Identification and Detection of Plant Diseases Using Image Segmentation Techniques: A Review

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Abstract

This review paper discusses various image segmentation methods for parting plant images to identify infected part of leaf. Segmentation is an image processing system that is used to divide image into parts in light of pixel and auxiliary data. Segmentation is utilized to separate area of interest based on the application. This paper explains about area based and edge based segmentation methods under which thresholding, K-mean, Fuzzy C mean systems are examined.

Introduction

Being developed of human progress, agribusiness is assumed as an essential part. In nations where economy is exceptionally relied on farming, at that point it those cases it end up noticeably important to identify infected portion in plant as plant diseases can decrease amount and nature of horticulture items all things considered. Identification of diseases in plant is a broadly utilized as research area which includes identification of infection on leafs of plant. In plants, infection at first found on stem part at that point continues towards leaves and afterward at long last to organic product.

For distinguishing infected parts in plants we need to use computing system that identifies infected parts of leaf. For this we use image processing techniques. Firstly image is captured using digital camera and processed using image processing techniques. Image processing is a field of visualizing and extracting region of interest.

Literature Review

Smita Zol et al. discussed thresholding and Deformable Model (DM) for image processing. Thresholding Methods are reluctant to noise. DM gave easy process to represent complex images.

Nameirakpam Dhanachandra et al. explained about segmenting an image by using K-clustering techniques. It uses substractive cluster to generate initial centroid. Also better Segmentation is achieved by varying the hyper sphere cluster radius.

Soumi Ghosh et al. compared K-means Partition and Fuzzy C -means clustering Methods. This paper concludes that K-means algorithm is better than FCM algorithm. FCM is used to handle issues related to noisy data and provide solution faster.

P.Pedda Sadhu Naik et al. proposed a new approach of image segmentation technique for the coloured image. After Segmentation results are compared with K-means clustering and proved better segmentation technique than K-mean.
Zhensong Chen Et Al. proposed new image segmentation technique based on DP clustering algorithm. This algorithm helps in hierarchal segmentation. This algorithm will help in pattern reorganization and image semantic annotation.
Sheela.Sa et al. discussed and elaborated various types of segmentation techniques for pattern reorganization and images analysis. This paper also concludes is better of speed.
Nida M.Zaitoun et al. discussed two type of segmentation techniques region based and edge based. Each of them is further classified into different techniques.
Anand H.Kulkarni et al. presented a segmentation technique for reorganization of plant disease using ANN based classifier. This uses combination of color and texture features.
Arti N Rathod et al. reviewed different techniques of image processing for leaf diseases. These techniques are for increasing throughput in detecting leaf diseases.
Uma Maageswaris et al. explored different edge based segmentation methods as Sobel, Prewitt, and Canny. Various Experiments are performed on textured images and results are compared.
Anis Ben Ishak presented a multilevel dimensional thresholding method for grey level image segmentation. This paper uses two type of entropies Renyi and Tsallis.

Comparison of Image Segmentation Techniques

Segmentation is procedure of part the image into various regions in light of the application. Image is e.g. in distinguishing ailments of leaf picture of leaf is sectioned and when infected part is encountered, its pixel data is put away. Segmenting into various parts, once part of interest is discovered, helpful data is stored. Segmentation techniques are utilized as a part of image processing to process area of interest. Segmentation strategies are characterized in light of methodologies:
(i) Segmentation based on structure information: In these strategies, division is done in view of the data of structure of required part of picture.
(ii) Segmentation based on pixel data: These Segmentation methods utilize pixel data rather than structure.
(iii) Hybrid system: Methods in this class utilizes both basic data and additionally pixel data.

Characterization of Segmentation Techniques

Following figure demonstrates the characterization of Segmentation techniques. Which comprehensively ordered into two classifications: pixel based and message based**.** Pixel based methods are additionally grouped into area based and edge based while message based are arranged into two principle classifications as based n random structure and regular structure.
We will talk about just pixel based division strategies in this paper.

