Efficient Technique in Image Segmentation

Huda A. Ahmed

Basrah univ.- College of Science

Computer Science Dept.

Khawla H. Ali

Basrah univ.- College of Education

Computer Science Dept.

Abstract

Image segmentation is a very important step in image processing. Extracting useful information from an image is the goal of image segmentation.

In this paper, simple images was taken scanned in gray scale (different degree of gray scale) image type, Tiff file format, and 100 dpi resolution, then applied Low_Pass filtering to obtain a smoothed images, followed by implement Sobel operators to edge detection that considered the main base of this technique. Experimental results appear the efficiency of this algorithm in image segmentation for all images that taken in research.

1- Introduction

Computer vision can be looked upon as an information processing activity that involves construction of representation at successive levels of abstraction[1].

A Segmented image, Produced by grouping the elements of an input image into semantically entities, is generally considered to be the highest domain_independent abstraction of the input image. Typically, A Segmented image is the input to high level_vision which utilizes domain_specific Knowledge to interpret and analyze the image contents.

Image segmentation is the process of dividing an image into regions or objects. It is the first step in the task of image analysis. Image processing displays images and alters them to make them look "better" while image analysis tries to discover what is in the image[2,3].

This mean that image segmentation is a process of partitioning an input image into disjoint subregions which individually satisfy the properties of homogeneity and connectivity. A region is considered homogeneous if all pixels are homogeneous with respect to one or more pixel attributes such as intensity, texture, color, range, etc. A region is considered connected if there exists a connected path between any two pixels within the region[1].

The basic idea of image segmentation is to group individual pixels together into regions if they are similar. Similar can mean they are the same intensity(shade of gray), from a texture, line up in a row, create a shape, etc.

There are many techniques available for image segmentation, and they vary in complexity, power, and area of application[3,4].

The level to which this subdivision is carried depends on the problem being solved.

2- Image Segmentation

The goal of image segmentation is to partition an image into mutually exclusive and exhaustive regions. Each region spatially contiguous and the pixels within the region are homogeneous with respect to a predefined homogeneity criterion. Some widely used criteria for homogeneity include values of intensity, texture, color, range, surface normal and surface curvature(s).

Images of real_world scenes contain objects of varying sizes and objects viewed at different distances and from varying viewpoints resulting in image features at many different scales. Choosing the correct scale for analyzing the image features is critical for image segmentation and subsequent scene analysis.

That is, Segmentation should stop the objects of interest in an application have been isolated. In fact, effective segmentation rarely fails to load to a succeful solution. For this reason, considerable care should be taken to improve the probability of rugged segmentation.

Segmentation algorithms for monochrome images generally are based on one of two properties of gray_level values:- discontinuity and similarity. In the first catecagory, the approach is to partition an image based on abrupt changes in gray level. The principle approaches in the second category are based on thresholding ,

region growing, and region splitting and merging the concept of segmenting an image based on discontinuity or similarity of the gray level values of (time varying) images[3,5].

