Study and Analysis of Placenta Images Using Edge Detection Approach

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Abstract— Medical diagnosis is the major challenge faced by the medical experts. Specialized tools are necessary to assist the experts in diagnosing the diseases. The ultrasound images are usually low in resolution which may lead to loss of characteristic features of the ultrasound images. This pilot study involves the feasibility for classifying the ultrasound images of placenta using various Edge Detection Methods.

Keywords: Edge detection, Sobel, Prewitt, Laplacian

I. INTRODUCTION

Image processing algorithms are complex and difficult to apply when it involves massive image data. In order to decrease the execution time and increase the response time of any image processing algorithms. An image with high contrast and brightness is called fine quality image while a poor quality image is identified by low contrast and poorly defined boundaries between the edges [2]. Image enhancement can be considered as transformation of poor quality Image into good quality image to make its meaning clearer for human perception or machine analysis. In general, image noise should be eliminated through image preprocessing. And there is some specifically-given work (such as region extraction and image marking) to do after the main operation of image segmentation for the sake of getting better visual effect.[1]. Segmentation is unsupervised learning. Model based object extraction, e.g., template matching, is supervised learning.The ultrasound images of placenta obtained is subjected to histogram equalization to enhance the contrast of the Input image. The ultrasound placenta images is then reduced to 64X64 pixels and stored. The reduced image is used in measuring the Placenta thickness, area and perimeter using the crown – rump length and biparietal diameter.

II. EDGE DETECTION TECHNIQUES

The Research on Image Edge detection for many years has been a high degree of attention.

– Detecting Discontinuities

It means to partition an image based on abrupt changes in intensity, this includes image segmentation algorithms like edge detection.

– Detecting Similarities

It means to partition an image into regions that are similar according to a set of

Edges occur on the boundary between two different regions in an image. The technique may be classified as derivative based on first or second order derivative on each pixel or gradient based where a gradient of consecutive pixels is taken in x and y direction.

The edges identified by edge detection are often disconnected. The disconnected regions boundaries must be closed to generate segmented image [4]. The gradient magnitude includes sobel, prewitt, canny, laplacian, zero crossings and Roberts. There are three basic types of gray-level discontinuities in a digital image: points, lines, and edges. The most common way to look for discontinuities is to run a mask through the image.

We say that a point, line, and edge has been detected at the location on which the mask is centered if, where

$$R = W_1Z_1 + W_2Z_2 + \ldots\ldots\ldots\ldots\ldots + W_9Z_9$$

W1	*W2*	*W3*
W4	*W5*	*W6*
W7	*W8*	*W9*

A. Sobel Edge Detection.

The Sobel operator performs a 2-D spatial gradient measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input grayscale image. In theory at least, the operator consists of a pair of 3x3 convolution kernels as shown in Figure 1. One kernel is simply the other rotated by 90°.This is very similar to the Roberts Cross operator. Shows the comparison of the edge detections for the example image. The kernels can be applied separately to the input image, to produce separate measurements of the gradient component in each orientation Gx and Gy[1]. These can then be combined together to find the absolute magnitude of the gradient at each point and the orientation of that gradient. The gradient magnitude is given by [6],[8]:

$$|G| = \sqrt{Gx^2 + Gy^2} \qquad (1)$$

Using this information, calculate the gradient's direction. The Kayyali operator for edge detection is another operator generated from Sobel operator.

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

Gx Gy

Fig. 1: Sobel Mask

B. Roberts Edge Detection.

It is used to compute the 2D spatial gradient measurement of an image [6], [5]. It is similar to Sobel operator. The pixel values at every point in the output are the estimation of absolute magnitude of the spatial gradient. The gradient magnitude is given by equation (1).

C. Prewitts Edge Detection.

The prewitts operator [6], [5] is used to estimate the magnitude and orientation of an

edge which calculates the maximum response of a set of convolution kernels to find the local edge orientation for each pixel. The maximum response for each pixel is the value of the corresponding pixel in the output magnitude image. The values for the output orientation image lie between 2 and 7, depending on which of the 8 kernels produced the maximum response [9]. The horizontal and vertical edges in an image can be detected.

