A SURVEY ON LEAF DISEASE DETECTION USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

In the study on leaf disease detection can be a helpful aspect in keeping an eye on huge area of fields of crops, but it's important to detect the disease as early as possible. Our survey paper mainly focuses on the research oriented techniques which detects the leaf diseases to the earliest and image processing methods have been proposed by the authors which enhances the crop yield thus in stopping various bacterial, virus, fungal and nematodes. Summary of various papers have been drawn, which gives us clear idea on how to improve other parameters which in turn helps us to stop the diseases. Plant disease detection is emerging field in India as agriculture is important sector in Economy and Social life. Earlier unscientific methods were in existence. Gradually with technical and scientific advancement, more reliable methods through lowest turnaround time are developed and proposed for early detection of plant disease. Such techniques are widely used and proved beneficial to farmers as detection of plant disease is possible with minimal time span and corrective actions are carried out at appropriate time. In this paper, we studied and evaluated existing techniques for detection of plant diseases to get clear outlook about the techniques and methodologies followed.

Keywords: leaf disease Detection, nematodes, Image processing Techniques.

INTRODUCTION

Agriculture is just not helpful for human feeding or earning it is much more like energy and global warming. Leaf disease has been affecting many aspects in the field of agriculture mainly they are production, quality and quantity. India is a country which is dependent on agriculture. Leaf disease detection can be helpful for the farmers. Research works in smart computing surrounding to identify the disease using the pictures of leaves. Several problems are to be identified which are given as follows.

Detecting the diseased leaf, to measure area affected by the disease, identifying the boundary of affected area by disease ,finding out the color of the affected area and what exactly causes

the disease i.e., by insects, rust, nematodes etc., Diseases on the leaves are mainly viral, bacterial, fungal.

Plant disease is one of the important factor which causes significant reduction in the quality and quantity of plant production. Detection and classification of plant diseases are important task to increase plant productivity and economic growth. Detection and classification are one of the interesting topics and much more discussed in engineering and IT fields.

Identification of the plant diseases is the key to preventing the losses in 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 very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertize in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification.

