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CLASSIFICATION OF AGRICULTURAL DISEASES USING IMAGE PROCESSING TECHNIQUE- A REVIEW

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Abstract- This study serves as an introduction to recent studies on plant leaf disease detection and as an overview of several methods for classifying diseases of plant leaves. Because plant disease signs cannot be seen by the naked eye. Food is a basic human necessity, and as the world's population is expanding at an alarming rate, it is crucial to grow enough crops to feed such a large population. Since it is difficult to continuously monitor a field, certain automatic methods must be utilised. One such method is image processing, which has a large algorithm and can be used to detect plant illnesses. Various kinds of image processing methods that use the colour information in leaves to identify damaged leaves are suggested. k-Nearest Neighbour Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, Principal Component Analysis, Artificial Neural Network, Fuzzy Logic, etc. are some alternative classification algorithms. Choosing a classification method has always been challenging because the quality of the results can fluctuate depending on the input data.
Keywords: Genetic algorithm, histogram equalizer, support vector machine, k- nearest neighbour, Artificial neural network.

1 INTRODUCTION

Plants diseases have turned into dilemma as it can cause significant reduction both in quantity and quality of agricultural products. Plants get distorted for a variety of reasons sometimes due to some nutrient deficiency, toxicities and sometimes because of environment changes etc. that can cause plants to become distorted. However, the cultivation of these crop for optimum yield and quality production is highly technical. Hence by the using digital image processing histogram equalization method we have observed change in an image of leave or stem as most of the diseases are observed in these parts of the plants Digital Image Processing includes changing the nature of an image in order to improve its pictorial information for human interpretation and is a software used to manipulate the images with the help of computer system. Digital image processing can also be applied and is useful in many fields for example in Image sharpening and restoration, in medical field, in transmission and encoding, agriculture etc. digital image processing has vast applications in agricultural field also as agriculture is the primary source of livelihood for about 58% of India’s population.

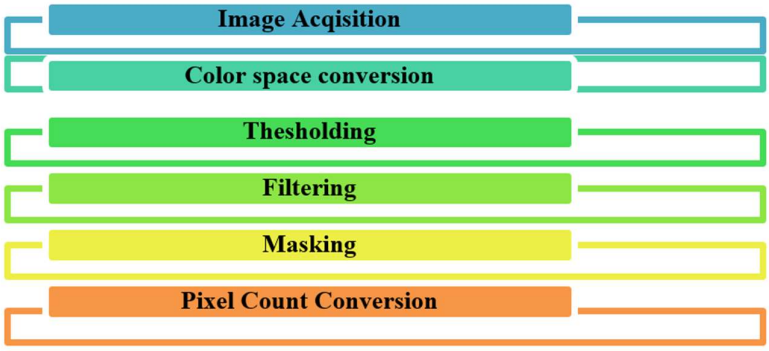


Fig-1 Steps for image processing

2 LITERATURE REVIEW

This section will provide various techniques and approaches implemented for the detection of various diseases in plant leaf using digital image processing-

Guan Wang, Yu Sun, and Jianxin Wang [1] In this proposed methodology plant disease severity can be estimated by the help of deep learning method which include deep convolution of neural network. For the classification of disease severity few training data samples were taken and then comparison has been made between the two architectures, namely, building a shallow network and transmission knowledge by fine-tuning the top layers of a pretrained deep network. Transfer learning is a useful approach to build powerful classification network using few data sets, by fine-tuning the parameters of a network pretrained on a large dataset. The training and testing accuracies of shallow networks trained from scratch in which both the training and the test accuracies improve slightly with the depth of the model at first and the best performance, a test accuracy of 79.3%, was achieved by the network with 8 convolutional layers.

Ashwin Dhakal, Prof. Dr. Subarna Shakya [2] In this proposed work is based on deep learning with includes convolution of neural network for the detection of plant disease. Leaves of Infected crops were collected and labelled according to the disease. Processing of image is performed along pixel-wise operations to enhance the image information which is followed with feature extraction, segmentation and the classification of patterns of captured leaves in order to identify plant leaf diseases. Four classifier tags are used as Bacterial Spot, Yellow Leaf Curl Virus, Late Blight and Vigorous Leaf. The structures take out were fit into the neural network with 20 epochs. Numerous artificial neural network manners were executed with the best performance of 98.59% accurateness. This method was a great success in demonstrating the feasibility in the field of Plant Disease Diagnosis and high crop yielding.

