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Detection of Plant Diseases from Image Processing Techniques

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Abstract:

More than 80% population of India is depend on the agriculture. It is an important for the survival but some diseases in the plant and crops destroy them due to which a heavy loss are faced by the agricultural industry. The identification of plant diseases is very important to prevent form the heavy loss and more production of yield. The primary symptoms of plant disease are seen the leaf in the form of changing colour, showing the spots on it. In recent time, the identification of plant diseases are done by the eye observation but it is very time consuming and not much accurate. Different researcher has been developed different types of techniques for the detection of diseases. This paper represent the use of image processing technique for the recognition of plant diseases. This method have different types of algorithm with different database of plant species.

Keywords: *Yield, Disease, Image processing, Algorithm*

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Introduction

In India, maximum part of the population depend on the agriculture. More production of food with a high quality at reduced expenditure is the aim of research in the field of agriculture. The complex interaction of soil, seed, and agro chemicals given the product in the form of agricultural food production. The most important food product of the agriculture are grain, fruits and vegetables. Their external appearance is the most important because this outer appearance affects the behavior of the consumer for buying any product. So, it is necessary to inspect the quality and grading system of the products in agriculture field for the cultivation of good healthy plants. But due to the disease in the crops and plants, agriculture field can go into an economic loss because these diseases management is a challenging task till today.

The detection of plant diseases is done by the plant pathologist. Plant pathology is the scientific study of diseases in plant generated by the activity of the pathogens and environmental conditions. The leaves or stem of plants show the colored spots or streaks due to the some diseases. In plants, fungi, bacteria and viruses are the main causes of the leaf diseases. In the leaves or stem of plants, different symptoms are seen due to the disease caused by these organism. The major symptoms caused by organisms are stunting, yellowing, wilting, twisting, reddening, leaf spots, browning, blighting etc. According to food and agriculture organization, 25% of the crop is lost due to the diseases and pests.

Plant Disease Triangle

Plant pathology's fundamental concept is represented by the disease triangle. In this triangle, each side or angle show the factor that is required for the disease development. At one side, pathogen causes diseases. Another sides are susceptible host and environmental conditions that are also enhance the development of disease. All three factors should be present in the triangle for the development of diseases.

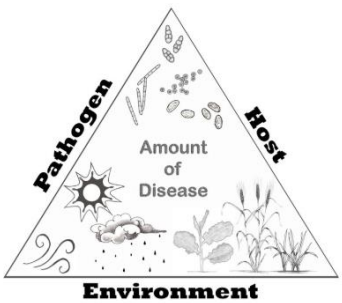

Figure 1 - Disease Triangle

Pathogen: means infectious agents like virus, fungus, bacteria, or parasite that cause the disease in the plants, humans, and animals. These pathogens alter the photosynthesis reaction as well as affects the respiration and transpiration activity of plants.

Abiotic and biotic are the factors which also responsible for the plant diseases.

Biotic Factors: Fungi, Bacteria, Viruses, Protozoa, Nemotodes etc.

Abiotic Factors: Light, temperature, humidity, soil moisture, insufficient nutrient, abnormality in soil conditions like acidic, alkaline, saline, etc.

Image Processing Technique

Manually, the experts detect and identify the plants through eye called eye observation but this method takes time because of the huge farms or land areas. Nowadays, the detection of plant diseases includes laboratory tests, skilled people, well required laboratories etc. But these things are not accessible all over mainly in remote areas. Various diseases can be detected by the help of automatic detection like image processing. Image processing plays vital role in the detection of plant disease because it provides best result with less human efforts. This technique are very helpful in the classification of crops, weed detection, product quality inspection, disease detection, pest identification etc. The characteristics features of disease region is extracted from the image for the recognition of the type of disease because features can vary according to disease. Color, shape, texture and so on are the features that are extracted from the image. Sometimes more features are extracted due to which the cost of hardware and software increases.

Procedure

1. Firstly, captured image is preprocessed and resized.
2. Then, image is segmented for the conversion into HIS color space format.
3. After that the features such as major axis, and minor axis are extracted from the image.
4. In last, classification of diseases are done by the help of these features.

