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Flower Recognition System Based On Image Segmentation Algorithms

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Abstract: ***Image segmentation is now established as the robust technique in image processing. Important features from image are extracted by using image processing tool. In order to extract important features from an image, segmentation provides a rapid solution. Digitizing the image and differentiating it into multiple segments to outline region of interest is known as image segmentation. Segmentation algorithms are differentiated based on colour, gray values or textures of an image are discontinuity and similarity. In this article ,we present different segmentation algorithms along with their experimental results.***

Keywords*: Image processing, Image segmentation, Segmentation algorithms.*

I. INTRODUCTION

Image processing is the important step in signal processing. It requires input as an image. It processes an image to produce an output. The input image is treated as a 2D signal and processed to obtain particular output. The processed output can be an image or parameters related to the input image. Image segmentation is an important part in modern computer vision applications[3]. Digitizing the image and differentiating it into multiple segments to outline region of interest is known as image segmentation.. The region of interest can be pixel grayscale, color, texture, etc. [7]. Segmentation algorithms are differentiated based on colour, gray values or textures of an image are discontinuity and similarity. Discontinuity is a technique which deals with changes in intensity values of the image. Changes in an intensity value correspond to portioning of image. Detection techniques such as point, line and edge are the categories of segmentation based on discontinuity. Points, lines and edges are basically high frequency components hence it needs mask which are basically high pass. Hence, the masks used for point, line and edge detection have the properties of the high pass mask. Similarity is a technique based on dividing image into distinguish sections. Threshold values are set to divide an image into distinguish sections. Thresholding and region based segmentation are the two main categories of segmentation based on similarity. This article consists of in-depth analysis of quadtree & merge algorithm, seed region growing algorithm, global thresholding algorithm, canny edge detection algorithm and k- means clustering algorithm.

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II. QUADTREE & MERGE ALGORITHM

A region-based image segmentation is used in Quadtree and merge algorithm.

The steps of quadtree and merge based segmentation algorithm -

Stage 1 - Acquire an input image.

Stage 2 - Transform the colour image to grayscale image. In colour images, each pixel is composed of red, green and blue values. Hence colour image is converted into grayscale by forming a weighted sum of the red, green and blue components.

Stage 3 - Define a threshold value to segment an image.Generally, threshold value is chosen depending on gray level variations in an image and expected output from system.

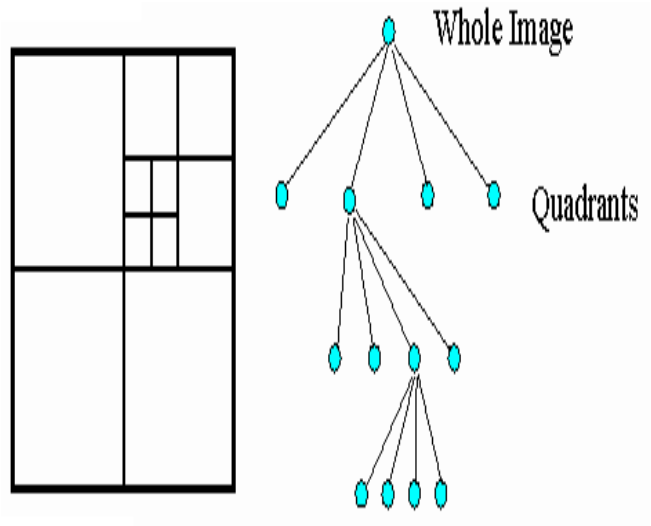

Figure 1:General concept of quadtree algorithm[7]

Stage 4 - Find out largest gray pixel difference in the image. For the first iteration, whole image is considered as study area. Hence, from whole image, maximum pixel gray difference is found out.

Stage 5 - If the threshold value is smaller than difference, which shows that pixels are having different gray level values in the region, segmentation is applied. Complete image is converted to four equal parts. Each part is considered as study area and Stage 5 is applied to each part.

Stage 6 - If the threshold value is larger than difference, segmentation is ended.[6]

Stage 7 - Define criteria for merging to reduce Oversegmentation due to quadtree. Mean and standard deviation are used to define criteria for merging.

Stage 8 - Merge the regions according to pre-defined criteria. An eight neighbourhood connectivity approach is used to merge the regions.

Stage 9 - Perform morphological operations onto an image.[13] Final result of quadtree & merge algorithm is shown in Figure 5.

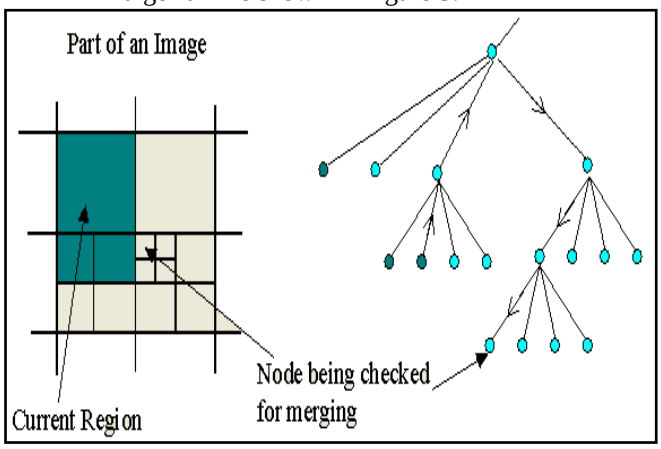

Figure 2: Concept of merging algorithm

III. SEED REGION GROWING ALGORITHM

A region-based image segmentation is used in seed region growing algorithm [2].

The steps of seed region growing segmentation algorithm-

Stage 1 - Acquire an input image.