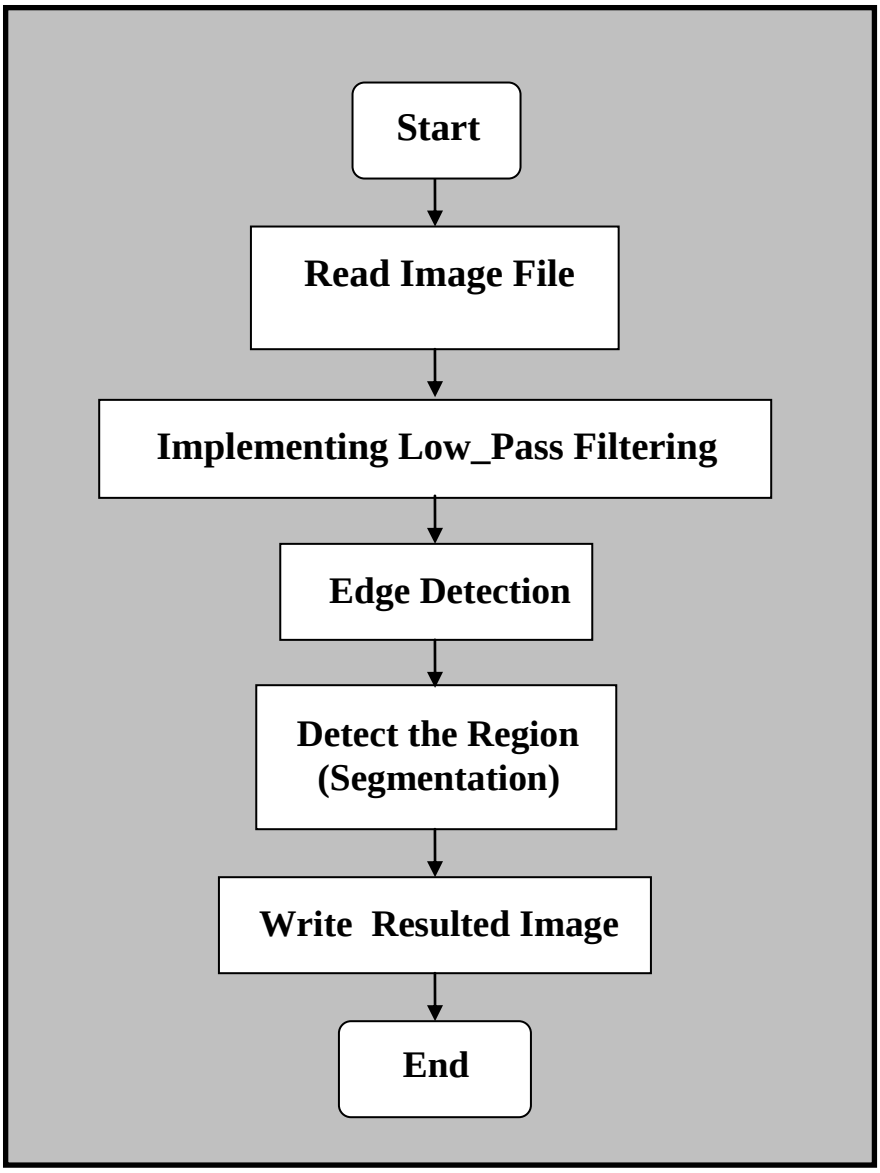
3-The previous techniques in Image Segmentation

One of the most simple and most often used is histogram_based image segmentation. It uses histogram to select gray_levels for grouping pixels[2,6]into regions. In a simple image there are two entities:- the background and the object. The background is generally one gray level and occupies most of the image. Therefore, its gray level is a large peak in the histogram. The object or subject of the image is another gray level, and its gray level is another small peak in the histogram.

There are another techniques that use the edge in the image, grow regions using the gray shades in an image, and used both the edges and gray shades[3].

4-The Flowchart of current technique

Fig.(1) showing the flowchart of image segmentation technique that used in the research.



Fig(1). The Flowchart of Image Segmentation technique

In the following the details of steps of above flowchart:

*** Read Image file**

Simple images are taken in this research, scanned under specific features they are:- gray scale, Tiff format file, and the resolution of image is 100 dpi , at last the image file must be uncompressed to process it.

- **Implementing Low_Pass Filtering**

Filtering is also a common concept[3,7] used in image processing, Low_Pass filters pass low frequencies and stop high frequencies. In the same manner, we can filter the spatial frequencies images as in fig.(2).

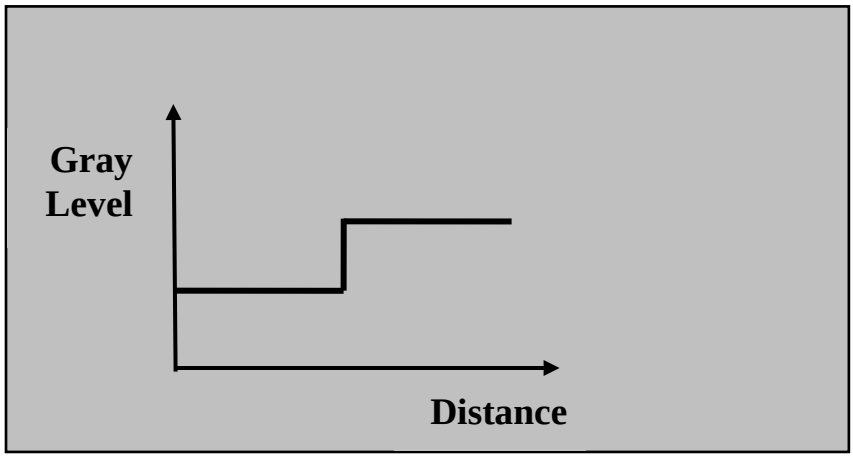


Fig.(2) The spatial frequency images

So Low_Pass filtering smoothes out sharp transitions in gray levels and remove noise. Fig.(3) shows two Low_Pass filter convolution masks convolving these filters with a constant gray level area of an image will not change the image.

