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Review on leaf disease detection using image processing techniques

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Abstract
Agriculture is the lifeblood of Indian savings. In India, it is almost seventieth in the crop growing sector. Nowadays, more than a few farmers along with the agro center are facilitating the use of various new technologies to increase agricultural production. Plants are becoming a very important supplier of energy. Currently, there are many diseases that impact plants with the potential to cause cost-effective and social losses. Plant disease recognition is the key to preventing fatalities during storage and quantity of agricultural product. The study of plant disease is the study of a visually observable prototype seen on a plant. Monitoring plant health and detecting infection is extremely important for sustainable agriculture. Image processing is therefore used to search for plant diseases. Disease detection involves steps similar to image segmentation and feature extraction as well as classification. This article discusses a technique used to detect plant disease utilization using images of their leaves. An overview of different foliar disease detection technologies using an image processing approach with their classification based on the type of analytical tool with applications. Approximately the prevailing technologies new in the foliar disease detection system are seriously reviewed and briefly discussed; comparison of the available approaches are investigated with the presented ones. A key problem with problems in the detection of foliar diseases is highlighted.

Keywords: Leaf disease detection, Image processing, segmentation, classification, feature extraction

Introduction

India is a cultivated country and also 70% of the population depends on agriculture. Farmers include a wide range of varieties to select different suitable crops with the discovery of suitable pesticides for plants. Plant infection leads to a significant reduction in the quality and quantity of agricultural products. The study of plant diseases transitions to the study of visually observable patterns lying on plants. Disease control of plant health plays a significant role in good farm crop farming. Initially, a person skilled in the art performs monitoring with plant disease analysis manually. This requires a lot of work and requires extreme processing time. Image processing technique can be used in plant infection detection. In most cases, the symptom of the disease can be seen on the leaves, stem with fruits. The leaves of the plant used for the detection of the disease, which show signs of infection, are considered.

Detection of plant leaf infection is very important at an early stage to take necessary measures to prevent its spread to other parts of the field. the farmer usually identifies the disease by examining the color and shape of the leaves. This technique requires long-term experience and also a lot of usual effort. This is almost impossible for large fields. different diseases occur in different parts of the plant, which can be identified by observing the change in symptoms, spots, color, etc. Less time consuming with automatic diagnostic method is a major requirement in agriculture to improve crop production rate. newly approach to image processing includes use to solve different problems based on agricultural applications such as leaf, stem and fruit disease identification [1-2]. Measurement of leaf infection severity with image processing detection has been reported by various researchers [3-6].

Digital image processing using computer algorithms to complete image processing on digital images. It allows a much wider difference of algorithms to be applied to a computer file, and thus can avoid problems such as increasing noise with signal distortion by each process. DIPs play a very important role in the field of agriculture. It is widely used to display crop infection with high accuracy. Detection and recognition of diseases in plant mistreatment digital imaging technology is extremely effective, provided that the symptoms of quality diseases are in their early stages. Plant pathologists decided to look at digital images of mishandling with a digital image processing process to analyze crop diseases.

Leaf disease can be investigated using a hardware technique similar to a farm robot, which solves the problem of capturing images of the crop using a web camera, and using these images, the built model robot learns about suitable diseases. However, there are several disadvantages that will not be able to provide a suitable result. The webcam is unable to capture a correct and clear image because of the pixels. other than accurate detection of diseases is important. Rather than through a web camera Computer systems area unit developed for agricultural applications such as detection of leaf diseases, fruit diseases etc. Overall these techniques are collected digital images using a camera and image processing technique is useful on these images to obtain valuable data using intentions are essential to the analysis. The disease occurs more often on the leaves and the stem of the plant. Diseases are viral, bacterial, fungal, diseases caused by insects, rusts, nematodes, etc. on the plant. The main task of farmers is to detect these diseases as early as possible. The following paradigm shows how disease on cotton reduces production. The image processing technique can be used in various applications as follows:

1. Identification of plant leaves, stems and fruit diseases.
2. Measure the affected area through the disease.
3. Reveal the boundaries of the affected area.
4. To resolve the color of the affected area
5. To find out the size and shape of the fruit

Now this document will describe things that are organized as follows. In the next part II, various classification techniques will be described. Section III describes the description of related work on this article. The next section IV contains the conclusion and future work.

Pests Management in Cotton Crop

Bacterial Blight of Cotton

Pest Control in Cotton Crops: Insect pests that feed on plant structure and produce directly are retreating, such as growing spikes with fruiting structure, which is usually the biggest problem in cotton crops.