Trimi Neha, Mesra Ranchi, Jharkhand [3] In this paper an image-based approach is used for identification of the disease of potato leaf with the help of k – clustering algorithm and artificial neural network in which different segmentation technique has been used for identification of plant leaf disease. Clustering and sorting of plant leaf diseases had been framed by the applications of image thresholding, clustering and Neural Networks . The diverse procedure was tried on diverse diseases influence on the plants. The image segmentation based on ANN

algorithms with the experimental results which significantly support an accurate result in less computing time is neural network which give best accurate result compared to others.

Emma Harte [4] This paper demonstrates the technical feasibility of convolution of neural network in classifying plant diseases and presents a path towards artificial intelligence solutions. The performance of a pre-trained ResNet34 model is used in detecting crop disease. This developed model is deployed as a web application and capable of recognizing 7 plant diseases out of healthy leaf tissue. A dataset containing a leaf image were captured in a controlled environment, is established for training and validating the model. Authentication outcomes display that the proposed technique can accomplish an accurateness of 97.2%.

Ke Lin, Liang Gong, Yixiang Huang, Chengliang Liu and Junsong Pan [5] In this proposed methodology a deep learning-based segmentation and convoluted neural network of cucumber powdery mildrew has been considered In this paper a new deep learning scheme is proposed which represents powdery mildew infection by masked regions generated from the segmentation model to exact severity of the disease. Compared to the hyperspectral image-based method, this proposed method is easier to implement and does not require expensive special imaging equipment. Further, compared to methods based on visible image classification, this method is able to obtain the location of the disease regions the proposed method can also provide the area and shape of the disease regions so further it can be used to indicate the severity of the disease, and can also help with the morphological analysis of the disease regions.

M. Akila Deepan [6] Plants are susceptible to several disorders and attacks caused by diseases and environmental conditions such as temperature, humidity, nutritional excess nutritional losses, light and the most mutual diseases that comprise of bacterial, virus, and fungal diseases.

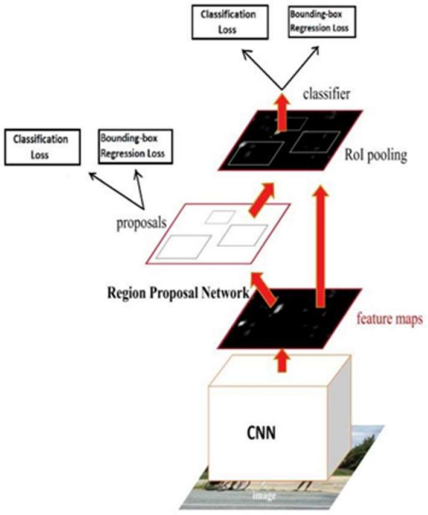


Fig-2 Basic architecture of Faster R-CNN

Above is the basic architecture used by the authors of the paper . In this diseases along with the plants shows a different physical characteristic on the leaves which may include changes in shapes, colours etc. This proposed methodology not only deals with the identification of disease but also the infection status of the disease in leaves and tries to give solution. In this paper, proposed work is based on recent detectors such as Faster Region-Based Convolutional

Neural Network (Faster R-CNN), Region-based Fully Convolutional Networks (R-FCN) and Single Shot Multibox Detector (SSD) to identify and classification of plant leaf diseases that affect in various plants. The exciting part of this method is not only pact with disease detection, and also known the infection grade of the disease in leaves and tries to give explanation. The experimental results were compared between various deep-architectures with feature extractors and demonstrates how deep-learning-based detector is able to successfully recognize different categories of diseases in various plants and also give solution for concern diseases.

S. Arivazhagan, R. Newlin Shebiah , S. Ananthi, S. Vishnu Varthini [7] In this paper, detection and classification of leaf diseases has been proposed by the method which is based on masking and removing of green pixels and applying a specific threshold to extract the infected region and computing the texture such as Contrast, Energy, Local homogeneity, Cluster shade and cluster prominence are computed for the H image statistics to evaluate the diseases. For this method sample of the acquired leaf images are taken and converted into HSI format. The co-occurrence features like contrast, energy, local homogeneity, shade and prominence are derived from the co- occurrence matrix. By these established of co-occurrence features the plant diseases are detected.

