A Review on the Plant Leaf Disease Detection Techniques

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Abstract— Plants are the way to live. We are completely dependent on plants from our daily life factors to breathing. So, there should be proper care of plants. Many studies show that quality of agricultural products may be reduced due to various factors. One of the most important factors contributing to low yield is disease attack. The plant diseases are such as fungi, bacteria and viruses. The leaf diseases not only restrict the growth of the plant but also destroy its crop. There is the need of some expert to identify plant diseases but manual identification is time consuming & laborious process. So, some automatic methods required. In this paper, we have presented a survey on the existing methods of plant leaf disease detection.

Keywords— Leaf Disease, Image Processing, Feature Extraction, Disease Identification

I. INTRODUCTION

India is a land of farmers and agriculture is the main source for farmers. There is the availability of the variety of crops for the agriculture and diversity of pesticides for better growth. But there are various other factors destruct the growth of crops like weather conditions, accurate resources, crop requirements and diseases. One of the major factors responsible for the crop destruction is diseases. Fortunately, people are aware about the importance of plants and they want to save plants and earth but they are not aware about the different categories of plants their different diseases. Different plants suffer with different diseases. The main part of plant to examine the plant diseases is leaf. The major categories of plant leaf diseases are based on viral, fungal and bacteria. The Diseases on leaf can reduce both the quality and quantity of crops and their further growth. The easy method to detect the plant diseases is with the help of expert having knowledge of plant diseases. But this manual detection of plant disease takes so much time and is much laborious work. So, there is the need of some automatic method to detect the leaf diseases. Computer can play a major role to develop the automatic methods for the detection of leaf diseases. There can be various image processing techniques that can be used in the leaf disease detection [1].

The detection and classification of leaf diseases accurately is the key to prevent the agriculture loss. Different plant leaf bears different diseases. There are a list of methods and classifiers to detect plant leaf diseases. The considered methods for plant leaf disease are explained as existing work in section IV.

Section II describes the basic concept of leaf disease detection. Section III brief about some important leaf diseases, Section IV explains the literature review. Section V research gap and Section VI concludes the paper.

II. BASIC CONCEPT OF LEAF DISEASE DETECTION

Plant leaf disease detection involves some basic steps of image processing to detect & classify plant disease [2]. These steps are image acquisition, image pre-processing, feature extraction and leaf disease detection. These steps are described as below in figure 1.

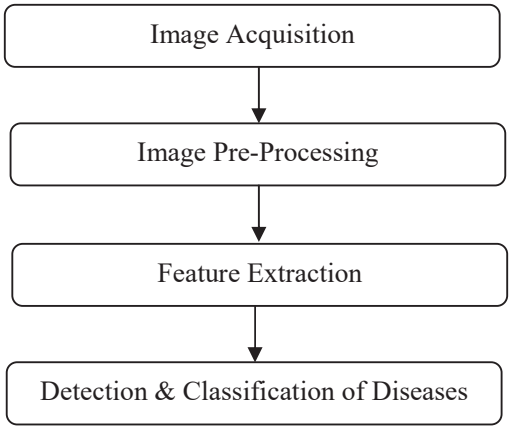

Figure 1: Basic concept of plant leaf disease detection

A. Image Acquisition

Image acquisition involves the steps to obtain the plant leaf and capture the high quality images to create the required database. The efficiency of the concept depends upon the quality of database image. So, images should be considered of high quality with RGB color

B. Image Pre-processing

Image preprocessing involves the steps of image enhancement, color conversion and image segmentation. Here, the captured image is enhanced to remove the noise from image, and then RGB color image is converted into HSV plane image. Finally image segmentation is applied to simplify the representation of image with segments so that it can be easily analysed.

C. Feature Extraction

After the segmentation, disease portion from the image is extracted. This leaf diseases area is treated as area of interest for the image processing. Then, further features are extracted that are used to detect the disease types. Mainly feature extraction involves the color, shape and pattern of image.