Bacterial blight of cotton: Is an infection that affects cotton, resulting from Xanthomonas with Xonopodis pathovar malvacearum (Xcm), a Gram-negative, motile, rod-shaped, non-sporeforming bacterium with a single polar flagellum.

plant diseases cause major production and economic losses in agricultural trade worldwide. monitoring the health and detection of plant and tree diseases is vital to agriculture. To our knowledge, there is no commercially available device for periodic tree health assessment. Classification strategies are often considered as an extension of detection strategies, but rather than trying to observe only one particular disease in the midst of a wide variety of conditions and symptoms, these attempt to identify and label any pathology that has effects on the plant.

Steps for plant disease detection

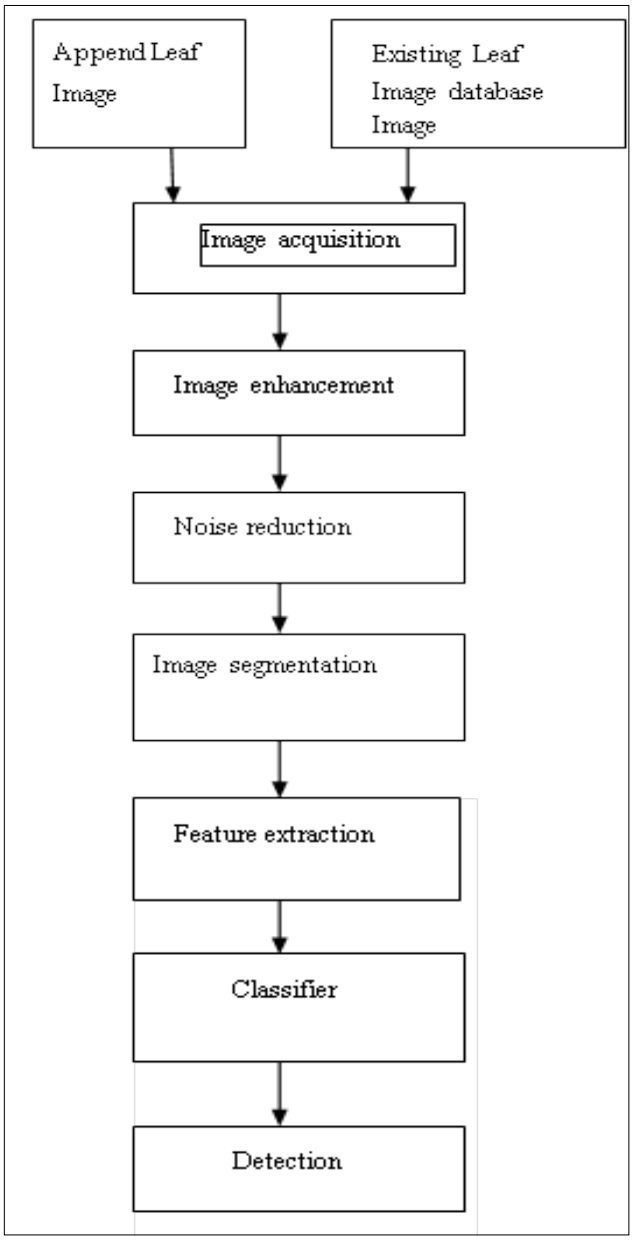

Fig 2: Flow Diagram

The block diagram of leaf disease finding system use image processing is given in Figure 1. The leaf database consist unhealthy and healthy leaves, which are captured from digital camera [8].

In image acquisition process, initially unhealthy and healthy leaves are processed. These unhealthy and healthy leaves dataset is called the training dataset. The train images of leaves store in black box to avoid variation in light intensities or putting in white box with light source at 45 degrees [9-10] to reduce the reflection and better brightness. Once training dataset has been processed, and then append the test leaf image. Further image analysis for more suitable display, image enhancement process applied.

Leaf Disease Detection System Using Image Processing Techniques: An Overview

Crop production is directly proportional to healthy crops. Diagnosis and appropriate treatment of crop diseases is the first basic requirement of the crop production process. A farmer's misdiagnosis of a crop disease causes incorrect pesticide spraying. Various image processing techniques are significantly used to observe crop growth progress and disease diagnosis. Plant diseases occur in different parts of the plant. In general, the leaves of diseased plants change their color, shape, size, texture, etc. Therefore, the diagnosis and proper treatment suggestions for plant diseases can be determined using image processing techniques.

Monica Jhuria *et al*. uses image processing for disease detection and fruit grading in [1]. They used an artificial neural network to detect diseases. They created two separate databases, one for training already stored disease images and the other for implementing query images. Backpropagation is used to adjust the weight of the training databases. They consider three feature vectors namely color, textures and morphology [1]. They found that the morphological trait gave better results than the other two traits.

Thus, studying various plant diseases means studying the visual pattern because it is difficult to manually observe diseases on a plant. Basic steps like image acquisition, pre-processing, segmentation, extraction; detection and classification of plant diseases is used [2]. K- stands for clustering followed by thresholding and feature extraction is described. ANN and BPNN neural network classification has also been used for disease detection.

