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Detection and Analysis of Plant Diseases Using Image Processing Technique

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Abstract - *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 segmentation, feature extraction and classification. This paper discussed the method used for the detection of plant diseases using their leaves images.*

Agriculture is a most important and ancient occupation in India. As economy of India is based on agricultural production, utmost care of food production is necessary. Pests like virus, fungus and bacteria causes infection to plants with loss in quality and quantity production. There is large amount of loss of farmer in production. Hence proper care of plants is necessary for same.

Key Words: Image processing, Plant Diseases, Agriculture

1. INTRODUCTION

India is a cultivated country and about 70% of the population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant. Disease on plant leads to the significant reduction in both the quality and quantity of agricultural products. The studies of plant disease refer to the studies of visually observable patterns on the plants. Monitoring of health and disease on plant plays an important role in successful cultivation of crops in the farm. In early days, the expertise person in that field did the monitoring and analysis of plant diseases manually. This requires tremendous amount of work and requires excessive processing time. The image processing techniques can be used in the plant disease detection. In most of the cases disease symptoms are seen on the leaves, stem and fruit. The plant leaf for the detection of disease is considered which shows the disease symptoms. This paper gives the introduction to image processing technique used for plant disease detection.

Today India ranks second worldwide in farm output. Agriculture is still the largest economic sector and plays a major role in socioeconomic development of India. Agriculture in India is the means of livelihood of almost two thirds of the workforce in India. India has over 210 million acres of farm land. Jawar, wheat, sunflower, cereals are the major crops. Apple, banana, sapota, grapes, oranges are the most common fruits. Sugarcane, cotton, chili, groundnuts are the major commercial crops. Computer Vision Systems (CVS) developed for agricultural applications, namely, detection of weeds, sorting of fruits in fruit processing, classification of grains, recognition of food products in food processing, medicinal plant recognition, etc. In all these techniques, digital images are acquired in a given domain using digital camera and image processing techniques are applied on these images to extract useful features that are necessary for further analysis. Plant disease diagnosis is an art as well as science. Many diseases produce symptoms, which are the main indicators in field diagnosis. The diagnostic process (i.e., recognition of symptoms and signs), is inherently visual and requires intuitive judgment as well as the use of scientific methods. The photographic images of symptoms and signs of plant's diseases used extensively to enhance description of plant diseases are invaluable in research, teaching, diagnostics, etc. Plant pathologists incorporate digital images using digital image transfer tools in diagnosis of plant diseases. Till now experts identify the presence of the disease in the plants manually, but it is expensive for a farmer to consult an expert due to their distant availability, so it is required to detect the symptoms of the plant diseases automatically as early as they appear on the plant. Early detection will help farmers to avoid huge loss. Technology support would help them in early detection of diseases, cutting on cost of pesticides, and good returns for the efforts, thus making the profession attractive. To remedy this situation various alternatives are being searched to minimize the application of these hazardous chemicals. One of the main concerns of scientists is the automatic disease diagnosis and control. Several key technologies incorporating concepts from image processing and artificial intelligence are developed by various researchers in the past to tackle this situation.

We can analyze the leaf diseases by using hardware techniques like agriculture robot which will capture the images of crop by using webcam and with the help of those images the robot built model detect the appropriate diseases. However, there exist some drawbacks which will not be able to give appropriate result. The webcam is not able to capture the accurate and clear image because of pixels. But accurate detection of diseases is important. Rather than using webcam in hardware model we can

propose a software which is based on neural network. In this project we are going to develop a system which detect the diseases on leaf in which the images will be capture by smart phones because in today's era everyone has smart phones hence every farmer will be able to capture images and upload those to detect diseases. This software will solve and answer different type queries and particular person can ask queries in their own language for his/her convenience. If they are looking for the remedies of particular disease the they can login and get the remedies.

2. LITERATURE SURVEY

Monica Jhuria et al uses image processing for detection of disease and the fruit grading in [1]. They have used artificial neural network for detection of disease. They have created two separate databases, one for the training of already stored disease images and other for the implementation of the query images. Back propagation is used for the weight adjustment of training databases. They consider three feature vectors, namely, color, textures and morphology [1]. They have found that the morphological feature gives better result than the other two features.