P.Revathi and M.Hemalatha,[8] This paper proposed the methodology of classifying the disease on cotton leaf using Edge detection image processing technique .Production of agricultural products is difficult task as the plant comes to an occurrence from numerous micro-organisms, pests and bacterial diseases. The proposed paper discusses the image processing techniques used in performing early detection of plant diseases. The objective of the proposed work is to implement image analysis and classification techniques for extraction and classification of leaf diseases. The sample of Leaf image is captured and processed to determine the status of each plant. Proposed framework is divided into four parts which includes image pre-processing image enhancement, image segmentation using K-mean clustering for statistical usage to determine the defect and severity areas of plant leaves, feature extraction and classification. texture feature extraction using statistical GLCM (grey level co- occurrence matrix) and colour feature by means of mean values. After finding the mean values endmost classification can be achieved by using SVM (Support vector mechanism). This proposed technique will ensure that chemicals only applied when plant leaves are identified to be affected with the disease.

Shoyeb Ahammad Rafi, Md. Washimul Bari, Toukir Hasan Chowdhury, Md. Jahidul Islam, Dewan Md. Anisur Rahaman[9] This research methodology is an autonomous robotic technology used to assist the farmer by detecting the leaf disease here the sample of the guava leaf has been taken. The initial goal was to implement a prototype and test its feasibility to find out the diseases. This prototype is designed with two features. One is motion and the second one is study with image processing along with real-time data processing. In motion part, the robot is taking the decision whether to take left turn, right turn or stop, based on three specific range of colours (on the field). In the second part the robot analyses that the leaf is normal or is affected by the disease. The temperature and humidity monitoring of the environment is an additional feature of this prototype. This prototype has been technologically advanced with the intent to support the farmer for redeemable their time and for the improvement of straight agricultural decisions.

Dr. Pankaj Mohindru1, Gagandeep Kaur2 , Dr. Pooja3 [10] This paper explore the leaf disease prediction by using KNN (k-nearest neighbour) algorithm. A colour-based segmentation model is well-defined to segment the diseased area and placing it to its appropriate classes. Sample shave been taken and experimental analyses were done on the sample images in terms of time complexity and the area of infected region. Plant diseases can be detected by image processing technique like image acquisition, image pre-processing, image segmentation, feature extraction and classification. This paper gives a method which is used to distinguish the plant diseases and delivers an explanation to recover from the disease. It results in the inflated part of the leaf in percentage.

Mukesh Kumar Tripathi D. Y. Patil Dr. Dhananjay D. Maktedar [11] This paper compares the number of systems on the basis various criteria which includes the product and its disease. The main aim of the proposed work is to detect the diseases on all types of vegetables and increase yield of crops. Samples has been taken which consist of input image of vegetables the input images are resized for faster computation. After that number of processes have been deployed which includes abstract image processing to improve the quality of image, image segmentation to extract the meaningful object by excluding the pointless background features are taking out to find out the meaning of testing sample and finally classification of given testing input query according to the disease. The dataset for evaluating this system is containing all kind of vegetable images which can be captured from camera.

Dr. Sridhanthan C, Dr. M. Senthil Kumar[12] In this proposed methodology plants disease infections are detected based on K-means clustering and GLCM (grey level co-occurrence matrix) techniques. It contains Image Acquisition in which images of leaves were captured. Then Image Pre-processing was done which improves the quality of the image by removing undesired distortions. Image Segmentation is performed image is divided into sub images in this paper K-mean segmentation technique which uses hue estimation method for dividing and clustering the image. After that Feature Extraction part of an image is performed by (GLCM)Gray level co- occurrence matrix is one of the best methods for texture analysis.

Piyush Chaudhary, Anand K. Chaudhari, Dr. A. N. Cheeran and Sharda Godara [13] In this research an algorithm is used to detect disease spot in plant leak segmentation using image processing techniques. Automatic recognition and sorting of plant diseases is the first and significant phase. Disease spots are in different colour but not in intensity, in comparison with plant leaf colour. So, colour transform of RGB image can be used for better segmentation of disease spots. In this paper an assessment of the consequence of CIELAB, HSI and YCbCr colour space in the procedure of disease spot recognition is done. Median filters are used for image smoothing and threshold can be calculated by applying Otsu which is automatic image threshold method on colour component use to detect the disease spot.