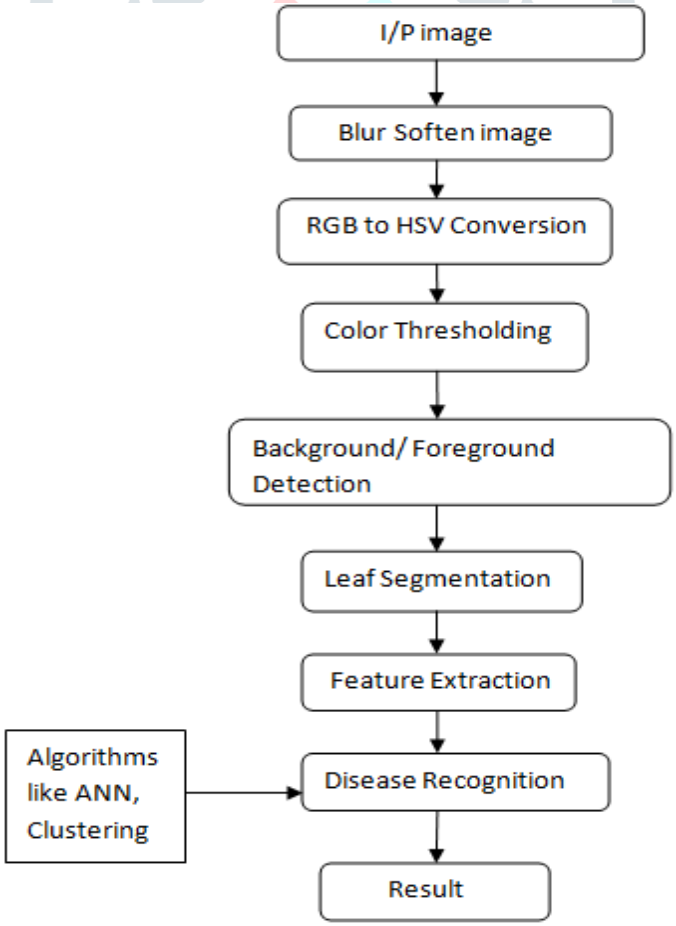

Fig 1. Leaf Disease Detection Flowchart

There are various techniques emerged to detect the plant disease such as thresholding, region growing, clustering, watershed, etc. To detect plant disease the image should go through pre-processing, segmentation, feature extraction and classification processes. The pre-processing is an improvement process of image data to suppresses unwanted distortion or enhances some image features important for further processing [1]. The segmentation process is to partition an image into meaningful regions and it is vital process through which image features are extracted. There are various features of an image such as grey level, color, texture, shape, depth, motion, etc. Classification process is used to classify the given input data into number of classes and groups. It classifies the data based upon selected features [2].

Common diseases in leaves

a) **Leaf Blotch**: It has small oval and rectangular or irregular brown spots appear on leaves and it will become dirty brown as shown in Figure 2. The disease is controlled by use of Mancozeb pesticides [3].

Figure 2. Leaf Blotch

b) **Leaf Spot**

It causes greyish or whitish spots with brown boundary of different sizes which appear on the upper surface of leaves and the spots are greyish or whitish dark in the center. Due to leaf spot, leaves will get dry and died as shown in Figure 3. The disease is controlled by use of Zineb or Bordeaux pesticides [3].

Figure 3. Leaf spot

c) Target spot

This disease produces tan to brown color spot that have concentric rings like a bull's-eye as shown in Figure 4. Infected plant may look healthy from the top, so it is important to check lower leaves, where the first spot usually appears. It will start with only a few spots but after that, the disease will progress with more infection, and it does not take so much time spread on plant [4].

Figure 4. Target spot

LITERATURE REVIEW

Amar Kumar Deya*, Manisha Sharmaa , M.R.Meshram, 2015. This paper provides a survey to study in different image processing techniques used for studding leaf diseases. This is an innovative approach ever done for extracting disease features of the leaf. The methodology uses a blend of machine vision and machine intelligence for precision agriculture.

In machine vision part, image processing is used where the leaf detail, the disease infected area will be extracted. This is a small contribution towards agriculture and growing this medicinally valued precious plant species, to boost up the national economy as well as the national employment generation through proper exploitation of betel vine crop.

Prof. Sanjay B. Dhaygude, Mr.Nitin P.Kumbha, 2011 The detection of plant leaf is an very important factor to prevent serious outbreak. Automatic detection of plant disease is essential research topic. Most plant diseases are caused by fungi, bacteria, and viruses. Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures.

Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission Viruses are extremely tiny particles consisting of protein and genetic material with no associated protein[6].

Megha.S, Niveditha C.R, 2012 In this paper detection of leaf diseases has been used method is threshold : 1) identifying the infected object based upon k- means clustering; 2) extracting the features set of the infected objects using color co-occurrence methodology for texture analysis; 3) detecting and classifying the type of disease using NNs, moreover, the presented scheme classifies the plant leaves into infected and not-infected classes[7].

Piyush chaudhary, Anand K Chaudhary, 2010 In this paper a comparison of the effect of CIELAB, HSI and YCbCr color space in the process of disease spot detection is done. All these color models are compared and finally‘ component of CIELAB color model is used[8].

S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, 2012 In this paper Support vector machines are a set of related supervised learning met hod used for classification and regression. The detection accuracy is improved by SVM classifier. [9]

The process of image segmentation was analyzed and leaf region was segmented by using Otsu method. In the HSI color system, H component was chosen to segment disease spot to reduce the disturbance of illumination changes and the vein. Then disease spot regions were segmented by using Sobel operator to examine disease spot edges. Finally plant diseases are graded by calculating the quotient of disease spot and leaf areas.

Chanchal Srivastava, Saurabh Ku mar M ishra, Pallavi Asthana, G. R. Mishra, O.P. Singh, 2013. This paper gives an idea of the plant diseases mean the studies of visually observable patterns seen on the plant [10]. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertize in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. This paper discussed the methods used for the detection of plant diseases using their leaves images. This paper also discussed some segmentation and feature extraction algorithm used in the plant disease detection.

