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Comparison on Two-Dimensional Ultrasound to Three-Dimensional Placenta Image using Segmentation Techniques

J. James Manoharan

Department of Computer Science, Bishop Heber College, Tiruchirappalli, Tamil Nadu, India

Corresponding Author: rajeshwari.radhakrishnan@gmail.com

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Abstract— Ultrasound Placenta image are usually low in resolution which may lead to loss of characteristics features of the image. Discarded at birth, the placenta is a highly complex and fascinating organ. During the course of a pregnancy, it acts as the lungs, gut, kidneys, and liver of the fetus. Ultrasound is a diagnostic technique which has many purposes though it is typically used by a Gynecologist to check the fetus in the mother's womb during pregnancy. Image Segmentation is very important in many medical reputation applications. This survey aims at providing an insight about different 2-Dimensional and 3-Dimensional Placenta image segmentation techniques and to help better understanding to the people who are new in this field. This comparative study summarizes the benefits and limitations of various segmentation techniques.

Keywords: Placenta Imaging; Image Segmentation; Image Processing; 2-Dimensional image segmentation; 3-Dimensional image segmentation.

I. Introduction

Current advances in medical imaging are made in fields such as instrumentation, diagnostics, and therapeutic applications and most of them are based on imaging technology and image processing. 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. In fact, medical image processing has been established as a core field of innovation in modern health care. 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. Image enhancement can be considered a transformation of poor quality. Image into the good quality image to make its meaning clearer for human perception or machine analysis. In general, image noise should be eliminated through image preprocessing. Segmentation is unsupervised learning. Model- based object extraction, e.g., template matching, is supervised learning.

II. SEGMENTATION TECHNIQUES

Segmentation is a process of distinguishing objects from the background. Hence, Imagesegmentation is distinguishing segmentation is the operation of partitioning an image into a collection of connected sets of pixels. The classification of image segmentation techniques [1] based on the detection performance is edge, threshold, region, fuzzy and neural network based. The edge detection [2] based recognition of real images reduces the false hit ratio. Threshold based techniques [3] such as mean, p-tile, edge maximization and visual applied to improve the performance of image segmentation. The region based [4], fuzzy based Gaussian Mixture Model (GMM) [5] and neural network [6] applied to segmentation in order to analyze the curvature regularity, energy function and noise effects in the image, The detailed description of Edge based image segmentation techniques based on the various factors discussed in this paper.

III. EDGE BASED SEGMENTATION METHOD

Edge detection is a process of locating an edge of an image. Detection of edges in an image is a very important step towards understanding image features. A connected pixel that is found on the boundary of the region is called an edge. So these pixels on an edge are known as edge points [3]. The edges extracted from a two-dimensional image of a three-dimensional scene can be classified as either viewpoint dependent or viewpoint independent. A viewpoint independent edge typically reflects inherent properties of the three-dimensional objects, such as surface markings and surface shape. A viewpoint dependent edge may change as the viewpoint changes, and typically reflects the geometry of the scene, such as objects occluding one another. A typical edge might, for instance, be the border between a block of red color and a block of yellow. In contrast, a line can be a small number of pixels of a different color on an otherwise unchanging background. For a line, there may therefore usually be one edge on each side of the line.

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=W1Z1+W2Z2+………………+W9Z9

3.1 SOBEL EDGE DETECTION

It is 3x3 convolution kernels. One kernel is simply the other rotated by 90^0. It is a row edge detector.

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

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

Fig1. Gx and Gy are common mask used in Slobel Operator

The kernel can be applied separately to the input image for obtaining gradient component in each orientation i.e. GX and GY. The magnitude is given by: $|G|=\sqrt{Gx^2+Gy^2}$

3.2 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 the absolute magnitude of the spatial gradient.

3.3 PREWITT EDGE DETECTION

It is similar [4] to the Sobel Operator and is used to detect vertical and horizontal edges in an image.

3.4 CANNY EDGE DETECTION.

The Canny edge detector addresses the fact that for edge detection, there is a tradeoff between noise reduction (smoothing)

and edge localization. – A form of optimal edge detection.