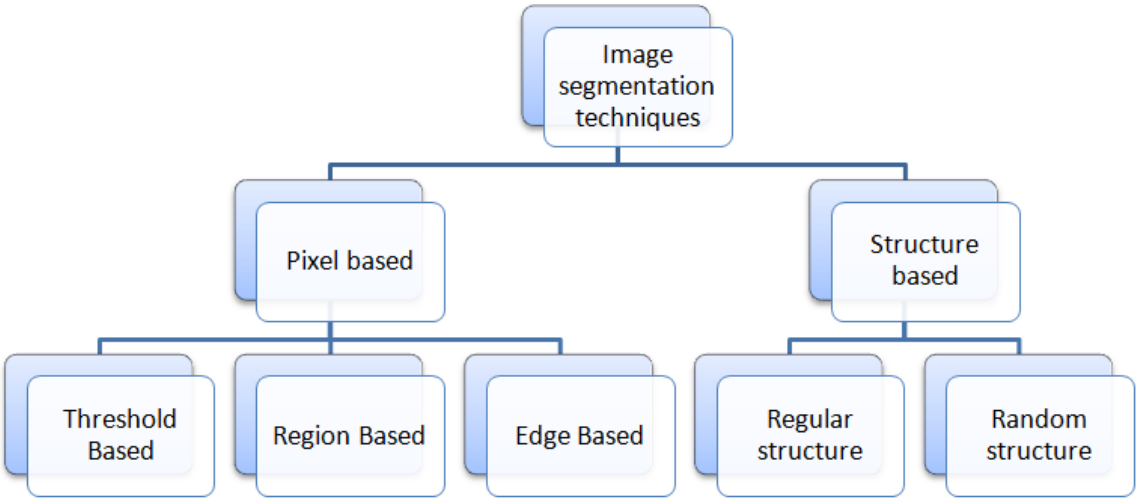

Fig 1 Classification of Segmentation Techniques

Thresholding Segmentation: Infected parts of plant can be identified using thresholding technique for segmentation. In this system of division an earlier learning about plant image is necessary. This procedure is liked to use to portion images that has lighter object part than background. Thersholding is of three sorts:

(i) **Global Thresholding**: This kind of thresholding utilizes one settled thresholding esteem T in light of which picture is segmented. To distinguish leaf illness by inspect the leaf we set fitting edge in view of which infected part is separated from remaining part .Consider a infected output image q(x,y).we take an esteem T as threshold value. Pixels of image having values more prominent than edge add to one fragment and pixels having values lesser than edge frame other portion.

(ii) **Variable Thresholding**: benefit of thresholding can change with the time over picture. This is of two sort:

(iii) **Adaptive thresholding**: thresholding estimation of picture relies on the area estimation of x promotion y pixel.

$$q(x,y)=\begin{cases}1 \; if \; p(x,y) > T\\ 0 \; if \; p(x,y) < T\end{cases}$$

(iv) **Multiple thresholding**: rather than single worldwide thresholding, various thresholding utilize at least two values at that point output image is obtained as many calculations or peaks of histogram are used to ascertain limit esteems.

$$\begin{cases}m \; if \; p(x,y) > T1\\ n \; if \; p(x,y) \leq T1\\ o \; if \; p(x,y) \leq T0\end{cases}$$

Edge based division: This procedure of division in light of discontinuities in picture. Edges in image tell about discontinuities in image. Edges have pixel values profoundly not the same

as neighbor pixel values. Different techniques utilized under edge based segmentation are as:

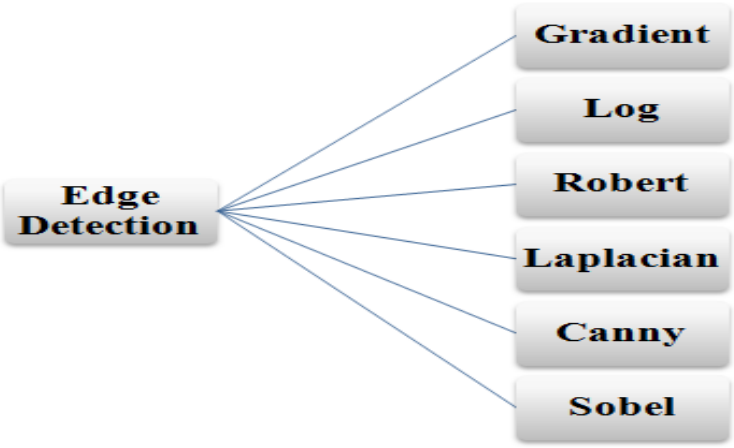

Fig 2 Edge based segmentation

(i) **Robert Edge Detector**: This procedure is utilized for handling images in 1963 by Lawrence Robert. This locator is simple but difficult to compute. This identifier rapidly recognizes regions that are edges.