J. G. A. Barbedo[14] A methodology presented in this paper is to distinguish and compute leaf symptoms by means of conventional colour digital images. The method was intended to be fully automatic which eliminates the possibility of human error and falling time taken to measure disease severity. The program is accomplished of dealing with images containing multiple leaves by further reducing the time taken. Accurate results are possible when the indications and leaf veins have alike colour and shade characteristics. The algorithm is subjected to one constraint that is the background must be as close to white or black as possible.

Tests exhibited that the method providing accurate estimations over a wide variety of conditions.

H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamnehWe [15] the suggested methodology is based on a software solution for automatic detection and classification of plant leaf diseases. The developed processing method consists of four main stages which includes as in the first step we recognize the mostly green coloured pixels. These pixels are disguised based on specific threshold values that are totaled using Otsu's method, then those typically green pixels are masked. The other add-on step is that the pixels with zeros red, green and blue values and the pixels on the borders of the disease-ridden cluster were completely removed. The tentative results validate that the proposed technique is a vigorous technique for the recognition of plant leaves diseases. The developed algorithm's usefulness can effectively distinguish and categorize the detected diseases with a correctness.

V. Vivekanandhan, M. Shah Fahad, G. Surya, V. Umashankar[16] In this work, numerous methods for identifying and classifying bacterial, fungal, and viral plant leaf diseases are reviewed and summarized. With the aid of classification tools, plant leaf diseases can be automatically identified and grouped according to their morphological characteristics. The primary goal of this paper's ongoing research is to employ CNN as a classifier to detect leaf diseases in mulberry plants. It also aims to use hybrid algorithms to increase the detection rate and classification accuracy of the severity of leaf diseases.

R. Cristin, B. Santhosh Kumar, C. Priya, K. Karthick "Deep neural network based Rider-Cuckoo Search Algorithm for plant disease detection"[17] In this study, a useful image processing technique is developed for identifying plant illnesses. The input image is first subjected to the pre-processing stage in order to remove any noise and artefacts. The segmentation step is applied to the image after it has undergone pre-processing in order to produce the segments. PiFCM is used to segment the data. The texture features are extracted from each segment utilising information gain, HOG, and entropy during the feature extraction step. The classification step of the process, which employs the DBN for effective plant disease identification, is applied to the collected texture features. Here, the DBN is trained using the planned Rider-CSA. The ROA and CSA are integrated in the design of the suggested Rider-CSA. The classification process is carried out using the proposed Rider-CSA-based DBN to find plant diseases. The classification process is carried out using the proposed Rider-CSA-based DBN to find plant diseases. The Plant Village database is used to apply the suggested strategy, depending on the metrics.

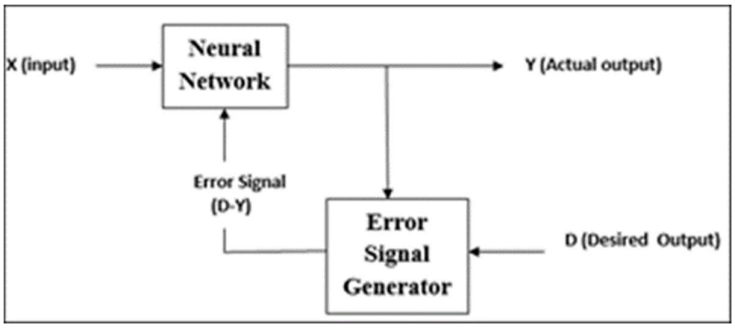


Fig-3 Neural Network steps

Smita Naikwadi, Niket Amoda [18] This study proposed a methodology and found that it is a reliable and effective method for identifying plant diseases automatically. In this study, histogram matching is used to identify plant diseases. The colour feature and the edge detection method form the foundation of histogram matching. The use of colour feature extraction is done on samples that have both healthy and sick plant leaves. The layer separation approach, which divides layers of RGB images into red, green, and blue layers, and the edge detection technique, which detects edges of layered images, are both used in the training process to train these samples. Once the histograms are formed for both samples and the testing image, immediately we implemented the comparison technique based on the histogram. In order to determine whether the testing sample is diseased or not, a comparison is first made between the testing sample and a healthy sample. If the testing sample is diseased, a comparison is next made between the testing sample and the diseased sample. The complete procedure is displayed using the GUI (graphical user interface). The waiting bar appears on our display when the comparison is applied, and the GUI displays the findings.