The steps of the canny algorithm [2] are as follows:

1. Smoothing: Blurring of the image to remove noise by convolving the image with the Gaussian filter.
2. Finding gradients: The edges should be marked where the gradients of the image have large magnitudes, finding the gradient of the image by feeding the smoothed image through a convolution operation with the derivative of the Gaussian in both the vertical and horizontal directions.
3. Non-maximum suppression: Only local maxims should be marked as edges. Finds the local maxima in the direction of the gradient, and suppresses all others, minimizing false edges.
4. Double thresholding: Potential edges are determined by thresholding, Instead of using a single static threshold value for the entire image, the Canny algorithm introduced hysteresis thresholding, which has some adaptively to the local content of the image. There are two threshold levels, th, high and tl, low where th>tl. Pixel values above the th value are immediately classified as edges.
5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very strong edge.

3.5 LAPLACIAN OF GAUSSIAN

The Laplacian of Gaussian operator (LOG) plays a very important role in image segmentation [1]. It is a convolution filter that is used for edge linking and edge mapping of different objects. This filter first applies a Gaussian blur, then applies the Laplacian filter and finally checks for zero crossings, i.e. when the resulting value goes from negative to positive or from negative to positive. The main objective of this filter is to highlight edges different objects. As a input, the LOG operator takes a single gray level image and produces another binary image as output. A 5x5 mask LOG filter has been shown below.

0	**0**	**-1**	**0**	**0**
0	**-1**	**-2**	**-1**	**0**
-1	**-2**	**16**	**-2**	**-1**
0	**-1**	**-2**	**-1**	**0**
0	**0**	**-1**	**0**	**0**

*Fig2. A Conventional 5*5 log Surround filter*

IV. COMPARISON OF EDGE BASED SEGMENTATION METHODS

Edge detection was performed on the synthesized image with Sobel, Prewitt, Canny, Laplacian of Gaussian, Roberts [9]. 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. To quantify the performance of a segmentation method, validation experiments are necessary. Edge detection depends on the discontinuity of gray level and on intensity variation on the grayscale images. The difference in gray levels can be used to detect the discontinuity of gray levels. This is used to detect the object boundary. In the Fig [3],[4],[5][6] will represent various edge based Segmentation Techniques.

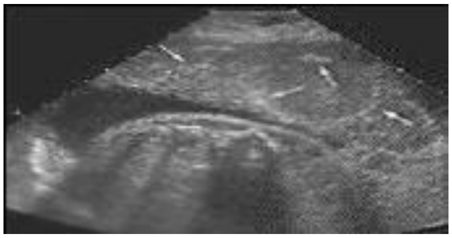

Fig3. Placenta Image

Fig4. Laplacian of Gaussian

Fig5. Sobel- Image

Fig 6 Canny

V. COMPARATION ON 2-D ULTRASOUND TO 3-D PLACENTA IMAGES

Conventional two-dimensional (2D) ultrasound has been widely used for the evaluation of the placenta during pregnancy [8]. This 2D ultrasound evaluation includes the morphology, anatomy, location, implantation, and an anomaly, size, and color placenta. The introduction of three-dimensional (3D) ultrasound would facilitate the novel assessment of the placenta, such as Segmentation Techniques. 3D ultrasound may be an important modality in future placental research, in the evaluation of feto-placental insufficiency in clinical practice, and in the prediction of fetal growth restriction and pre-eclampsia, although some limitations regarding the assessment of the placenta employing 3D ultrasound still remain unresolved. In the Fig.[7] and Fig[8] will show the 2d placenta image and 3d placenta image.

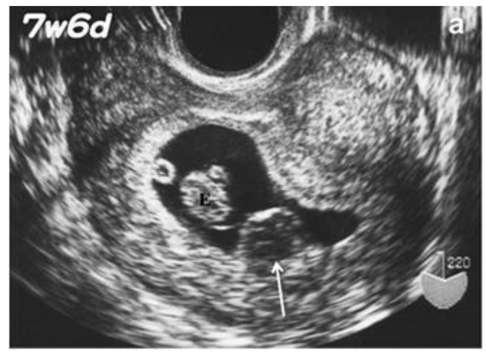

Fig7. 2d Placenta Image

Fig8. 3d Placenta Image

VI. CONCLUSION

In the 2d Placenta images using segmentation Techniques we clearly identify the problems but in the 3d Placenta images to clarify the Problem very quickly and resolve the problem [9].To Compare 2d and 3d images we cannot tell which one is better. Some of the images in 2d are better than 3d images. In another Point, we said 3d images are better than 2d images. In Future, we take any Problem and we compare 2d and 3d Placenta images using Segmentation Techniques which one is better.

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