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## RESEARCH ARTICLE

### Segmentation Technique for Soybean Leaves Disease Detection

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#### Abstract

Soybean is a very essential crop which plays a key role in the complete food chain. But due to the different reasons like diseases, pest attack & suddenly changing weather conditions, the productivity of soybean crop decreases qualitatively and quantitatively. To minimize the loss in productivity of soybean crop the early stage disease detection is required preventive measure. An application of Image processing technique, in the field of agriculture is emerging exponentially which is ranging from the field management to crop disease detection. This paper presents study of soybean leaves colored images for disease detection by inspecting the visual symptoms of particular disease by using segmentation. Soybean is prone to many diseases and traits. To control these diseases farmers are experiencing so much toughness while making the one disease control policy to another. Always insecticides are not more efficient to control diseases, as the diseases on soybean leaves causes major loss in production and economic loss in the soybean crop. Hence to take the corrective action, digital image processing technique is used to detect diseased leaves. This article provides an advanced technique to detect the diseased leaves and normal leaves of soybean crop. In this work the kinds of methods are used to observe and learn the soybean leaves diseases using digital image processing. For image segmentation phenomenon, in this article sobel filter, canny edge detector, prewitt filter, k-means clustering techniques are used. By Using above segmentation techniques we can analyze the diseased crop or normal crop in better way.

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## INTRODUCTION

### I.Introduction

The image processing technique in nowadays is rapidly going to be used in agricultural field. There might be use of image processing in electrical motor which is for irrigation purpose i.e. machine vision, disease detection of field crop which is our application, also in field management. The digital image processing in this case is going to be used in agricultural application for this particular purpose. In general cases the pests' attacks or symptoms of diseases are present on the plant leaves or stems of the plant. Hence it is beneficial that the recognition of soybean plant leaves and searching the the attack's of pest and symptoms of the diseases act as a key role in successful production of soybean crops [2].The quality and quantity of soybean crop is completely dependent on the type of soil, seed, organic fertilizers, chemical fertilizers as well as inter-relation between them. Hence, proper management of all the contents is vital for the desired productivity of soybean crop. But if we concentrate only to enhancing the productivity by using fertilizers and use of pesticides, without understanding the bionomical effects due to this degradation of environment happens. Therefore we have to find the solution that should not made any adverse

consequences while enhancing the productivity in a sustainable manner [8]. To avoid the use of pesticides while controlling the pest by means of biological method is now preferred. So the agricultural research are aimed the direction towards the enhancement in productivity, quality of food in minimum expenditure with maximum profit. The previous and current scenario is the unavailability of automatic algorithm which detects the pest attack on plant precisely and periodically. Now current situation is the observation of pest attack on plants, to see the visual symptoms of diseases on soybean leaves but this method required so much time. So by means of advanced digital image processing in which color, texture, intensity of digital image are considered for the development of algorithm for the classification of soybean diseases autonomously[5]. The complete work begins with capturing the images, after that filtering the images and then segmentation. Filtration is the first step of the image processing .Then segmentation is done on the basis of different features obtained from the preprocessed image.

## II.Methodology

In our experiment the 1000 image of soybean leaves are taken for preparation of image database. The images are captured from the farm of soybean using 5 MP cameras. There are some kind of noise in the raw images are present which are directly captured.Hence we had used the noise filter to remove unwanted noise. Image histogram is created since it gives the intensity graph of given image.

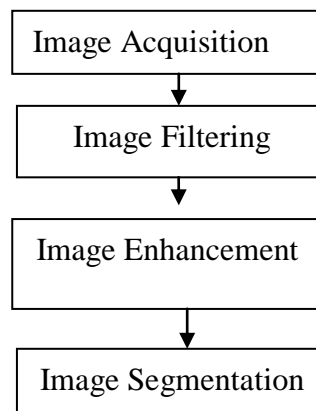


Fig.1 Proposed system

The following are the sequence of complete procedure

- 1) Acquisition of image
- 2) Pre processing of image
- 3) Segmentation of image

## III.Image Acquisition

In this stage image is completely raw material for the further process, so we have done the filtering of image, removal of noise, image enhancement. In this experiment, about 1000 samples of images are used for database. Images are taken from farm of soybean crop. The Leaf images are captured using 5 MP cameras and stored in RGB format for further processing. The leaves images are in JPEG format.

