Breast Segmentation in Mammograms using Manual Thresholding

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Abstract— **Breast segmentation is an important pre-process in mammogram image processing and computer-aided diagnosis of breast cancer. Limiting the area to be processed into a specific target region in an image would increase the accuracy and efficiency of processing algorithms. In this paper we are presenting a algorithm for estimating breast segmentation using manual thresholding and extracting the region based on area and Centroid and also briefing about different methods such as Fast marching, watershed algorithm, tracking etc. We have evaluated the performance of the algorithm by using 100 mammogram images taken from mini-MIAS database. The results obtained from the experimental evaluation indicate that this algorithm explains 98.6% of the ground truth breast region and accuracy of the segmentation is 90.1%**

Index Terms— **Mammogram, Algorithm, Watershed Algorithm.**

I. INTRODUCTION

Mammography is the process of using low-energy-X-rays (usually around 30 kVp) to examine the human breast and is used as a diagnostic and a screening tool. The goal of mammography is the early detection of breast cancer, typically through detection of characteristic masses and/or microcalcification. A mammogram is an x-ray picture of the breast.

Mammograms can be used to check for breast cancer in women who have no signs or symptoms of the disease. This type of mammogram is called a screening mammogram. It involve two x-ray pictures, or images, of each breast. The x-ray images make it possible to detect tumours that cannot be felt. Screening mammograms can also find micro calcifications (tiny deposits of calcium) that sometimes indicate the presence of breast cancer Mammograms can also be used to check for breast cancer after a lump or other sign or symptom of the disease has been found. This type of mammogram is called a diagnostic mammogram A cancerous tumor in the breast is a mass of breast tissue that is growing in an abnormal, uncontrolled way. The tumor may invade surrounding tissue, or shed cells into the bloodstream or lymph system. A breast tumor is a dense mass and will appear whiter than any tissue around it. Benign masses usually are round or oval in shape Lumps in the breasts are the most common warning sign of breast cancer – making it clear the importance of checking your breasts for lumps. If breast

cancer is found early then the chance of survival is much higher – and the treatment is much less invasive. The size of the primary tumor is very important as it will affect what treatment you will receive. The larger the tumor the more aggressive it may be – so the treatment will need to be much more invasive Mammograms is the process to find the tumors and it is done through segmentation. "Segmentation is the partition of a digital image into multiple regions (sets of pixels), according to some criterion." [1]

II. TYPES OF SEGMENTATION

A. Thresholding

For mammograms, thresholding usually involves selecting a single gray level value from an analysis of the grey-level histogram, to segment the histogram into background and breast tissues. All the pixels with grey level value less than the threshold are marked as background and the rest as breast. Thresholding uses only grey level value and no spatial information is considered. Therefore, the major shortcoming of the threshold is that there is
often an overlap between grey levels of the objects in the breast and the background.

Micro calcification clusters are the primary indicator of malignant type of breast cancer, the detection is important to prevent and treat the disease. The micro calcification appears in small clusters of a few pixels with relatively high intensity and closed contours compared with there neighboring pixels. However, it is a challenge to detect all the micro calcifications since they appear as spots which are slightly brighter than their background. The micro calcifications in mammograms can be detected by using dual threshold method [1]. Experimental results showed that proposed method can locate the micro calcifications exactly in the mammograms as well as restrain the contours produced by the noises.

B. Watershed Algorithm

Watershed is the ridge that divides areas drained by different river systems. A catchments basin is the geographical area draining into a river or reservation .The watershed transform applies these ideas to gray-scale image processing in a way that can be used to solve a variety of image segmentation problems. Watershed classifies pixels [3] into regions using gradient descent on image features and analysis of weak

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points along region boundaries. The image feature space is treated , using a suitable

mapping, as a topological surface where higher value indicates the presence of boundaries in the original image data.

C. Tracking

Tracking the breast border means involves implementing a tracking algorithm that marks a pixel as a border pixel if it satisfies certain condition. Yen. et.al [2] used a four connectivity tracking algorithm to find the breast border. In this computerized scheme is developed for the detection of masses in digital mammograms. Based on the deviation from the normal architecture symmetry of left and right breast , a bilateral subtraction technique is used to enhance the conspicuity of possible masses. The right and left breast images in each pair are aligned manually in each pair. A non linear bilateral subtraction technique that involves linking multiple subtraction images has been investigated and compared to simple linear subtraction model. Various feature extraction techniques are used to reduce false positive detection resulting from bilateral

subtraction. In [3] a semi automatic method of detecting the breast border, utilizing the gradient of gray levels in three user selected regions. The algorithm used thresholding and pair wise pixel differences in specific directions to detect the breast border. Two radiologists and one physic evaluated the result.