Stage 2 - Transform the colour image to grayscale image.

Stage 3 - Select the seed points to initialize segmentation. The ginput command is used to select seed points. The ginput command allows user to enter seed point graphically by using mouse and curser.

Stage 4 - Select the threshold value for region growing. Generally, threshold value is chosen depending on gray level variations in an image and expected output from system.

Stage 5 - If the absolute difference between original image & seed points is less than threshold then grow region. A four neighbourhood connectivity approach is used to grow region. Hence, by considering seed point as centre pixel, according to four connectivity approach region is grown.

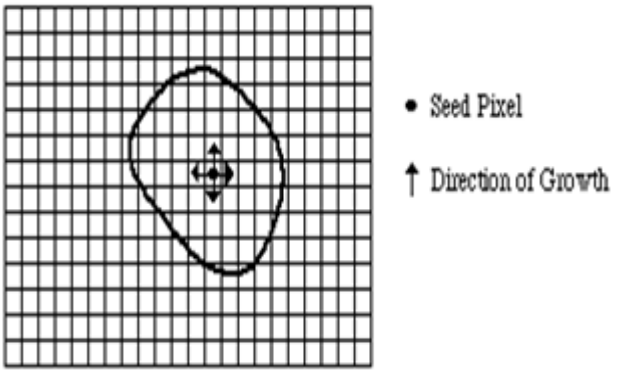

Figure 3: Seed region growing algorithm concept[13]

Stage 6 - If the absolute difference between original image & seed points greater than threshold then stop process.

Stage 7 - Perform morphological operations onto an image.[13] Final result of seed region growing algorithm is shown in Figure 5.

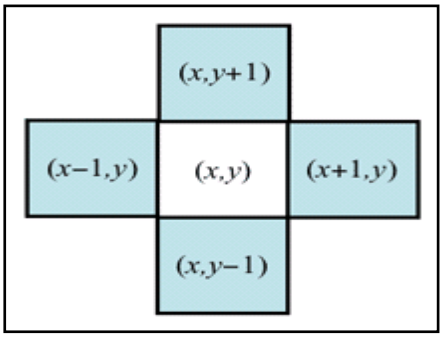

Figure 4: General concept of four neighbourhood connectivity

IV. GLOBAL THRESHOLDING ALGORITHM

In image segmentations, Thresholding is used to produce regions of uniformity within the given image based on some threshold criteria T. Global thresholding is given by,

$$T = T\{f(x, y)\}$$

It simply means that partitioning the image histogram by using single thresholding function T.

The steps of global thresholding algorithm algorithm-

Stage 1 - Acquire an input image.

Stage 2 - Plot histogram image.

Stage 3 - Choose threshold T based on histogram.

Stage 4 - Using the threshold T, segment image into foreground(object) and background.Final result of global thresholding algorithm is shown in Figure 5.

V. CANNY EDGE DETECTION ALGORITHM

Canny edge detection algorithm is a first derivative edge detector coupled with noise cleaning.In this method, we first smoothen the image using a Gaussian low pass filter and then take the first derivative.[14]

The steps of canny edge detection algorithm-

Stage 1 - Acquire an input image.

Stage 2 - Noise present in an image is removed by using smoothing operation. Here, Gaussian filter is used for image smoothing.

Stage 3 - Image gradient is found by using sobel operator. Image gradient gives the information of strength of edges in an image.

Stage 4 - All the blurred edges in an image are converted into sharpe edges.
Stage 5 - Thresholding is performed to remove false edge points present in an image.[14] Final
Stage 6 - result of canny edge detection algorithm is shown in Figure 5.

VI. K-MEANS CLUSTERING ALGORITHM

The steps of k-means clustering algorithm-
Stage 1 -Acquire an input image.
Stage 2 -Define the value of clusters k.
Stage 3 -Initialize the training samples to partition the data into clusters k.
Stage 4 -Take each sample from the data and find its distance from centroid
Stage 5 -Update the cluster by adding new sample
Stage 6 -Change the centroid of cluster after addition of each new sample from the data.
Stage 7 -Repeat stage 4,5 and 6 till the convergence is achieved[14]. Final result of k-means clustering algorithm is shown in Figure 5.

VII. EXPERIMENTAL RESULTS

Figure 5: (a)original image. (b)output of quadtree and merge.(c) output of seed region growing. (d) output of global thresholding (e) output of canny edge detection. (f) output of k-means clustering.

Table 1: Comparison of all algorithms

Name of the algorithm	Accuracy
Quadtree and merge	40-50%
Seed region growing	75-80%
Global thresholding	60-70%
Canny edge detection	85-90%
K-means clustering	95%

Table 1 shows the comparison of all algorithms used for flower recognition in terms of accuracy. Quadtree and merge algorithm has the least accuracy of 40-50%.
It means this algorithm is not able recognize only flower from is background. Seed region growing algorithm, Global thresholding algorithm and Canny edge detection algorithm performs reasonably well and are able to recognize flower from background but some part of background is also detected along with foreground(flower). K-means clustering algorithm gives the best results and detects only flower and no part of background is detected.

VIII. CONCLUSION

In this article, quadtree & merge algorithm, seed region growing algorithm, global thresholding algorithm, canny edge detection algorithm and k- means clustering algorithm are analyzed. The quadtree & merge algorithm and global thresholding algorithm is mostly suitable for simple images. Also, quadtree & merge algorithm requires that image should be integer power of two. Seed region growing algorithm performs reasonably well for complex images. Canny edge detection algorithm and k-means clustering algorithm gives the accurate segmentation results also they have better noise immunity.

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