P. Revathi & *et al.* (2012) [2] describes the identification of the affected part of leaf diseases.

First, an edge detection technique is used for image segmentation, and finally, a Homogenous Pixel Countique for Cotton Disease Detection (HPCCDD) algorithm is proposed for image analysis and disease classification. The aim of this research is to find leaf spot disease of cotton by image processing technique and analyze the input images by counting RGB pixels and recognize the affected part of leaf spot using Sobel and Canny Edge detection technique and output.

Image should be noise free for processing. Thus, noise reduction and image enhancement techniques are required for the required processing. Valliammai and Geethaiakshmi (2012) [1] found that noise suppression is extremely crucial for the input image leading to stable plant feature extraction. The image of the leaf appears to be blurred by applying Gaussian noise because the edges of the leaf veins are not clearly visible. Leaf size, shape and pattern are greatly affected by spotting. Therefore, Gaussian and speckle noise removal techniques are necessary to recover undisturbed leaf images for further processing. This hybrid filter method was developed to remove noise, improve image quality and thus achieve better results compared to other traditional filters.

Singh and Mishra (2016) [4] presented a genetic algorithm based automatic image segmentation and classification technique to find plant leaf diseases with very less computational effort. This method can identify plant diseases at an early or initial stage. Artificial neural network, Bayesian classifier, fuzzy logic and hybrid algorithms can also be used to increase the recognition speed in the classification process.

Gavhale and Gawande (2014) [13] presented a review and summary of image processing techniques for several plant species that have been used for plant disease recognition. The main techniques for plant disease detection are: backpropagation neural network (BPNN), support vector machine (SVM), K-nearest neighbor (KNN) and spatial gray level dependence matrices (SGDM). These techniques are used to analyze the leaves of healthy and diseased plants.

P. Revathi & et.al (2012) [14] describes the identification of the affected part of leaf diseases. First, an edge detection technique is used for image segmentation, and finally, a Homogenous Pixel Countique for Cotton Disease Detection (HPCCDD) algorithm is proposed for image analysis and disease classification. The aim of this research is to find leaf spot disease of cotton by image processing technique and analyze the input images by counting RGB pixels and recognize the affected part of leaf spot using Sobel and Canny Edge detection technique and output.

Santanu Phadikar and Jaya Sil (2008) [3] described a software prototype system for disease detection using image rasterization and image segmentation techniques.

Geng Ying (2008) [4] *et al*. studied image processing methods. To this end, they used cucumber powdery mildew, spotting and downy mildew as study samples and reported the details of the effect of single and medium filter

Table 1

echnique	Key references	Merits	Demerits	Potential application
Hybrid method of Noise reduction	[1, 2, 3]	Multiple Gaussian and speckle noise can be removed	Choice appropriate threshold value in wavelet analysis	Leaf image becomes noise free and produces clear vein Genetic
Genetic algorithm for segmentat ion	[4, 5, 6] and [7]	Very less computational efforts and the optimum results	Efficiency and time of the process depends upon the initial generated population of	Genetic algorithm optimizes continuous or discrete variable efficiently. Large
			chromosomes	searches area and large number of variables can be processed at the same time.
K-means clustering technique s	[8, 9, 10]	Guaranteed to converge, to reduce the number of false	Quality of the solution depends on the initial set of	K mean clustering method is used in image segmentation. It can be hybrid

		edges	clusters and the value K	with other optimization method easily.
Decision Tree classifier (DTC)	[11]	Decision trees indirectly perform variable screening or feature selection, require relatively little effort from users for data preparation, easy to interpret and explain to executives	Instability, over fitting, unstable in small variations, cannot guarantee to achieve the globally optimal decision tree.	Classification and prediction, risk analysis
Recurrent Neural Network	[12]	Less computation time, used for difficult and complex problems	the training outcome can be non determinist- ic and depend crucially on the choice of initial parameters	Leaf disease detection, standard speech recognition
HPCCDD Algorithm	[14]	Reduce the production Loses	Accuracy can be improved	image analyzing and classification of diseases
a software prototype system	[15]	Zooming Algorithm can easily extract the feature of an image Success	Success ratio is very low at most of the cases	disease detection
Studied the regularization and extraction	[16]	Achieved 90% of accuracy to detect fungal	Only focus is upon fungal disease	feature detection
technology		disease		

Conclusion

This paper gives the survey on leaf disease detection and classification techniques using image processing. Different authors used different algorithms for accurate detection of diseases. Advantage of using image processing method is that the leaf diseases can be identified at its early stage. For improving recognition rate, most of researchers used artificial neural networks and classifiers like ANN, SVM, etc. All methods in this paper save time and provide efficient result.

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