H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh [19] The overall concept that serves as the framework for any vision-related image classification algorithm is nearly identical. The digital images are first captured from the environment using a digital camera. The acquired images are then subjected to image-processing techniques in order to extract useful features required for further analysis. The images are then classified using a variety of analytical discriminating techniques based on the specific problem at hand.

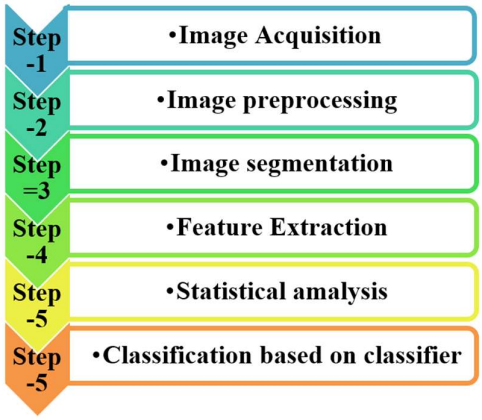


Fig-4

Bashish, D., Braik, M.Bani- Ahmad.S. [20] In this proposed framework is image- processing-based and consists of the following main steps: the images at hand are segmented using the K-Means technique in the first step, and the segmented images are passed through a pre-trained neural network in the second step. A set of leaf images from Jordan's AlGhor area were used as a testbed. The experimental results show that the proposed method can greatly aid in the accurate and automatic detection of leaf diseases. The developed Neural Network classifier, which is based on statistical classification, performed well and successfully detected and classified the tested diseases with an accuracy of around 93%.

Priyanka Paygude, Rahul Garg, Pranjal Pathak, Abhinav Trivedi, Aman Raj [21] The paper essentially describes the anomaly while also demonstrating the mathematical methods and

algorithm required for their recognition. With the development of a new and advanced algorithm for identifying handwritten characters, a more diverse data set of handwritten digits is now available. The issue, however, is the behavior of those handwritten data sets. In this methodology more sophisticated handwritten digit representation model based on multiple instance learning (MIL), where a bag contains different digit data from different feature spaces, to address the drawback that handwritten digit data sets of different features cannot compute. This paper presents various approaches to off-line pattern recognition using various machine learning techniques. Several machine learning algorithms are used, including Multilayer Perception, Support Vector Machines, Convolutional Neural Networks, and others. The main goal or purpose is to identify the most effective and efficient pattern recognition method. The paper demonstrates that different classification algorithms have varying degrees of accuracy. The process of identifying symbols and different numbers is generally based on machine learning methods. A segment binary image passes a "rough" classification by the Bayesian Network for the initialization of the symbols. Neural Networks are also used for classification using contents.

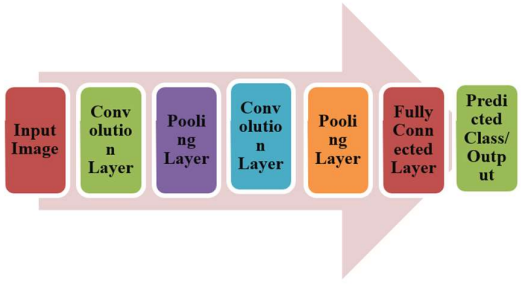


Fig -5 Architecture of CNN

Muhammad Anwarul Azim, Mohammad Khairul Islam, Md. Marufur Rahman, Farah Jahan [22] The approach put out in this work entails removing the background, segmenting the impacted spots, extracting the features, and classifying the results. This method's suggested photos are utilized as input. The photographs in the dataset that was utilized were taken with a white backdrop and are often saturated. Thus, convert an RGB image to HSV, then crop out the backdrop. This makes sure that the feature extraction procedure is unaffected by shadows and other outliers. The next step is to remove the leaf parts that have disease signs. On the hue plane of the HSV pictures, a threshold mask is used to achieve this. Extract different elements from the color, shape, and texture of the affected spots to create a disease signature.