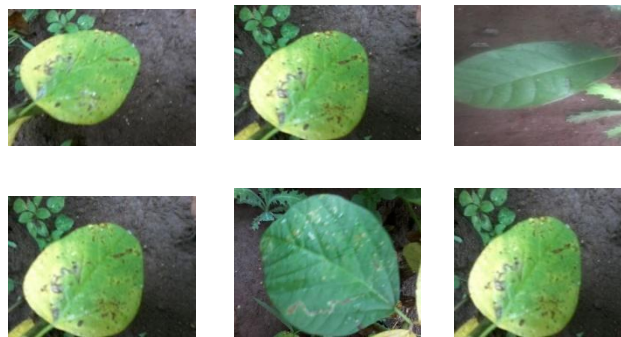


Fig: 2 Samples of leaves

### A. Preprocessing

Removal of noise can be done with the various filter techniques; rank filter is good for the pest image. Rank filter is nonlinear filter, which gives the line shape, edge and other information with high accuracy and precision [7]. Preprocessing is an important step in which raw images are processed for further processing. In this stage intensity transformation skew and noise removal using filter, normalization, Image enhancement, histogram equalization etc. is done [6]. The preprocessing techniques used is shown in Fig. 3 as a block diagram schematic which explains the proper image preprocessing



Fig: 3 Block diagram schematic

### B. Image enhancement

Image enhancement is a subfield of image processing and consists of techniques to modify the appearance of an image, to point out the important characteristics features of an image, and to make this image more accurate for use in a particular application.

## IV. SEGMENTATION

Segmentation is a technique which made the part wise segments or groups of its original image. The subdivision process continues till the desired result doesn't get it. It means segmentation should stop the process when the objects of interest in an application have been differentiated. Segmentation method is depends on two basic properties of image for monochrome images which are image intensity values: discontinuity and similarity. In the previous class, the way is to divide an image based on changes in intensity, such as edges. The basic approach in the second class is based on dividing an image into regions that are similar according to a set of predefined criteria [14]. When the segmented parts or objects are clubbed together then they are collectively reconstruct the original image, since these are the features extracted from given original image. Every pixel in each point of given image is completely related with regarding to certain characteristics features, color, intensity or texture [15].

In this article we used the following methods

- 1] Edge detection
- 2] K-means clustering

Depends on intensity values:

- 1) Discontinuity (edges Detection)
- 2) Similarity (Thresholding, region growing)

#### 1) Discontinuity (Edge detection)

##### (A) Sobel's operator

Sobel operator works on first order derivatives and made the image approximations digitally by differences. The sobel operator computes the gradient by using the discrete differences between rows and columns of a 3\*3 neighborhood [7]. The Sobel edge filter is worked on convolution of the original image with a small, separable, and integer valued filter in both direction horizontal & vertical. Hence it is less costly. But on other way, for high frequency variations in the images the gradient approximation can not produces good result. Sobel operator makes some inaccurate approximation of gradient.

Sobel masks

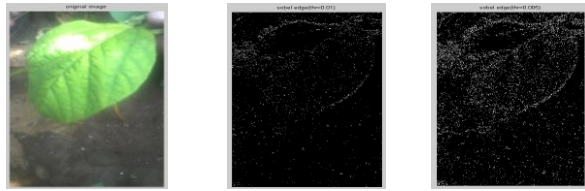
-1	-2	-1
0	0	0
1	2	1

Gx

-1	0	1
-2	0	2
-1	0	1

Gy

Where  $G_x$ =horizontal mask  
 $G_y$ =vertical mask



Original image      sobel image      sobel image (thr=0.09)

Fig: 4 Sobel edge filtered images

**(B) Prewitt operator**

For the masking purpose the prewitt edge detector uses the differentiation  $G_x, G_y$  for digital image approximation. In this filter the parametric units of this function are similar with the sobel edge filter parametric units. The computation of convolution process while implementing it is slightly simpler than the sobel edge detector, but it tends to produce somewhat noisier results [7].The Prewitt operator is worked on the basis of convolution of the original image with a mask which is small, separable, and integer valued filter operated in both direction horizontally and vertically. Hence relatively less costly in terms of convolution computations with compared to others. In prewitt edge filter the points of gradient vector are directed towards the largest possible increasing intensity at every point of image and the length of the gradient vector correlated with the rate of change in that direction. This gives the analyzing result of this edge detector at the point of image where the region of constant image intensity as zero vectors and at a point on an edge is a vector which points across the edge, from darker to brighter values.The prewitt operator masks for horizontal and vertical directions are given below.

-1	0	1
-1	0	1
-1	0	1

-1	-1	-1
0	0	0
1	1	1

$G_x$

$G_y$

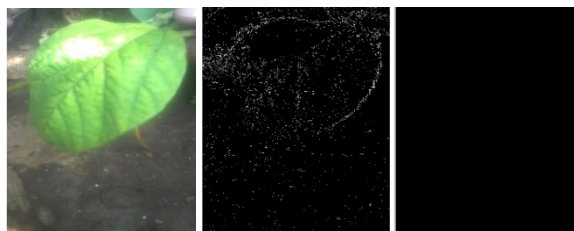
Where

$G_x$ =horizontal mask

$G_y$ =vertical mask

**(C) Canny edge detector**

Canny edge filter is the detection techniques which give the more accurate and reliable edge than the sobel, prewitt edge operators. The optimality of canny edge filter is good because it uses three criterion for edge detection and after that the complete simple process for implementation, therefore it becomes popular filtration method [11]. The edge filter is very widely used method to the image segmentation problems. The canny edge filter algorithm work as the detection of points while doing this it takes abrupt changes at gray levels [16]. This canny edge filter operates on the local maxima of the gradient of  $f(x, y)$ . The gradient is calculated by means the differentiation of a Gaussian filter. This filter algorithm uses double Thresholding for the edge detection [5].