D. Canny Edge Detection.

The canny edge detector first smoothes the image to eliminate and noise. It then finds the image gradient to highlight regions with high spatial derivatives. The algorithm then tracks along these regions and suppresses any pixel that is not at the maximum (no maximum suppression)[5]. The gradient array is now further reduced by hysteresis which is used to track along the remaining pixels that have not been suppressed. It uses two thresholds and if the magnitude is below the first threshold, it is set to zero (made a non edge). If the magnitude is above the high threshold, it is made an edge and if the magnitude is between the 2nd thresholds, then it is set to zero unless there is a path from this pixel to a pixel with a gradient above threshold two [6] Gaussian smoothing is performed using standard convolution methods. The edge strength is obtained by taking the gradient of the image.

The edge strength is obtained by

$$|G| = |Gx| + |Gy| \quad (2)$$

Where G is the edge gradient, Gx is the first derivative in horizontal direction, Gy is the first derivative in vertical direction. The edge direction is obtained by

$$\Theta = \arctan(Gy/Gx) \quad (3)$$

E. Laplacian of Gaussian.

Laplacian Edge detection searches for the zero crossing in the second derivative of the image [6]. It highlights the regions of rapid change in intensity of the image[7]. Let I = (x,y) be the intensity of the pixel at x,y. The laplacian L(x,y) of the pixel intensity I(x,y) is give by,

$$L(x,y)=d2l/dx2+d2l/dy2 \quad (4)$$

III. COMPARISON OF EDGE BASED SEGMENTATION METHODS

Edge detection was performed on the synthesized image with Sobel, Prewitt, Canny, Laplacian of Gaussian, Roberts [3] . The ultrasound placenta image, which is synthesized as a result of wavelet decomposition stereo mapping, gives closer to accurate results when compared to classification done with the original ultrasound placenta [8]. To quantify the performance of a segmentation method, validation experiments are necessary. Edge detection depends on discontinuity of gray level and on intensity variation on the gray scale images. The difference of gray levels can be used to detect the discontinuity of gray levels. This is used to detect the object boundary.

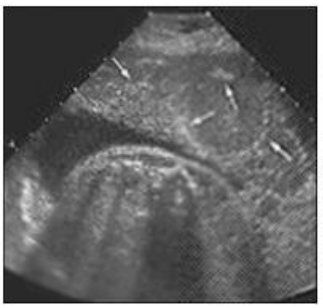

Fig. 2: Synthesized Placenta Image

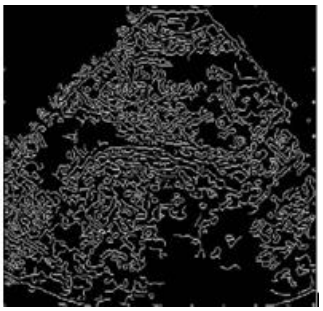

Fig. 5: Canny

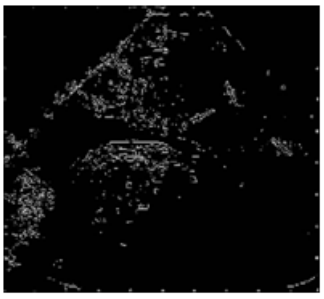

Fig. 3: Sobel- Image

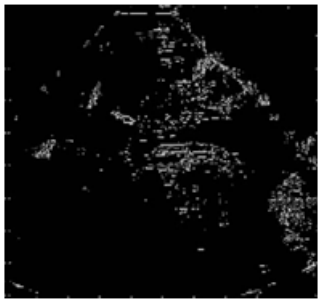

Fig. 6: Roberts

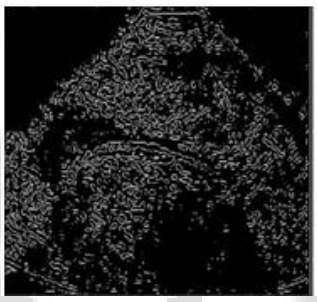

Fig. 4: Laplacian of Gaussian

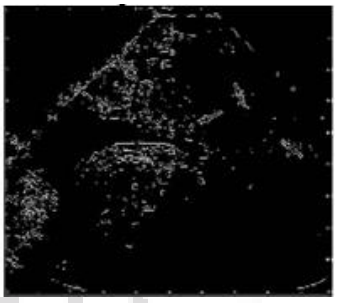

Fig. 7: Prewitt

IV. CONCLUSION

In this paper, image Edge detection algorithms is classify and discuss main. Placenta image evaluate and compare. The work can be extended by developing Statistical measurement of placenta images using various Segmentation Approach.

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