1/6	*	0 1 0 1 2 1 0 1 1
1/9	*	1 1 1 1 1 1 1 1 1
1/10	*	1 1 1 1 2 1 1 1 1
1/16	*	1 2 1 2 4 2 1 2 1

Fig.(3) Low_Pass filter convolution mask

The next two figures fig.(4-A) and fig(4-B) show numerical examples of how a Low_Pass filter affects an image[2]. Fig.(4-A)appear an image segment with low spatial frequencies. The image segment changes gray level once, but with a sharp transition.

150	150	150	150	150
150	150	150	150	150
150	150	150	150	150
150	150	150	150	150
150	150	150	150	150
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1

A

150	150	150	150	150
150	150	150	150	150
150	150	150	150	150
150	150	150	150	150
125	125	125	125	125
25	25	25	25	25
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1

B

Fig. (4) A- An image segment with low spatial frequencies.

B- The result of applying Low_Pass filter mask in fig.(3) with the image segmented in fig.(4-A).

Fig.(4-B) shows the result of convolving the first 3*3 Low_Pass filter mask of fig.(3) with the image segment given in fig.(4-A). The high and low gray level rows remain, but the transition differs. The Low_Pass filter smoothed the transition from one row to three rows of pixels.

- **Edge Detection**

The most common way to look for edge detection is Sobel operators[3,8]. These operators uses to compute the sum of products of the coefficients with the gray level contained in the region encompassed by the mask 3*3.

That is the response of the mask of any point in the image is

$$R=W_1Z_1+W_2Z_2+...+W_9Z_9$$

= $\sum_{i=1}^{9} W_i Z_i$, **Where Z^s are gray level values so the weights W of the Sobel operators are explained in fig.(5).**

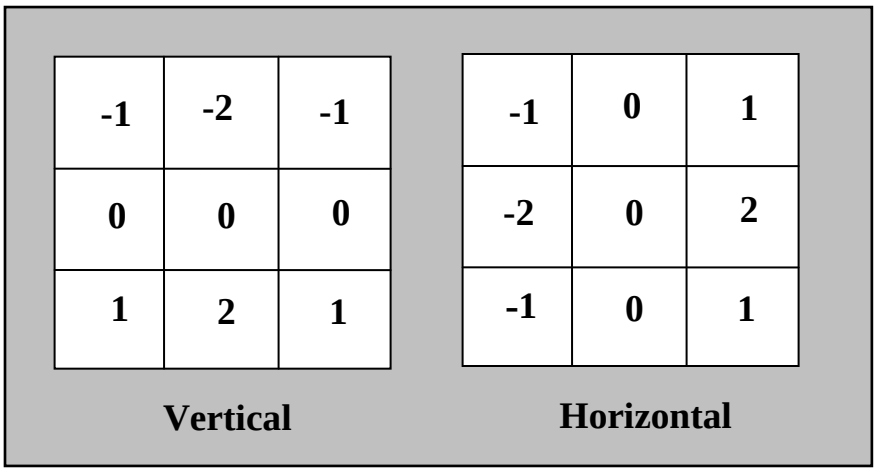
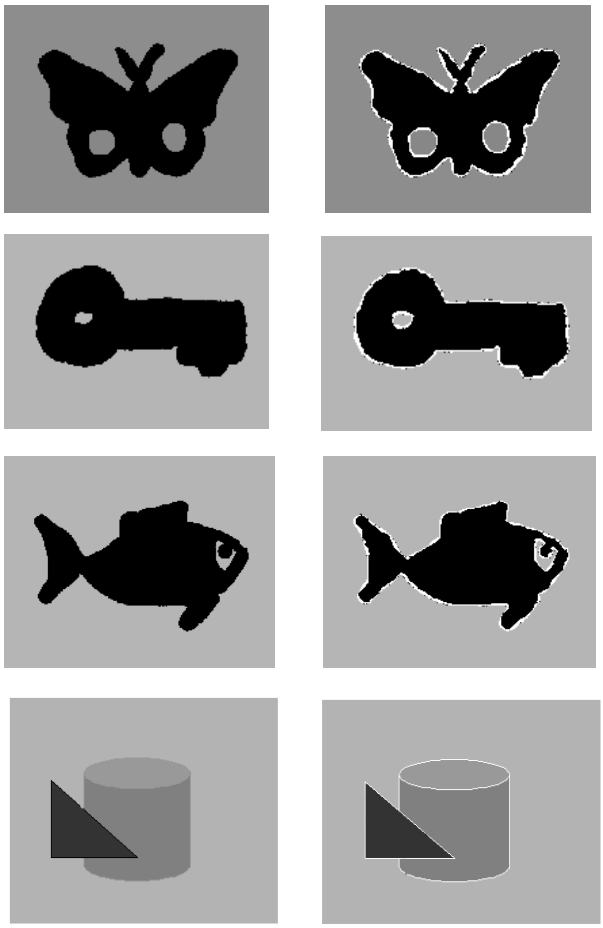