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

For proper and successful cultivation of crops it is necessary to detect diseases accurately [3]. Hence, from above discussion it can be seen that image-processing techniques have proved useful in all means. We can accurately detect and classify diseases on various plants using all above techniques. K-means Clustering to detect infected objects and Neural Networks are thus commonly used for obtaining accuracy in detecting and classifying diseases. Hence, these techniques have potential to be use in Agrobot system.

Di Cui et al. [4], explains the image processing techniques for multispectral images to detecting rust on plant leaf and its growth amount of disease. The dataset contains the images collected from a greenhouse of research institute. The explained method uses the concept of evaluate centroid for each image for further processing.

Rittika Raichaudhuri et al. [5] this venture is to give a framework to identifying wheat leaf Diseases. In this robotized framework will be utilized to identify the wheat leaf infections however picture preparing. The k mean calculation and vigilant channel are utilization for the image preparing and segmentation handling. Design acknowledgment is accomplished through PCA or GLCM and arrangement through SVM or ANN. Procedures, for example, middle channel, histogram balance, picture smoothening, image honing, and so on., can be utilized for performing picture improvement. A portion of the calculation procedures that can be utilized for surface element extraction are Gabor channel, shading co-event techniques, wavelet change, and so forth.

3. STEPS FOR PLANT DISEASE DETECTION

In this section, the basic steps for the disease detection as shown in fig:

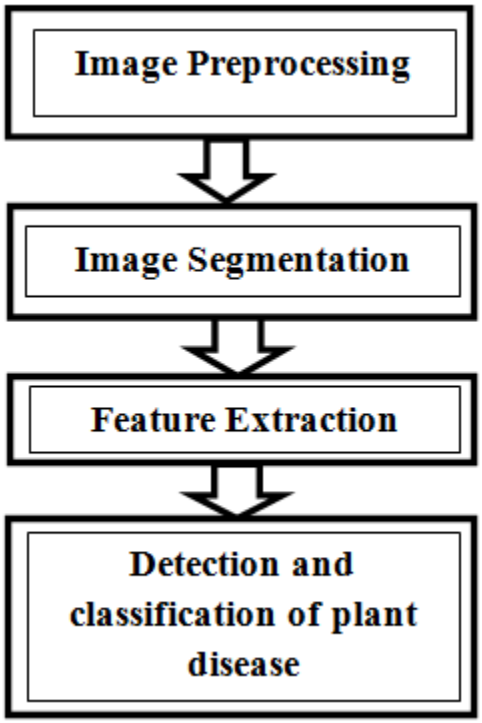

Fig 1: Steps for Plant Disease Detection

[A] Image Preprocessing

Image preprocessing is to remove noise from the image or other object removal, different preprocessing techniques. Here we are using image scaling. Image scaling is used to convert the original image into thumbnails because the pixel size of original image is large and it require more time for the overall process hence after converting the image into thumbnails the pixel size will get decreases and it will require less time.

[B] Image Segmentation

Image segmentation is one of the mostly used methods to classify the pixels of an image correctly in a decision-oriented application. It divides an image into a number of discrete regions such that the pixels have high similarity in each region and high contrast between regions. It is a

valuable tool in many field including health care, image processing, traffic image, pattern recognition etc. There are different techniques for image segmentation like threshold based, edge based, cluster based, and neural network based1. From the different techniques, one of the most efficient methods is the clustering method. Again, there are different types of clustering: K-means clustering, Fuzzy C-means clustering, mountain clustering method and subtractive clustering method. One of most used clustering algorithm is k-means clustering. It is simple and computationally faster than the hierarchical clustering. In addition, it can work for large number of variable. However, it produces different cluster result for different number of number of cluster. So it is required to initialize the proper number of number of cluster, K2. Again, it is required to initialize the k number of centroid. Different value of initial centroid would result different cluster. So selection of proper initial centroid is also an important task. Nowadays image segmentation becomes one of important tool in medical area where it is used to extract or region of interest from the background. So medical images are segmented using different technique and process outputs are used for the further analysis in medical. t plant.

