Edge Based Segmentation in Medical Images

B. Karthicsonia, M. Vanitha

Abstract: Image segmentation is the method to fragment a given image into a number of Regions or objects. The level of detail to which the partition is carried depends on the problem being solved. Edge detection is mostly used techniques in digital image processing. Edge detection will preserve the structural properties of an image and filter out unwanted data. In this paper, Edge detection methods such as Sobel, Prewitt, Robert, Canny, and Laplacian of Gaussian (LOG) are used. These methods are used in image segmentation. Edge detection can be enhanced by combining with denoised image. Wiener filter, Gaussian Filter and Median Filters are used for noise reduction. The results of various methods are analyzed by implemented in MATLAB.

Keywords: Image processing, Image segmentation, Sobel method, Prewitt method, Canny method, Robert method.

I. INTRODUCTION

Partitioning the image into set of pixel is called segmentation. The main objective of image segmentation is to represent an image with uniqueness, to make it easier to analyse much more informative. The segmentation is based on grey level, colour, texture, depth or motion of an image. The output of image segmentation is a set of segments of whole image. The pixels with similar characteristics are grouped such as colour, intensity, or texture. The applications of image segmentation are:

a) Medical imaging
b) Object detection
c) Face, finger and iris recognition
d) Traffic control system
e) Computer vision

II. EDGE BASED SEGMENTATION

Image Segmentation Algorithms are mostly based on two basic properties of intensity profile: Discontinuity based segmentation and similarity based segmentation. In the Discontinuity based segmentation technique, segmenting an image based on sudden change in intensity. Discontinuity mainly concerned with identification of isolated points, lines and edges of an image. Edge detection is mostly used techniques in digital image processing. Two fundamental steps in performed in edge detection: First, Image smoothing done with help of various filtering techniques then edge point is detected. Edge detection Techniques are:

A) The Robert Cross Method
B) The Prewitt Method
C) The Sobel Method
D) The Laplacian of Gaussian Method
E) The Canny Method.

Revise Manuscript Received on October 05, 2019

Karthicsonia B, Master of philosophy in computer science from Swami dayananda arts and science college, Manjakudi, Tamilnadu under Bharathidasan university Tiruchirapalli.

Dr. Vanitha M, Asst professor of computer application department, Alagappa university Karaikudi.

Figure 1

A. The Robert Cross Method

The Robert cross method is proposed by Lawrence Roberts. This is a first edge detection technique. The concept behind this method was to approximate the gradient of image through separate differentiation that is achieved by calculating sum of the squares of the differences between diagonally adjacent pixels. Its main disadvantages is very perceptive to noise. It does not produce good result to real edges unless they are very sharp.

The Robert method is specified by BW=edge (A,'robert'). BW = edge (A,'robert', thresh). Edge ignores all edges not exceed thresh value. If thresh value is not defined or empty. Edge selects the value automatically.

Figure 2

B. The Prewitt Method
The prewitt method is based on convolving the image with a tiny, discrete, integer valued filter in vertical and horizontal direction. It produces more accurate result than Robert method. It computational time is less expensive and faster method for edge detection.

The Prewitt method is specified by 
\[ BW = \text{edge}(A,'prewitt') \]

where BW is the image with edges detected. The prewitt method ignores all edges that do not exceed the threshold value. If the threshold value is not defined or empty, the method selects a value automatically.

Figure 3 shows image are segmented using Prewitt method technique with various image filtering techniques.

C. The Sobel Method:

The Sobel method is based on convolving the image with a tiny, discrete, integer valued filter in vertical and horizontal direction. It has better noise suppression. The Sobel method is similar to Prewitt, only difference is coefficient of mask can be adjusted . The computational time slightly differ with Prewitt method.

The Sobel method is specified by 
\[ BW = \text{edge}(A,'sobel') \]

where BW is the image with edges detected. The Sobel method ignores all edges that do not exceed the threshold value. If the threshold value is not defined or empty, the method selects a value automatically.