Jayme Garcia, Arnal Barbedo, 2013. This paper presents a survey on methods that use digital image processing techniques to detect, quantify and classify plant diseases from digital images in the visible spectrum. [11]Although disease symptoms can manifest in any part of the plant, only methods that explore visible symptoms in leaves and stems were considered. This was done for two main reasons: to limit the length of the paper and because methods dealing with roots, seeds and fruits have some peculiarities that would warrant a specific survey. The selected proposals are divided into three classes according to their objective: detection, severity quantification, and classification. Each of those classes, in turn, are subdivided according to the main technical solution used in the algorithm. This paper is expected to be useful to researchers working both on vegetable pathology and pattern recognition, providing a comprehensive and accessible overview of this important field of research.

Arti N. Rathod, Bhavesh Tanawal, Vatsal Shah, 2010. The term disease is usually used only for destruction of live plants. This paper provides various methods used to study of leaf disease detection using image processing. The methods studies are for increasing throughput and reduction subjectiveness arising from human experts in detecting the leaf disease digital image processing is a technique used for enhancement of the image. To improve agricultural products automatic detection of symptoms is beneficial [12].

Amit Yerpude, Dr. Sipi Dubey, 2012. This paper presents The image segmentation performs a significant role in the field of image processing because of its wide range of applications in the agricultural fields to identify plants diseases by classifying the different diseases. Classification is a technique to classify the plants diseases on different morphological characteristics. Different classifiers are used to classify such as SVM (Support Vector Machine), K- nearest neighbour classifiers, Artificial Neural Networks, Fuzzy Logic, etc. This paper presents image processing techniques used for the early detection of different Plants diseases by different authors with different techniques. The main focus of our work is on the critical analysis of different plants disease segmentation techniques [13].

P. Revathi , M.Hema Latha (2012) describes to identify the affected part of leaf diseases. At first, Edge detection technique is used for image segmentation, and At last proposed a Homogenous Pixel Counting Technique for Cotton Disease Detection (HPCCDD) Algorithm for image analyzing and classification of diseases.

The aim of this research to find the diseases of cotton leaf spot by image processing technique, and analyze the input images by RGB pixel counting and recognize the affected part of leaf spot by Sobel and Canny Edge detection technique and output is obtained [14].

Santanu Phadikar and Jaya Sil, (2008) described a software prototype system for disease detection and used image growing, image segmentation techniques on this. This paper provides survey on leaf disease detection technique by using image processing. India is an agricultural country and most of peoples wherein about 70% depends on agricultural. So leaf disease detection is very important research topic. Number of crops caused by fungi, bacteria etc. To overcomes this by using automatic leaf detection[15].

Geng Ying, Li Miao, Yuan Yuan &Hu Zelin (2008). studied the methods of image processing. For that purpose they used cucumber powdery mildew, speckle and downy mildews as study samples and to relate the details of effect of simple and medium filter. The detection of plant disease is significantly based on type of family plants and same is carried out in two phases as segmentation and classification. Here, we have discussed existing segmentation method along with classifiers for detection of diseases in Monocot and Dicot family plant[16].

Ajay A. Gurjar, Viraj A. Gulhane (2010) studied the regularization and extraction technology and describe the Eign features of this technology and this technology gives more accuracy than other detection feature technology. Most plant diseases are caused by fungi, bacteria and viruses. Image processing techniques are used to detect various plant diseases. This includes several steps viz. input images, image preprocessing, and extraction of features and classify them on the different basis. It uses many classification techniques such as K Nearest Neighbor classifier, k-means Classifier, Neural Networks, Support Vector Machine, Artificial neural network, and Fuzzy logic. Selecting a best classification method is cumbersome because the efficiency of result can vary based on input data[17]. This paper focuses on different image processing techniques along with different classification techniques used for plant leaf disease classification.

H. Al-Hiary, S. Bani-Ah Mad, M. Reyalat, M. Braik And Z. A Lrahamneh (2010) describes the three methods of leaf disease detection: 1) To identify the affected part of leaf by using K-means Clustering. 2) To solve the affected part of leaf by using color co occurrence methodology for texture analysis. 3) To find and classify the type of disease by Neural Networks (NN's).

