within the agriculture field and considering the sort of disease for further research work
[8] Identification of Plant Disease using Image Processing Technique	Abirami Devaraj et al.,[8]	Detects disease in less time and involves automatic detection technology	Even though the disease is detected in less time, there are limitations in terms of accuracy
[9]Detection of Plant Disease Using Threshold, K- Mean Cluster and ANN Algorithm	Trimi Neha Tete et al.,[9]	This involves a classification technique to classify the plants, enabling easy identification of plant diseases.	Algorithm of k means clustering requires a priori specification about number of cluster centers

IV. CONCLUSION

The occurrence of diseases in plants leads to an increase in the number of disease detection systems and applications. This research shows the various factors which have been used in various techniques so far for the sake of detection of the diseases. Also, a brief explanation of the devices and components used in these techniques is also provided.

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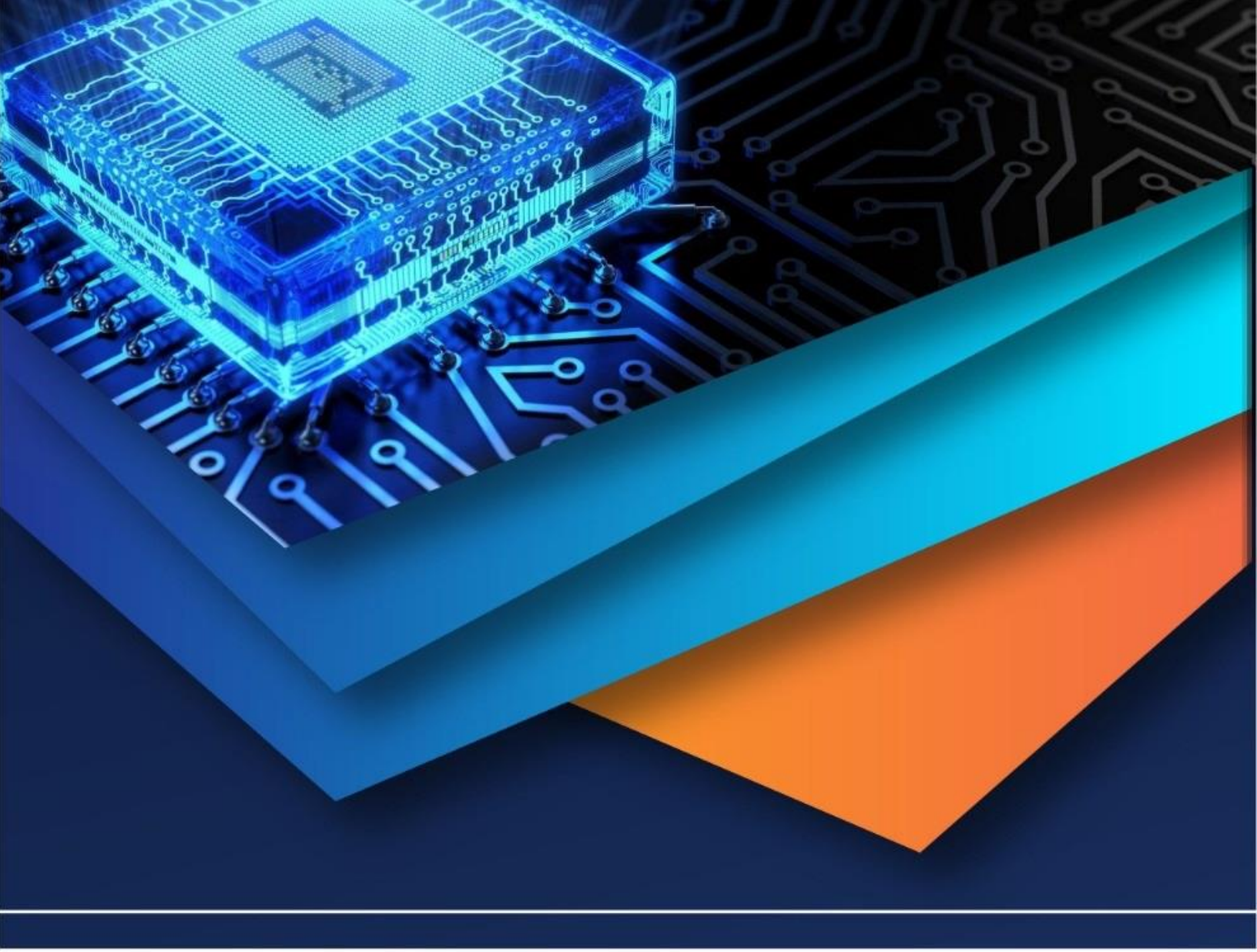

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