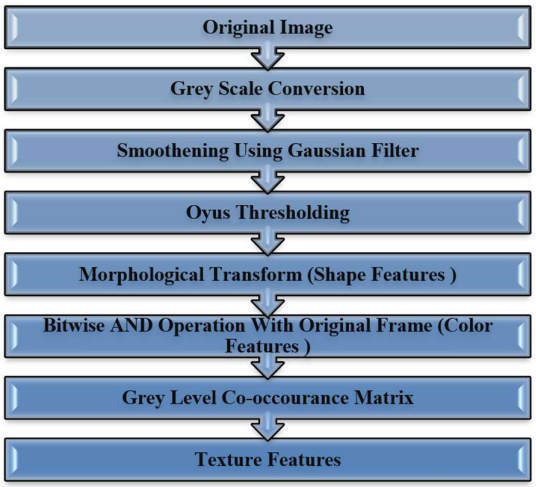
The RGB colour space is used by the photos in the collection. Moreover, all of the picture backgrounds are white.

Images are first transformed from RGB to HSV color space for background removal. A leaf's saturation and a background's saturation are absolutely unrelated. On the pictures' saturation plane, binary thresholding is done. Set the background separation threshold to 71. The threshold picture is then combined with the original image to get the background-free image. A damaged leaf develops colors that are entirely different from the unaffected green section, such as brown, grey, dark grey, or reddish brown. In comparison to K-Means, hue-based segmentation is proven to be more successful and time-efficient in our research. The hue plane of the pictures are subjected to binary thresholding with a threshold value of 22, which is determined to be appropriate by histogram analysis.

S. Phadikar, J. Sil, and A. K. Das [23] In this research paper proposed methodology includes the images which are collected from different parts of East Midnapur, a major rice producing district of South Bengal, India and the features for classification of the rice leaf diseases has been extracted through execution of the following steps: -

a) Gather photos of rice leaves from sick, infected plants in the field.
b) Do image preprocessing to get rid of noise from the leaf picture's affected area.
c) Complete steps (d), (e), and (f) for a sick leaf
d) By segmenting the picture, remove the diseased area.
e) Create the segmented areas feature vectors, which are radial hue distribution vectors.

[24] In this research approach, a public data set for plant leaf disease detection caltted plant village was employed, and this data set contains approximately 80 thousand RGB images of healthy and unwell plant leaves, 25 of which were used in the experiment. Following that, data pretreatment and feature extraction were carried out in that Data preprocessing is a crucial operation in any computer vision-based system. To obtain precise results, some background noise should be removed prior to feature extraction. Therefore, first, the RGB image is transformed to greyscale, and then the image is smoothed using a Gaussian filter. The image is then binaries using Otsu's thresholding method. The image is first converted to HSV colour space, and the ratio of pixels with hue (H) channel pixel intensities between 30 and 70 and the total number of pixels in one channel is then calculated to determine the quantity of green color in the image. Calculating the non-green portion of an image requires subtracting the green color portion from one. For classification or detection tasks, the random forest classifier has been utilized. Often, decision trees are employed to gain improved accuracy. Yet, they are vulnerable to over fitting issues. Therefore, a random forest classifier—a combination of various decision trees—is used to address this problem. Hence, a random forest classifier—a collection of many decision trees—is employed to address this problem. Each tree is trained using various subsets of the entire dataset, which might lessen overfitting and increase the classifier's accuracy. The dataset has been divided into a train set (80%) for model fitting and a test set (20%) for model validation. The K-fold cross validation method is used to calculate the accuracy score. With no bias, this approach can determine accuracy throughout the entire dataset. Following data fitting, the f1 score, precision, recall, and accuracy were calculated.