D. Extended Edge Operators

Prewitt, Sobel, Kirch and Compass operators are used for finding edges in images. For detecting tumors in mammographic images extended Edge operators for Prewitt, Sobel, Kirsh and Compass operator are proposed. These operators are proposed in the preceding section.
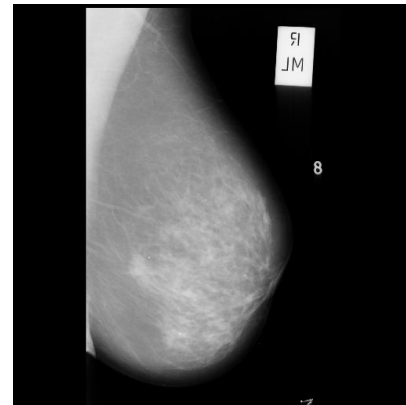
4.1 Kirsch Edge Detector

The kirsch operator[7] is a non linear edge detector that finds the maximum edge strength in a few predetermined directions. The kirsch edge detector detects edges using eight filters are applied to the image with maximum being retained for the final image. The eight filters are a rotation of basic compass convolution filters. The 3 X 3 kernels over segmented the image, so to reduce their artifacts they are extended to 5 X 5 kernels and their extensions are shown below.
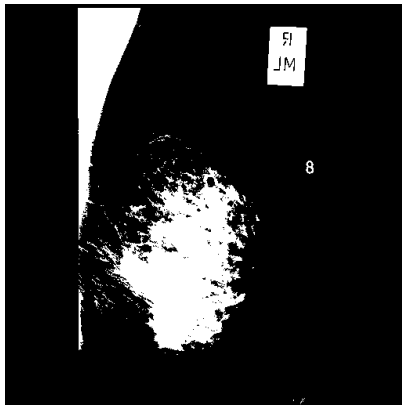
$$\begin{pmatrix} 9 & 9 & 9 & 9 & 9 \\ 9 & 5 & 5 & 5 & 9 \\ -7 & -3 & 0 & -3 & -7 \\ -7 & -3 & -3 & -3 & -7 \\ -7 & -7 & -7 & -7 & -7 \end{pmatrix}$$
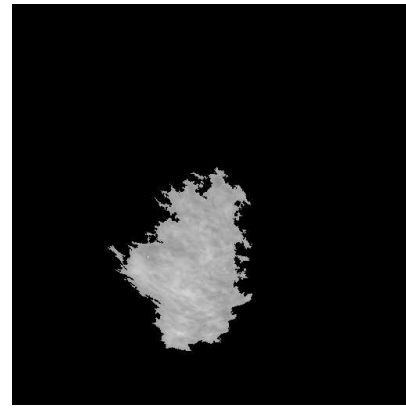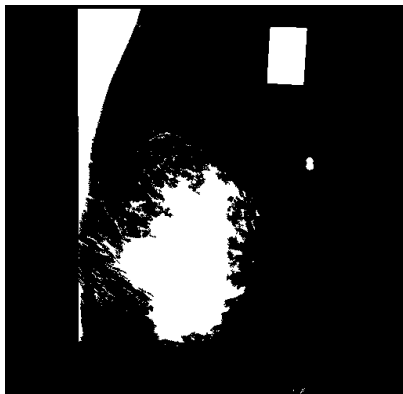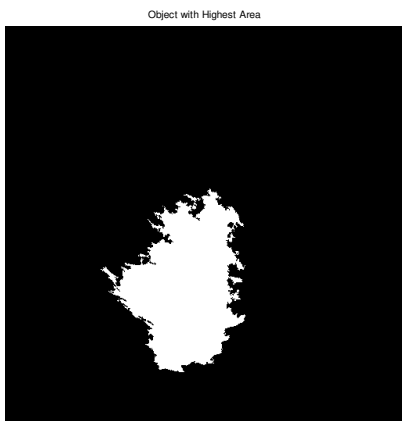
Gx

fig. 4(a)

$$\begin{pmatrix} 9 & 9 & -7 & -7 & -7 \\ 9 & 5 & -3 & -3 & -7 \\ 9 & 5 & -0 & -3 & -7 \\ 9 & 5 & -3 & -3 & -7 \\ 9 & 9 & -7 & -7 & -7 \end{pmatrix}$$

Gy

Fig. 4(b)

III. PROPOSED METHODOLOGY AND SCOPE OF THE WORK

In our Segmentation first we have done a step called presegmentation it has something to do with enhancement. We divide the image into a specified matrix.i.e we are converting the gray scale image in the matrix to binary by dithering. Specified block are taken into consideration and rest all are converted to zeros. A particular value is applied as threshold value to convert image to binary. If there is any holes then it is filled. A hole is a set of background pixels that cannot be reached by filling in the background from the edge of the image. Now region props is done i.e. a set of properties is measured for each connected component in binary image. We are using the Area and Centroid Each Centroid is the mean of the points in that cluster, by using this the part with largest area is maintained and the remaining part is excluded and thus the segmentation is done. It has certain disadvantage like every time the value has to be set but generally it gives exact values at 0.67.This concept can be advanced in adaptive filtering.

a)   **Original image**

b) Pre segmentation Image.

e) Segmented output.

c) Region Filled Image

d) Highest expected area

CONCLUSION

The segmentation algorithm is applied to the detection of regions of interest (ROI's) in mammograms, including masses and the pectoral muscle. To evaluate the performance of the algorithm, the MIASmammogram database [5] was used. Many times when pectoral muscles are of dense then the output pretends to be false and it can be Corrected by first removing the Pectoral Muscle and then applying the algorithm. gives the accurate result.

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