In details; first is RGB images of leaves are acquired and apply for color transformation structure. After that image is segmented by K-means clustering technique and masked the green pixels value and remove the green masked pixels and obtained the threshold value of object by Otsu's method. The RGB images are sets the zero value for converting color co-occurrence technique. After that infected clusters was converted into Hue Saturation Value (HSV) and for texture analysis use the SGDM matrix for each image formation. Finally the recognize the process was execute the solution by Neural Network's[18] .

Sushil R. Kamlapurkar, 2016. This paper gives the identification of disease on the plant is a very important key to prevent a heavy loss of yield and the quantity of agricultural product. The symptoms can be observed on the parts of the plants such as leaf, stems, lesions and fruits. The leaf shows the symptoms by changing colour, showing the spots on it. This identification of the disease is done by manual observation and pathogen detection which can consume more time and may prove costly. The aim of the project is to identify and classify the disease accurately from the leaf images. The steps required in the process are Preprocessing, Training and Identification. The disease considered are Powdery Mildew, Downey Mildew which can cause heavy loss to Grape fruit. For identification of disease features of leaf such as major axis, minor axis etc. are extracted from leaf and given to classifier for classification[19].

SUMMARISATION OF LITERATURE REVIEW TABLE

SL.NO	AUTHORS	PROPOSED METHOD	ADVANTAGES	DISADVANTAGES
1.	Amar Kumar Deya, et.Al.,	Studding leaves techniques have been discussed	Accuracy is high .	Only cotton Crop has been discussed
2.	Prof. Sanjay B. et al	Binary fission analysis to detect the leaf disease	False positive analysis given is comparatively good.	No proper conclusions have been drawn
3.	Megha.S, Niveditha C.R	K-Means clustering to detect leaf diseases	Sensitivity parameter is given	Elaborate experimental analysis

4.	Piyush chaudary, Anand .K chaudary	Transform based leaf disease detection	Statistical parameters are clearly mentioned	The technique suits to few crops such as turmeric etc.,
5.	S. Arivazhagan, R. Newlin Shebiah	Texture based leaf disease detection	Validation using matlab is given	Practically not possible for few leaves
6.	Chanchal Srivastava, et.Al.,	Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification	All the steps of segmentation., extraction results are given	Many steps are involved in the process One should be technically so strong to determine the result.
7.	Jayme Garcia Arnal Barbedo	Visible spectrum analysis	True false True positive cases are given	Spectrum is used to analyse the leaves
8.	Arti N. Rathod, et.Al	Image Segmentation is the proposed methodology	Accuracy percentage is good	Common methods which are very old have been discussed
9.	RakeshChawa re1 , et.Al.,	Image processing techniques.	Maximising of leaf diseases using a survey has been given	Classification is used for agricultural crops. Other plants are not validated using classification
11.	P.Revathi	HPCCDD algorithm for image analysing and classification of diseases	Percentage for leaf disease reduction is given	Implementation process to derive results is complex

12.	Santanu phadikar and Jaya Sil	A software prototype for disease prediction	Table indicates results Comparison of various software techniques.	Success ratio is very less in most of the cases
13.	Geng Ying	Methods of image processing	Accuracy is high	No accurate results based on the methods described
14.	Ajay A.Gunjar	About regularization and extraction technology for feature detection	New technologies have been discussed in the paper	Only focus is on fungal disease only
15.	Al Hiary	K-means and color occurance methodology for texture analysis	Color occurrence is beneficial strategy which gives the exact accuracy.	Could be improved to increase the recognition rate of classification
16.	Sushil R. Kamlapurkar	Preprocessing, Training and Identification to detect leaf diseases	Graphs are given to indicate leaf diseases.	Low accuracy of result

CONCLUSION

Our survey paper presents the research methodologies which are helpful for lead disease detection. The detection of plant disease is one of the important tasks. A plant disease reduces the production of agriculture. Every year the loss due to various diseases is challenging part in agriculture production. Although work is carried out till time on detection of diseases but proper segmentation of affected part based on type of plant family is still an open problem as a research area. Hence various techniques which could detect the leaf disease to the earliest were discussed. Summarisation was also given which helps to find several proposed methods including accuracy, sensitivity etc parameters.

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