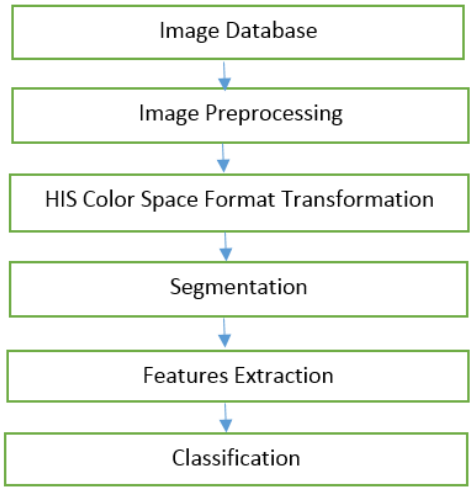

Figure 2 - Image Processing Technique

Application of Image Processing in Plants

1. The detection of disease in plant leaf, stem and fruits.
2. Estimation of the affected area by disease.
3. The edges of the affected areas are detected.
4. The color of affected area can also be determined.
5. The size and shape of the fruits can be determined.
6. Number of spots can also be estimated.

Review of Literature

Rewar *et al.* (2017) stated that image processing method is very useful in the field of agriculture. It detect the leaf diseases such as identifying the types of disease, finding the shape of affected area, detecting the edges of diseased leaf. They used a Weiner filter and adaptive histogram equalizer for the detection of infected and healthy part of the leaf. It gives a better results for the infected parts. This method can be used for the effective measures to solve the problems that can minimize the losses in agricultural production.

Varshney and Dalal (2016) proposed from their review study that different types of image processing techniques are used for the detection of plant diseases. The main feature of the technique should be speed and accuracy. Different techniques gives the different results on different database.

Tate and Kamlu (2017) concluded on the basis of their study that image processing technique can be used for the detection of plant diseases. In image processing, different types of segments are used for the identification of leaf diseases. In their paper, they used the application of image thresholding, K-means clustering and neural networks for the clustering and classification of plant leaf diseases. They concluded that neural network is best technique because of the less computing time with accurate results.

Renugambal and Senthilraja (2015) studied on the sugarcane plant diseases by the help of machine vision system. In which, digital image of sugarcane plants showed the symptoms of particular diseases. These disease segments are identified and segmented by the help of algorithm. GLCM feature used as a classifier because this feature gives the more information compared to others. They concluded that SVM system can be used to identify the plant diseases.

Landge *et al.* (2013) stated that the classification of diseases that affect the plants are formulated by the application of color transformation and neural networks (NNs). In this paper, they focused in developing algorithms like genetic algorithms and NNs by which the recognition rate and severity of detected diseases.

Megha S. *et al.* (2017) concluded from their paper by image processing system from FCM-Clustering technique that it is an efficient technique that give the result of plant disease with high accuracy. They used a SVM classifier which is based on the color, texture, and shape. FCM clustering technique is used to segment the diseased area. In the end, they stated that result can be obtained with less computational efforts and prevention method can also be detected for the diseases.

Raut and Ingole (2017) proposed from their review study that image processing is used for the detection of leaf disease and classification techniques. In this technique, different algorithms has been used for the accurate and less time consuming detection. The major advantage of this technique is that it can detect the disease of leaf at earlier stage. Artificial neural networks and classifier such as ANN, SVM are used in image processing.

Kamlapurkar (2016) concluded that the monitoring and management system are very popular for the detection of diseases. In some case, the detection and identification of disease is unknown to severe stage. So, to increase the accuracy and less time consumption, image processing technique is best.

Conclusion

Plant disease is a major problem due to which huge loss occur in the agriculture field. These diseases are caused by the pathogen as well as environmental effects. There is need to prevent the plant form

diseases. Before the prevention, the detection of disease is necessary. Hence, different types of techniques has been developed for the detection of disease such as DNA technique, immunoassay technique, image processing etc. This paper concluded from the review that image processing is a method that detect the diseases in plant with high accuracy in less time. This method can detect the disease in the early stage of disease.

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