Below table -1 provides all the proposed methodology used in detection and recognition techniques used for the detection of plant diseases

S.No	Author	Proposed Work	Year
1.	Guan Wang, Yu Sun and Jianxin Wang	Automatic Image Based- Plant Disease Severity EstimationUsing Deep Learning	2017
2.	Ashwin Dhakal, Prof. Dr. Subarna Shakya	"Image-Based Plant Disease Detection with Deep Learning"	2018
3.	Trimi Neha Tete, Sushma Kamlu	"Plant Disease Detection Using Different Algorithms"	2017
4.	Emma Harte	Plant Disease Detection Using CNN	2020
5.	Ke Lin, Liang Gong, YixiangHuang, Chengliang Liu and Junsong Pan,	"Deep Learning-Based Segmentation and Quantification ofCucumber Powdery Mildew Using Convolutional Neural Network"	2019
6.	M. Akila, P. Deepan ,	"Detection And Classification of Plant Leaf Diseases by Using Deep Learning Algorithm"	2018
7.	S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini	"Detection Of Unhealthy Region of Plant Leaves and Classification of Plant Leaf Diseases Using Texture Features"	2013
8.	P. Revathi; M. Hemalatha,	"Classification Of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques"	2012
9.	Shoyeb Ahammad Rafi,Toukir Hasan Chowdhury,Dewan Md. Anisur Rahaman,Md. Washimul Bari, Meer Shadman Shafkat Tanjim	" Crop Condition Analyzer Robot With Image Processing Feedback To Assist Farmer"	2021
10.	10. Dr. Pankaj Mohindru, Gagandeep Kaur , Dr. Pooja	"Stimulated Investigation for Plant Disease Using KNN Algorithm"	2019
11.	Mukesh Kumar Tripathi, Dhananjay D. Maktedar	"Recent Machine Learning Based Approaches for Disease Detection And Classification Of Agricultural Products"	2016
12.	V Suresh , Mohana Krishnan , M Hemavarthini , K Jayanthan, D Gopinath	"Plant Disease Detection Using Image Processing"	2020
13.	Piyush Chaudhary ,Anand K. Chaudhari, Dr. A. N. Cheeran ,Sharda Godara	Color Transform Based Approach for Disease Spot Detection on Plant Leaf	2012
14.	J. G. A. Barbedo	"An Automatic Method to Detect and Measure Leaf Disease Symptoms Using Digital Image Processing Plant Disease"	2014
15.	H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh,	"Fast And Accurate Detection and Classification of Plant Diseases"	2011

16.	V. Vivekanandhan, M. Shah Fahad, G. Surya, V. Umashankar	"Plant Disease Classification Using Deep Learning Technique"	2020
17	R. Cristin, B. Santhosh Kumar, C. Priya, K. Karthick	"Deep neural network based Rider-Cuckoo Search Algorithm for plant disease detection"	2020
18	Smita Naikwadi, Niket Amoda	"Advances in image processing for detection of plant diseases"	2013
19	H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh	"Fast and Accurate Detection and Classification of Plant Diseases"	2011
20.	Bashish, D.,Braik, M.Bani-Ahmad.S.	A framework for detection and classification of plant leaf and stem disease"	2010
21	Priyanka Paygude Rahul Garg Pranjal Pathak Abhinav Trivedi Aman Raj	Image processing using machine learning	2020
22	Muhammad Anwarul Azim, Mohammad Khairul Islam, Md. Marufur Rahman, Farah Jahan	An effective feature extraction method for rice leaf disease classification	2021
23	S. Phadikar, J. Sil, and A. K. Das	Classification of Rice Leaf Diseases Based on Morphological Changes	2012
24	Pranesh Kulkarni1, Atharva Karwande, Tejas Kolhe, Soham Kamble, Akshay Joshi1, Medha Wyawahare	Plant Disease Detection Using Image Processing and Machine Learning	2021

3 CONCLUSION

Recognition and analysis of disease is the most significant tasks in image processing. So, this paper presents a survey on diverse method for plant leaf disease detection using image processing technique and also signifies an approach taken by researchers for recognition of plant leaf diseases which is shown above in Table 1. In this survey paper has briefly explained the numerous techniques used for the purpose of recognition and analysis. Among all these diverse techniques best techniques will be analyzed who have the maximum benefits. But in spite of the maximum benefits every technique has certain limitations like variety of methods have been developed but there is still no general method or common system which is appropriate for recognition and analysis of any type of disease. To overcome the drawback of diverse techniques fusion of diverse techniques is a good idea. The study analyses and summarizes some methods have been used for plant disease detection.

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