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Segmentation of Breast Tumor from Mammographic Images Using Histogram Peak Slicing Threshold

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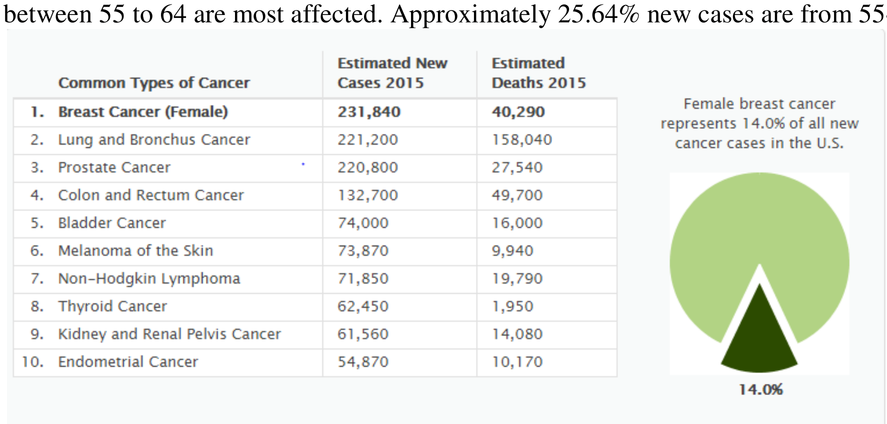
***Abstract*—Medical image processing is a huge and challenging research field. Cancer of the breast is the most common among women in world wide. Mammography is a effectivediagnostic and screening tool to detect breast cancer at early stage. Mammograms use doses of ionizing radiation to create images like all X-rays. These images are then analyzed for any abnormal findings. Multiple research studies have been developed to improve cancer detection,diagnosis and evaluation.Over the last decade there has been a marked increased in the use of mammography to detect breast cancer. Various segmentation techniques have been used for detection of breast tumor from mammographic image in last decade. In this paper a method has been proposed based on histogram segmentation to detect the breast cancer from Mammographic images. The whole procedure has been done in MATLAB.**

***Index Terms*—**Mammogram, Breast Cancer, Histogram Peak Slicing, Histogram Thresholding

I. INTRODUCTION:

Now a day, among women breast cancer is a leading cause of death and second major cause of death after lung cancer. In case of Indian women breast cancer is the second most common cancer[1]. Though, Men and Women can have breast cancer but female breast cancer is very common. Especially female who are mid-aged and older women are most affectedby this diesis. Women who are aged between 55 to 64 are most affected. Approximately 25.64% new cases are from 55-64 ages[2].



	Common Types of Cancer	Estimated New Cases 2015	Estimated Deaths 2015
1.	**Breast Cancer (Female)**	**231,840**	**40,290**
2.	Lung and Bronchus Cancer	221,200	158,040
3.	Prostate Cancer	220,800	27,540
4.	Colon and Rectum Cancer	132,700	49,700
5.	Bladder Cancer	74,000	16,000
6.	Melanoma of the Skin	73,870	9,940
7.	Non-Hodgkin Lymphoma	71,850	19,790
8.	Thyroid Cancer	62,450	1,950
9.	Kidney and Renal Pelvis Cancer	61,560	14,080
10.	Endometrial Cancer	54,870	10,170

Figure 1 : Compared to other cancers[2].

The most popular scanning technique to diagnose breast cancer is (i) Mammogram (ii) Ultrasound (iii) MRI. A mammogram is an x-ray of the breast and very effective to finding tumors that are too small to feel. An ultrasound of breast is a scan which uses penetrating sound waves that do not affect or damage the tissue and cannot be heard by humans. These waves aredeflecting by the breast tissue causing echoes, which a computer uses to paint a picture of the phenomena. Breast MRI is a scanning technique, where a magnet connected to a computer transmits magnetic energy and radio waves through the breast tissue. It scans the tissue, making detailed pictures of areas within the breast[3].