D. Leaf Disease Detection

Finally, classifiers are used for the training and testing of the dataset. These classifiers may be k-nearest neighbour, support vector machine, neural network, fuzzy logic based etc. These methods are used to classify and detect the diseased and healthy leaves.

III. Leaf Diseases & Symptoms

Leaves are mainly affected with fungal, bacteria or viral. Here, we are discussing about these disease symptoms that should be keep in mind if plant growth seems low.

A. Viral disease symptoms

Among all plant leaf diseases, those caused by viruses are the most difficult to diagnose. Viruses produce no telltale signs that can be readily observed and often easily confused with nutrient deficiencies and herbicide injury. Aphids, leafhoppers, whiteflies and cucumber beetles insects are common carriers of this disease, e.g. Mosaic Virus, Look for yellow or green stripes or spots on foliage, as shown in Fig. 2. Leaves might be wrinkled, curled and growth may be stunted [3].

Figure 2: Viral Disease Symptoms

B. Fungal disease symptoms

Plant leaf diseases, those caused by fungus are discussed below and shown in Fig. 3. e.g. Late blight caused by the fungus. It first appears on lower, older leaves like gray-green spots, water-soaked. When fungal disease matures, these spots darken and then white fungal growth forms on the undersides.

Figure 3: Fungal Disease Symptoms

C. Bacterial disease symptoms

The disease is characterized by tiny pale green spots which soon come into view as water- soaked. The lesions enlarge and then appear as dry dead spots as shown in Fig. 4.

Figure 4: Bacterial Disease Symptoms

IV. LITERATURE SURVEY

Khirade et al. [4] has discussed some segmentation and feature extraction algorithm that can be used for the detection of plant diseases by using the images of their leaves. It is very difficult to detect the plant diseases manually due to requirement of excessive time, knowledge of plant diseases and much amount of work. The author has divided the entire process of plant leaf disease detection into five steps: Image Acquisition, Pre-processing, Segmentation, Feature Extraction and Final Classification of diseases. Image acquisition used the transformation structure for RGB leaf image. Then image is pre-processed to remove the noise and enhance the image contrast. Segmentation is done for the partitioning of image into various feature parts using k-means

clustering, ostu filters etc. This segmented image is further used for feature extraction and then final classification is performed using various classifications. In this way, plant diseases can be efficiently identified.

Sannakki et al. [5] has used feed forward back propagation Neural Network based technique for the diagnosis and classification of diseases in grape leaf. Author has used the images of grape leaf with complex background for the diagnosis as input. Further anisotropic diffusion is used to remove the noise of the image which is further segmented using k-means clustering. Finally results are observed using neural network. Results are experimented on downy mildew and powdery mildew images with simulation in MATLAB. Confusion matrix is considered with the true positive and false positive parameters for the validation of results. The author claimed to have the training accuracy of 100% if used hue feature alone.

Kutty et al. [6] has used the neural network based system to classify the watermelon leaf diseases of Downey Mildew and Anthracnose. This classification is based on the color feature extraction from RGB color model which is obtained from the identified pixels in the region of interest. Author has calculated the true positive rate, true negative rate and overall accuracy for the efficiency of the proposed concept. The overall performance is depicted with ROC curve having AUC value of 0.5. The true classification results also depict the value of 75.9%.

Rothe et al. [7] has proposed pattern recognition techniques for the detection and classification of cotton leaf diseases of Alternarnia, Myrothecium and Bacterial Blight. The dataset images are taken from the fields of Central Institute of Cotton Research Nagpur. Active contour based snake segmentation algorithm is used for the isolation of diseased spots. Author has also suggested some future directions to use the similar concept for the crops of wheat, orange, citrus and maize etc.

Ramakrishnan et al. [8] has used back propagation algorithm for the identification of groundnut leaf diseases. Cercospora is the common groundnut disease. Its further stage is cercosposium personatum, then phaeoisariopsis and final stage is alternaris. This classification with the proposed concept shows the efficiency of 97.41%.

