ANALYSIS OF DEAD TISSUES IN MEDICAL IMAGES USING EDGE DETECTION TECHNIQUES

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ABSTRACT

Edge detection in medical image is an important task for object recognition of the human organs, which is affected and it is an essential pre-processing step in medical image segmentation and 3D reconstruction. It is one of the fundamental tool in image processing, machine vision and computer vision, which aim at identifying points in a digital image .Edge has detected according to some early brought forward algorithms such as gradient-based algorithm and Laplacian-based algorithm, but they are not so good for noisy medical image edge detection because of unsatisfactory result. This research paper presents a brief study of the fundamental concepts of the edge detection operation, theories behind different edge detectors. Edges finds for places in the image where the intensity changes rapidly. Edge returns a binary image containing 1's where edges are found and 0's elsewhere. Different edge detection methods Sobel, Prewitt, Robert's, Laplacian of a Gaussian (LOG), Zero Cross & Canny are applied on medical images.

Keywords: Edge Detection, Edge Detectors, Segmentation, Matlab.

I. INTRODUCTION

Edges in a digital image provide important information about the objects contained within the image since they constitute boundaries between objects in the image. By medical image processing, researchers and clinicians can easily analyses the image data, thereby enhancing their ability to study, monitor, diagnose and treat medical disorders. Edge detection techniques are classified as follows: the primary order by-product of selection in image process is that the gradient. The second order derivatives of selection in image process are typically computed

exploitation Laplacian. For Sobel and Prewitt strategies, we are able to opt to discover horizontal edges, vertical edges or each. Laplacian of a Gaussian (LOG) [3,4] finds edges by searching for zero crossing once filtering with a Gaussian filter[6]. Image Segmentation is the process of partitioning a digital image into multiple regions or sets of pixels[1][3].All of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture[7].

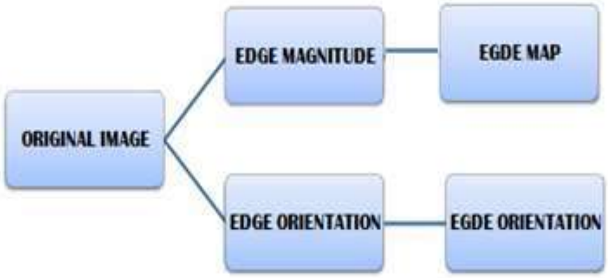

Figure1: Edge Detection Variations

II. MEDICAL IMAGING

The development of automatic systems for medical image processing, which can effectively act as an agent to aid medical diagnosis, is a goal that has been pursued by researchers since the first works on the field of medical image processing in the 80´s.The automation of image analysis tasks can produce very interesting results such as less time spent by specialists, decrease of intra-and inter-observer differences, second opinions to non-specialists and in educational systems. Medical imaging is the technique, process and art of creating visual representations of the interior of a body for clinical analysis and medical intervention. Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat disease. There is a continuous drive not only to improve the diagnostic yield of medical imaging techniques for clinical use, but also the management of the huge amount of digital information available to medical imaging departments[2].

III. METHODOLOGY

For detection of edges in medical images, we have proposed the following algorithm.
Step1. First take an intensity image
Step2.Apply edge detection technique.
Step3.Apply direction if necessary (Horizontal/Vertical, both by default)
Step4.Calculate,MEAN,Standard,Deviation.
Step5. Results are to be tabulated.
Step6. End.
The medical images have been taken as input images. We have applied different edge detection techniques; Sobel, Prewitt, Canny, Log, Zero cross & Roberts.

IV. EDGE DETECTION METHODS

Algorithms for edge detection contain three steps:

4.1 Filtering: Since gradient computation based on intensity values of only two points are susceptible to noise and other vagaries in discrete computations, filtering is commonly used to improve the performance of an edge detector with respect to noise. However, there is a trade-off between edge strength and noise reduction. More filtering to reduce noise results in a loss of edge strength.

4.2 Enhancement: In order to facilitate the detection of edges, it is essential to determine changes in intensity in the neighborhood of a point. Enhancement emphasizes pixels where there is a significant change in local intensity values and is usually performed by computing the gradient magnitude.

4.3 Detection: We only want points with strong edge content. However, many points in an image have a nonzero value for the gradient, and not all of these points are edges for a particular application. Therefore, some method should be used to determine which points are edge points. Frequently, thresholding provides the criterion used for detection.

5. EDGE DETECTORS

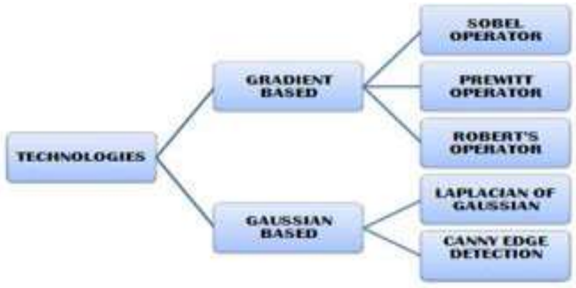

Figure2: Edge Detectors

5.1 Roberts Operator

The Roberts cross operator provides a simple approximation to the gradient magnitude:

$$G = \left|f[i,j]\right| = \left|f[i,j] - f[i+1, j+1]\right| + \left|f[i+1, j] - f[i, j+1]\right|$$

Using convolution masks, this becomes

$$G = f[i,j] = |G_x| + |G_y|$$

where Gx and Gy are calculated using the following masks:

$$G_x = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \qquad G_y = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

5.2 Sobel Operator

As mentioned previously, a way to avoid having the gradient calculated about an interpolated point between pixels is to use a 3 x 3 neighborhood for the gradient calculations. The Sobel operator is the magnitude of the gradient computed by

$$\mathrm{M} = \sqrt{s_X{}^2 + s_Y{}^2}$$

Where the partial derivatives are computed by

$$s_X = (a_2 + ca_3 + a_4) - (a_0 + ca_7 + a_6)$$
$$s_y = (a_0 + ca_1 + a_2) - (a_6 + ca_5 + a_4)$$

with the constant c = 2.