K-Means Clustering:

Clustering is a method to divide a set of data into a specific number of groups. It's one of the popular method is k-means clustering. In k-means clustering, it partitions a collection of data into a k number group of data11,12. It classifies a given set of data into k number of disjoint cluster. K-means algorithm consists of two separate phases. In the first phase it calculates the k centroid and in the second phase it takes each point to the cluster which has nearest centroid from the respective data point. There are different methods to define the distance of the nearest centroid and one of the most used methods is Euclidean distance. Once the grouping is done it recalculate the new centroid of each cluster and based on that centroid, a new Euclidean distance calculated between each center and each data point and assigns the points in the cluster, which have minimum Euclidean distance. Each cluster in the partition is defined by its member objects and by its centroid. The centroid for each cluster is the point to which the sum of distances from all the objects in that cluster is minimized. So K-means is an iterative algorithm in which it minimizes the sum of distances from each object to its cluster centroid, overall clusters.

K mean Clustering Algorithm

1. Initialize Pix [] with image pixels

2. select Random Centroids []

3. For i=0 to pix.len

    1. for j=0 to Centroids [].len
    2. calculate Eu[i] [j] = (i, sqrt (Sum (power (pix[i]-centroid[j]),2))
    3. end for
    4. arrange Eu [] [] in ascending order

4. classify the pixel into the cluster having centroid j for which the pixel has minimum Euclidian distance

5. end for

6. calculate centroid mean

7. check whether any Euclidian distance is greater than centroid mean or not.

8. if Euclidian distance of any pixel is greater than centroid mean then

9. make the pixel as centroid and repeat step 4 until the centroids get stable

10. rearrange clusters to form new-clustered image

11. save image on server

[C] Feature Extraction

Feature Extraction is an important part in the disease detection. It plays an important role in identification of an object. Feature extraction is used in many applications in image processing. Color, texture edges, morphology are the features, which are used in disease detection.

Monica jhuria et al took color, morphology, texture as feature for the disease detection. It is found that morphological result gives more result than any other features. Texture shows how the color is distributed in the image, hardness of the image.

[D] Detection and Classification of Plant Diseases

The final stage is the detection of the diseases and with the help of disease classify the plants with the disease matches with the given dataset. For the disease detection and classification, we are implementing the deep learning algorithm. Deep learning algorithm is used to classify the specified image into appropriate disease hence it will be easy to detect the disease and find out the remedy over the disease. Deep learning algorithm is the part where we are finding out the relevancy count of the pixels by comparing the images with the data set. According to the relevancy count we will find out the matched disease.

- **Deep Learning Algorithm**

1. upload image and read it into pix [][]
2. Initialize Pix [][] with image pixels
3. for i=0 to pix [][]. len
    a. match pix [][] attributes with dataset pixels' attributes
    b. store matching result in db
4. end for
5. calculate weights for every pixel
6. calculate z for matching diseases z=sum (w)
7. take average of z=avg (z)

8. Filter diseases having z value less than avg(z)
9. Transfer the output of 1st layer to 2nd layer
10. take average of z=avg (z)
11. filter diseases having z value less than avg(z)
12. transfer the output of 1st layer to 3nd layer
13. output of 3rd layer will be delivered to user.

4. ADVANTAGES

1. Efficient and user friendly system.

2. Improved accuracy with the help of K mean clustering Algorithm and Deep learning algorithm.

3. Increased layers of deep learning algorithm to get most accurate and appropriate result.

4. Our system is very fast as compared to other because segmentation makes the processing time less.

5. CONCLUSION

We have segmented an image by using k-clustering algorithm using cluster to generate the initial centroid and the final segmented result is compare with k-means clustering algorithm and we can conclude that the proposed clustering algorithm has better segmentation and after formation of clusters apply the deep learning algorithm to find out the matching image, we have found the value of z in each stage and compare those with the dataset images and the value having less z value will be the final value. Deep learning algorithm gives the appropriate result of the diseases and takes less amount of time for detection than other methods.

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