Table 1: Comparison of Different Groundwater estimation techniques

Author Name	Technique	Remarks
Sachin D. Khirade, A. B. Patil	K-Means Clustering	• Discussed various plant leaf disease detection & classification methods.
Sannakki et al.	Feed Forward Back Propagation Neural Network	• Neural Network based classification is performed for the grape leaf disease detection.
Kutty et al.	Neural Network	• Neural Network pattern recognition method is used to classify the watermelon leaf disease of anthracnose & downey medley with 75.9% accuracy.
P. R. Rothe, R. V. Kshirsagar	Neuro-Fuzzy Inference System	• Cotton leaf diseases of Alternarnia, Myrothecium and Bacterial Blight are detected.
M. Ramakrishnan, A. Nisha	Back Propagation	• identification of groundnut leaf diseases with its various stages of disease.

V. RESEARCH GAP

As per literature review, there are various traditional methods for the identification and classification of plant leaf diseases like pattern recognition method, back propagation, neural network, back propagation neural network etc. Different methods have used different dataset and assumptions to identify the plat leaf diseases. Khirade et al. have explained the complete process of plant leaf disease identification with the methods of segmentation like ostu filter and KNN etc. Sannaki et al. has used back propagation neural network based approach for the identification of grape leaf diseases. This method gives accurate results only with hue. Kutty et al. has classified the watermelon leaf diseases of Downey Mildew and Anthracnose using neural network but the accuracy level is only 75.9%. Rothe et al. classified cotton leaf diseases of Alternarnia, Myrothecium and Bacterial Blight using pattern recognition method.

The entire list of methods is traditional concepts like neural network, back propagation method and other pattern recognition concepts. The results from the concepts are accurate but not upto the extent that they can consider for the real life agriculture diseases. So, there is the need of some nature inspired technique for the efficiency of the results.

VI. Conclusion

Identification of plant leaf diseases is the key to reduce the agriculture loss. Study of plant diseases is the study of image processing concepts with region of interest is affected leaf parts. Plant disease methods should be automatic instead of manual. In this paper, we have discussed various methods for the identification and classification of plant leaf diseases like pattern recognition method, back propagation, neural network, support vector machine, back propagation neural network etc. We have also discussed the basic concept of plant leaf disease detection, various leaf diseases and research gap for the existing work.

References

[1] Arivazhagan, S., R. Newlin Shebiah, S. Ananthi, and S. Vishnu Varthini. "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features." *Agricultural Engineering International: CIGR Journal* 15, no. 1 (2013): 211-217.

[2] Gavhale, Kiran R., and Ujwalla Gawande. "An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques." *IOSR Journal of Computer Engineering, January 2014.*

[3] Pearson, Roger C., and Austin C. Goheen. *Compendium of leaf diseases*. American Phytopathological Society, 1988.

[4] Khirade, Sachin D., and A. B. Patil. "Plant Disease Detection Using Image Processing." In *Computing Communication Control and Automation (ICCUBEA), 2015 International Conference on*, pp. 768-771. IEEE, 2015.

[5] Sannakki, Sanjeev S., Vijay S. Rajpurohit, V. B. Nargund, and Parag Kulkarni. "Diagnosis and classification of grape leaf diseases using neural networks." In *Computing, Communications and Networking Technologies (ICCCNT), 2013 Fourth International Conference on*, pp. 1-5. IEEE, 2013.

[6] Kutty, Suhaili Beeran, Noor Ezan Abdullah, Habibah Hashim, and Aida Sulinda. "Classification of watermelon leaf diseases using neural network analysis." In *Business Engineering and Industrial Applications Colloquium (BEIAC), 2013 IEEE*, pp. 459-464. IEEE, 2013.

[7] Rothe, P. R., and R. V. Kshirsagar. "Cotton leaf disease identification using pattern recognition techniques." In *Pervasive Computing (ICPC), 2015 International Conference on*, pp. 1-6. IEEE, 2015.

[8] Ramakrishnan, M., and A. Nisha. "Groundnut leaf disease detection and classification by using back probagation algorithm." In *Communications and Signal Processing (ICCSP), 2015 International Conference on*, pp. 0964-0968. IEEE, 2015.