Figure 4 shows image are segmented using Sobel method technique with various image filtering techniques.

D. The Laplacian of Gaussian Method:

The concept behind this method is first image smoothing done with Gaussian filter to remove the noise from the image then it is operated by Laplacian operator. these two operations together is called Laplacian of Gaussian(LOG).

The Laplacian of Gaussian method is specified by 
\[ BW = \text{edge}(A,'log') \]

where BW is the image with edges detected. The Laplacian of Gaussian method ignores all edges that do not exceed the threshold value. If the threshold value is not defined or empty, the method selects a value automatically.

Figure 5 shows image are segmented using Laplacian of Gaussian method technique with various image filtering techniques.

E. The Canny Method:

The Canny method plays vital role in edge detection. The process of canny method is First, image smoothing done by Gaussian filter, then find the intensity of gradients of the image to compute edge strength then apply non maximal to the gradient magnitude finally apply threshold to non maximal suppression image.

The Canny method is specified by 
\[ BW = \text{edge}(A,'canny') \]

where BW is the image with edges detected. The Canny method ignores all edges that do not exceed the threshold value. If the threshold value is not defined or empty, the method selects a value automatically.

Figure 6 shows image are segmented using Canny method technique with various image filtering techniques.

III. CONCLUSION

In this paper, various edge detection techniques used in image segmentation such as Robert, Prewitt, Sobel, Laplacian of Gaussian and Canny were discussed. The Sobel is a strong response to diagonal edges. The Prewitt is Sensitive to noise. Laplacian and Gaussian operator cannot be use for edge detection even it produces double edges, so LOG is much better than those two operators. Canny edge give less sensitive to noise when compare to other edge detection techniques.

ACKNOWLEDGEMENT

This research work has been supported by RUSA PHASE 2.0, Alagappa University, Karaikudi,
REFERENCES

1. Kaur. "Comparison between edge detection techniques." IJCA, (2016).
2. Shrivakshan,. "A comparison of various edge detection techniques used in image processing." IJCS(2012).
3. Kumar, “Image segmentation using discontinuity-based approach.” Multimedia Image Process (2011).
4. Al-Asiri, “Image segmentation by using edge detection.” IJCS(2010).
5. S.Lakshmi “A study of Edge Detection Techniques for Segmentation Computing Approaches” IJCA on Imaging & Biomedical Applications” CASCT, 2010.
6. C.NagaRaju “Morphological Edge Detection Algorithm based on Multi-Structure Elements of Different Directions”.IJICT, May 2011.
7. K Sai Deepak Jayanthi Sivaswamy,’Automatic Assessment of Macular Edema from Color Retinal Images’, IEE Transactions on Imaging, March 2012.
8. JavadHaddadnia,“Recognition and Classification of Cancer cells by using Image Processing and LABVIEW”, IJCTE, February 2013.
9. Zolqemine Othman, habibollahharon, Mohammed Rafi, Abdul kadir, Comparison of canny and Sobel edge detection in mri images.
10. KAM SajadHyder and Vanitha M “Segmentation of Liver from images of Visceral Organs through Automatic Processing – A review”, (IJARCE).

BIOGRAPHY

Karthicsonia B., obtained Master of Computer applications in 2010 from St.Michael College of Engg &Tech, Kalayarkoil, Tamilnadu under Anna University Tiruchirapalli, Tamilnadu. She obtained Master of philosophy in computer science from Swami dayananda arts and science college, Manjakudi, Tamilnadu under Bharathidasan university Tiruchirapalli. At present, she is pursuing her Ph.D in computer science, Alagappa University Karaikudi

Dr. Vanitha. M., M.Sc(OR & CA),M.Sc.,M.Phil.,Ph.D (CS).Presently working as a Asst professor of computer application department, Alagappa university Karaikudi. She has more than 12 years of experience in teaching and more than 10 years of experience in research. She has published 52 papers in international journals and 21 papers in international and 2 in national conferences. She is a Deputy Coordinator in “Women Empowerment Cell” at Alagappa University, Karaikudi.