(ii) **Sobel edge indicator**: This locator are proposed by Irwin sobel and have two masks, one is vertical and other is horizontal. In this 3*3 network is utilized as a part of which sobel indicator for every area is vector aggregate of orthogonal pair. Advantage of sobel administrators is that they create cover images. Sobel administrator produces thicker edges. This thicker edge generation is the main demerit of this detector.

(iii) **Canny Edge Detector:** This is most generally utilized edge locator and used to recognize large number of edges.

Region Based Segmentation: Region based division strategies are known as similarity based segmentation. In these procedures, objects that are similar are gathered together. Rather than edge based segmentation, Region based segmentation, boundaries are recognized. Two systems are utilized while considering region based segmentation.

(i) **Region Growing:** This technique considers the underlying pixel values in light of priori information based on application. Then based on that knowledge of initial pixel image is segmented into multiple regions. Calculation utilized is as:

(i) Let P(x,y) be the information picture to which segmentation strategy is applied and S(x,y) is the paired picture where introductory pixels are found. This esteem which is to be inspected for every area.

(ii) All the associated part of S are disintegrated in initial step

(iii) Compute binary image P, such that $P_T(x,y)=1$ if T(x,y)=True

(iv) Compute a binary image Q where Q(x,y)=1 and $P_T(x,y)=1$ and (x,y) is 8-associated part to starting pixel in "S" .

(v) Along these lines q sectioned districts are gathered.

(ii) **Region Splitting and Merging:** This strategy contains two stages: First parts the picture of plant into different districts having comparative qualities and afterward blending or joining the comparative adjoining locales.

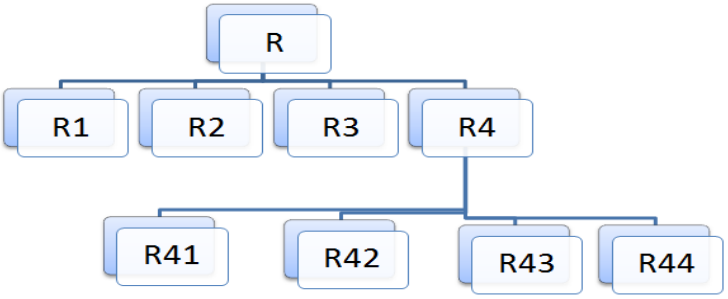

Fig 3 Region Based Segmentation

Calculation utilized for this is:

Give x a chance to be input picture and "P" be predicate to be assessed.

(a) Initially Ri is equivalent to X

(b) Each region is divided into four sections for which P(Ri)=False

(c) If for each P(Rj)=True at that point consolidate Ri and Rj

(d) Repeat step 3 until combining is impractical

Clustering Segmentation: Bunching is principally utilized for segmentation. In clustering, region that are similar in properties gather them in a solitary cluster. All pictures in one group are like each other are contrast from pictures of other bunch .Two predominantly utilized bunching strategies are K-implies, Fuzzy C-mean

(i) **K-mean Clustering**: Textured images use K-mean clustering. K-mean clustering calculation is produced by Macqueen (1967). In this strategy informational collection of n objects x1,x2,… ..xn is separated into K clusters . K centroids are characterized for each cluster. K mean capacity is as:

$$J = \sum_{J=1}^{K} \sum_{L=1}^{n} ||x_i - C_j||$$

Where K signifies number of clusters and C is centroid of group and Xi is an i^{th} object.

Steps required in this calculation:

(a) Define Centroid

(b) Find separate amongst centroid and data object.

(c) Locate that group to which distance is least.

(d) Again ascertain the new mean of cluster

(e) Repeat the progression till predefined edge is met

(ii) **Fuzzy C-mean**: In this clustering technique, image is thought to be fuzzy set. Objective capacity for Fuzzy C-mean is:

$$J = \sum_{i=1}^{c} \sum_{j=1}^{N} U_{ij}^{m} |x_i - c_j| \quad 1 \leq m \leq a$$

Here m is a real number which is greater than 1

C means the number of clusters

Uij is level of participation xi in cluster j

Xi-Cj is Euclidean distance amongst centroid and other data object.

Conclusion

Different segmentation methods like thresholding, region based, and edge based segmentation techniques are examined in this paper. These strategies are used on various images in light of use prerequisite. Thresholding is favored because of basic and quick processing. Edge based is less favored in light of the fact that it required edge linking as preprocessing. In future work, we will attempt to change one of existing segmentation technique to show signs of improvement after effects of segmentation in type of speed and time.

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