Fig.(5) Sobel Operators

So the Sobel operators was implemented on the images that taken from the scanner of Tiff file format, gray scale image type, and the resolution is 100 dpi ,this middle resolution takes a reasonable size of image and helps to extracts a good results.

- **Detect the region (Segmentation)**

After the Sobel operators was applied on the image, and edge detection of the objects in the image, segmentation was easy performed by detect the regions that contains of the edge detected objects. Fig.(6) explained in (A) part the original input images, and in (B) part the results images after segmentation.



(A) (B)

Fig.(6) (A) Original Images

(B) Segmented Images

From the fig.(6)(A) notes that all the images have the different degree of gray scale and the followed algorithm don't changes the status of this images and its efficient to segmented all images with any degree of gray scale.

- **write Resulted Images**

This steps includes appearing (writing) the final resulted images on a screen, This images shows clearly how the internal objects in that images are segmented by detected all of it's edges and regions with details, as that explained in fig.(6-B).

5- Conclusion

This paper considered the use of detect line regions for an important low level computer vision problem, called image segmentation. Simple images was taken in a Tiff file format, gray scale images type (values range from 0 to 255). The above experiments positively demonstrated the utility of image segmentation. Performance was good in gray scale images, but we can't apply this technique on a binary images(values only 0 or 1) because using Sobel operators that gives a good results if applied on gray scale images.

References

[1] Suchendra M. Bhanadarkar & Jean. M. "A hierarchical neural network and its application to image segmentation", Mathmatics and computer in simulation, 41,337-355, 1996.

[2] Dwayne Philips. " Image processing in C" , R&D publication, Inc., Lawrence, USA, 1994.

[3] Rafael C. Conzalez & R. E. Woods. " Digital image processing", Addison_Wesley, NewYork, 1992.

[4] Ed. K.& S. Fu.& A. B. "Picture processing in pattern recognition theory and application", Whinston, Noordhoff international publishing, 1977.

[5] Bhanadarkar S.M.& Huaiynan Y."Image segmentation using evolutionary computation", IEEE transactions on evolutionary computation, Vol.3, No.1, April, USA,1999.

[6] Starck J.L. & Mutagh F. & Bijaoni A."Image processing and data analysis", Cambridge university, London,1998.

[7] S. Basu, Image segmentation by semantic method, Pattern Recognition, pp. 497-511, 1987.

[8] Scott E. Umbaugh. "Computer vision and image processing: A practical approach using CVIP tools", Prentic_Hall, Inc., A Simon& Schuster company, Upper Saddle River, NJ 07458, 1998.

تقنية كفوءة لتقطيع الصور

هدى عبد الرحيم أحمد
جامعة البصرة–كلية العلوم
قسم علوم الحاسبات

خولة حسين علي
جامعة البصرة–كلية التربية
قسم علوم الحاسبات

الملخص

تعتبر عملية تقطيع الصور كخطوة أساسية مهمة جداً في مجال معالجة الصور، و إن الهدف الأساسي لعملية تقطيع الصور هو إستخلاص المعلومات المفيدة من الصورة(فصل الكيانات المتكونة منها الصورة).

أخذت في هذا البحث مجموعة من الصور البسيطة بدرجات رمادية مختلفة والتي تم مسحها في الماسح الضوئي بمواصفات خاصة هي (دقة المسح ١٠٠ نقطة/انج و من نوع تدرجات المستوى الرمادي و خزنت بملف صورة من نوع Tiff) ، خضعت هذه الصور الى تنقية بطريقة المرور_البطيء Low_Pass Filter بجعل الصورة اكثر وضوحاً ،ثم تخضع الصورة الناتجة الى عملية اكتشاف الحواف عن طريق تطبيق معاملات سوبل (Sobel Operators) عليها حيث تعتبر هذه الخطوة هي أساس للخوارزمية. أظهرت الصور الناتجة كفاءة هذه التقنية في تقطيع الصور وعلى مختلف درجات المستوى الرمادي للصور.