Like the other gradient operators, 8x and 8y can be implemented using convolution masks:

$$S_x = \begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix} S_Y = \begin{pmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{pmatrix}$$

Note that this operator places an emphasis on pixels that are closer to the center of the mask.

5.3 Prewitt Operator

The Prewitt operator uses the same equations as the Sobel operator, except that the constant c = 1. Therefore:

$$s_{x=} \begin{pmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{pmatrix} s_y = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{pmatrix}$$

Note that, unlike the Sobel operator, this operator does not place any emphasis on pixels that are closer to the center of the masks.

5.4 Canny Edge Detector

The Canny edge detection algorithm is summarized by the following notation. Let I[i, j] denote the image. The result from convolving the image with a Gaussian smoothing filter using separable filtering is an array of smoothed data, where 0 is the spread of the Gaussian and controls the degree of smoothing.

$$S = [i, j] = G[i, j; \sigma] * I[i, j]$$

Where 0's is the spread of the Gaussian and controls the degree of smoothing. The gradient of the smoothed array Sri, j] can be computed using the 2 x 2 first-difference approximations to produce two arrays P[i,j] and Q[i, j] for the x and y partial derivatives:

$$P[i, j] = ([i, j+1] - S[i, j] + S[i+1' j+1] - S[i+1, j]) / 2$$

$$Q[i, j] = ([i, j] - S[i+1, j] + S[i, j+1] - S[i+1, j+1]) / 2$$

The finite differences are averaged over the 2 x 2 square so that the x and y partial derivatives are computed at the same point in the image.

5.5 Algorithm for Canny Edge Detection

1. Smooth the image with a Gaussian filter.
2. Compute the gradient magnitude and orientation using finite-difference approximations for the partial derivatives.
3. Apply non maxima suppression to the gradient magnitude.
4. Use the double thresholding algorithm to detect and link edges.

VI. EXPERIMENTAL ANALYSIS AND DISCUSSIONS

This is a image of a skin disease called Seborrheic Keratoses. It is taken from the internet. Seborrheic Keratoses is Noncancerous growths that may develop with age, Seborrheic keratoses can appear on many areas of the skin either alone or in groups. They may be dark or multi colored, and they usually have a grainy surface, though they can be smooth and waxy. No treatment is necessary unless irritation develops or their appearance is a concern.

The following image is taken under consideration

Fig3: sample image for training

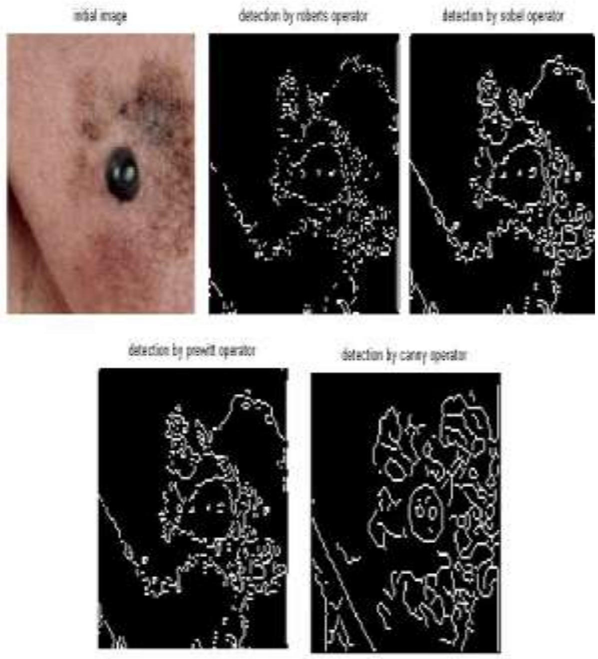

Figure4: Original Image with the result of various edge detection techniques

The Figure shows the segmented result using edge detection. By comparisons with segmented results, we can see image detected by canny operator has complete and meticulous edge, which is illustrated in the above figure. Based on qualitative evaluation, canny operator is better at detecting the edges than other three. Finally, all the segmented results show the same thing that canny operator is very suitable to be applied in welding detection because of its unparalleled good detection performance.

VI. CONCLUSION

The purpose of this paper is to present various approaches for image segmentation based on edge detection techniques. In this paper an attempt is made to analyze the edge detection techniques which are based on discontinuity intensity levels. The relative performance of various edge detection techniques is carried out with sample image by using MATLAB software. The study of different Edge detection techniques and their experimental results shows that canny yield best results. Canny result is superior one when compared to all for a selected image since different edge detections work better under different conditions in the field of medical imaging. Unlike Roberts and Sobel, the Canny operation is not very susceptible to noise. This makes Canny detector superior.

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