Original image      prewitt image      prewitt (thr=0.09)

Fig: 5 Prewitt edge filtered image

The pixels which has stronger edge than the threshold value high these are named as strong and those pixels which has weaker edge than the low value of threshold are get suppressed and the edge pixels between these two high & low thresholds are named as weak. In this case it uses two thresholds strong and weak for the detection of edges. The complete procedure of canny edge filtering algorithm can be made to 5 different stages:

*Stage 1* For removal of noise the application of Gaussian filter are used to make the smooth image.

*Stage 2.* Solve the gradients of the image for intensity Gradient.

*Stage 3.* To know the rid of spurious response in edges the application of non-maximum suppression are used.

*Stage 4.* For finding the potential edges double Thresholding are used.

*Stage 5.* For the tracking of edge the weak edges are disconnected from strong edges, this is done by means of Hysteresis and then selection of this edge is final.



original image      gray image      canny image

Fig: 6 Canny edge filtered image

## 2) K means clustering (Similarity)

K-Means algorithm is an unsupervised clustering method which is used for the classification of the input images into different classes of images on the basis of their inherent distance from each other. Clustering is the process which made the groups of sets those are similar or near about similar kind of physical or little part images. These similar sets formed are called as clusters. K-means algorithm made groups of bunches into different classes, Hence according to algorithm the data presents in the same class have high degree of similarity with respect to another data in same class but so much dissimilar to the objects in different clusters [12]. In similar way k- means clustering segmentation forms the K number of groups for the classification of objects which is based on different attributes or features. K-means clustering forms the groups using data and cluster centroid by minimizing the sum of squares of distances between data and the relative cluster centroid. This paper presents segmentation algorithm approach using K-means clustering segmentation based on color and intensity features from the soybean leaves images. K- Means clustering segmentation is made in 2 stages. In pre stage, the pixels are segmented on basis of their color and spatial features.

Then, the clustered segments are substituted to a certain number of regions like i, ii, iii etc [16]. Since k- means clustering uses two stage process. It is beneficial for increment in the segmentation computational efficiency which because it avoid the feature extraction of each pixel in the soybean image of leaves. K- Means clustering algorithm method considered that a vector space is formed them from the data features. K- Means clustering is a non-hierarchical technique and it gives a simple and easy approach for classification of a given dataset. As K-means algorithm is iterative, therefore it is applied only on sub group of original image rather than to full original image and it can be called as unsupervised training areas [12].

### Procedure

Stage 1: First it read the Original Image

Stage 2: Conversion of Original Image from RGB Color Space to L\*a\*b\* Color Space

Stage 3: Classification of the Color segments in 'a\*b\*' Space by use of K-Means Clustering

Stage 4: Then label the each pixel in the Image from the obtained results of K –means clustering.

Stage 5: Making of Images that Segment the Hue (H) & E Image by Color.

Stage 6: Then Nuclei get segmented into an individual Image

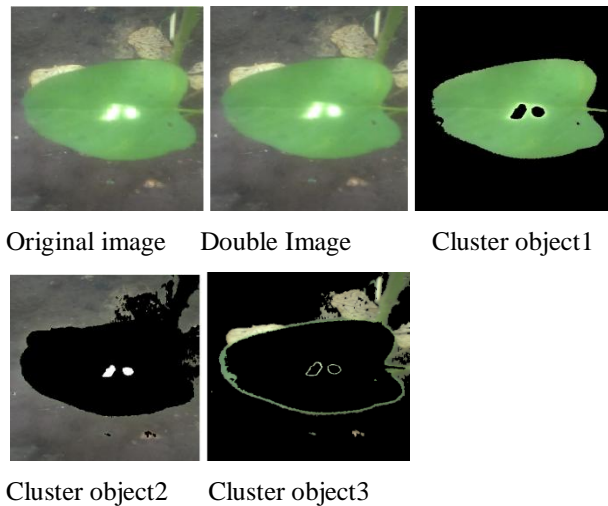


Fig: 7 K-means clustered images

## V.CONCLUSION

The image preprocessing which is done in our experimentation is image enhancement, histogram equalization, histogram of image. The image segmentation that is edge detection, K-means clustering is successfully completed. The Segmentation for disease detection on soybean leaves has been done and after this the good segmented groups are given for the next process which the classifiers in our application. Hence it is the middle stage of digital image processing and is very important stage while it might be in application of classification or pattern recognition. Image segmentation is a vital part of the processing system, the segmented parameter which decides the quality of result of the final system, here disease detection. For this purpose different segmentation techniques has been used. Sobel and prewitt edge detector had given the output in that images which are close to each other. Prewitt edge detector is simpler to implement. Sobel edge detector has better smoothed curves which are more preferable because noise suppression is more important while dealing with derivatives. The prewitt and sobel operator are good for this application but the canny edge detector had given better result than both of above. Among all the segmentation techniques used for the given application, the K-means clustering had given the best result for the detection purpose. So that we can select K-means clustering for next process such as feature extraction and after that disease detection.

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