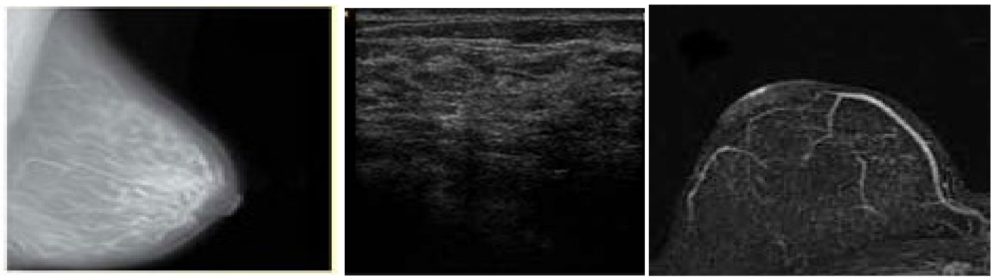


Figure 2: Mammography, Ultrasound and MRI of breast

The detection of breast tumor form Mammography images is a sensitive and challenging task. Usually in breast mammographic image abnormalities in breast tissue are includes asymmetrical breast tissue, asymmetric density, architectural distortion, mass, microcalcifications, interval changes compared with previous films, adenopathy, and other miscellaneous findings[4].

Here the proposed method can segment breast tumor from mammogram images using Histogram peak Slicing threshold method.

II. RELATED WORKS:

Various methods was proposed for detecting tumor in digital mammograms such as morphological approach[6], neural network analysis[7], wavelet based techniques[5], fuzzy logic based analysis[8]. All the above mentioned methods use histogram threshold as a preprocessing step. Here, it has been shown that histogram threshold can be use to do segmentation in effective and efficient way.

III. PROPOSED WORK

The presented work is standing on the concept ofasymmetric density in the breast. In the Mammogram image, Tumor part takeshigher intensity than non lesion part.In the Figure 3 shown in below is a breast mammographic image consist tumor. There is a asymmetric density in the left top corner of Figure 3.

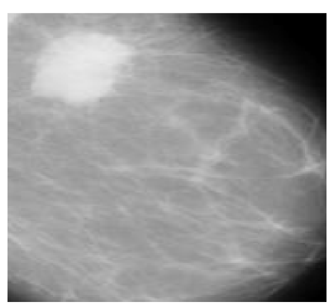


Figure 3 : Mammography of Breast with Tumor

The following Figure 4 shows a normal breast mammographic image. Here the density is almost symmetric for the whole breast object.

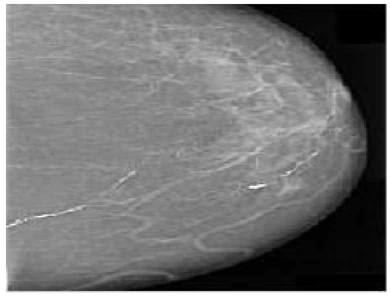


Figure 4 : Normal Breast Mammography

The work is implemented in MATLAB 13. The Procedure has the following steps:
Input : JPG image.
Output : Segmented image.
Step-1:Preprocessing:
 1.1 : Gray scale conversion.
 1.2 : Filtering image using median filter.
Step-2: Calculating 4 thresholding points from Histogram peak.
Step-3: Segmentation Using the 4 thresholding points by the following formula :

$$C(i,j,1) = \sum \begin{matrix} 0 < T1 \\ 64 < T2 \\ 128 < T3 \\ 255 > T3 \end{matrix}$$

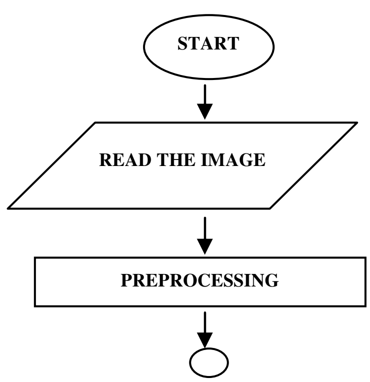
$$C(i,j,2) = \sum \begin{matrix} 0 < T1 \\ 64 < T2 \\ 128 < T3 \\ 0 \geq T3 \end{matrix}$$

$$C(i,j,3) = \sum \begin{matrix} 0 < T1 \\ 64 < T2 \\ 128 < T3 \\ 0 \geq T3 \end{matrix}$$

Step-5: stop

IV. METHODOLOGY

The Methodology is based on Histogram thresholding technique, which can identify the tumor's part from a Mammogram image.



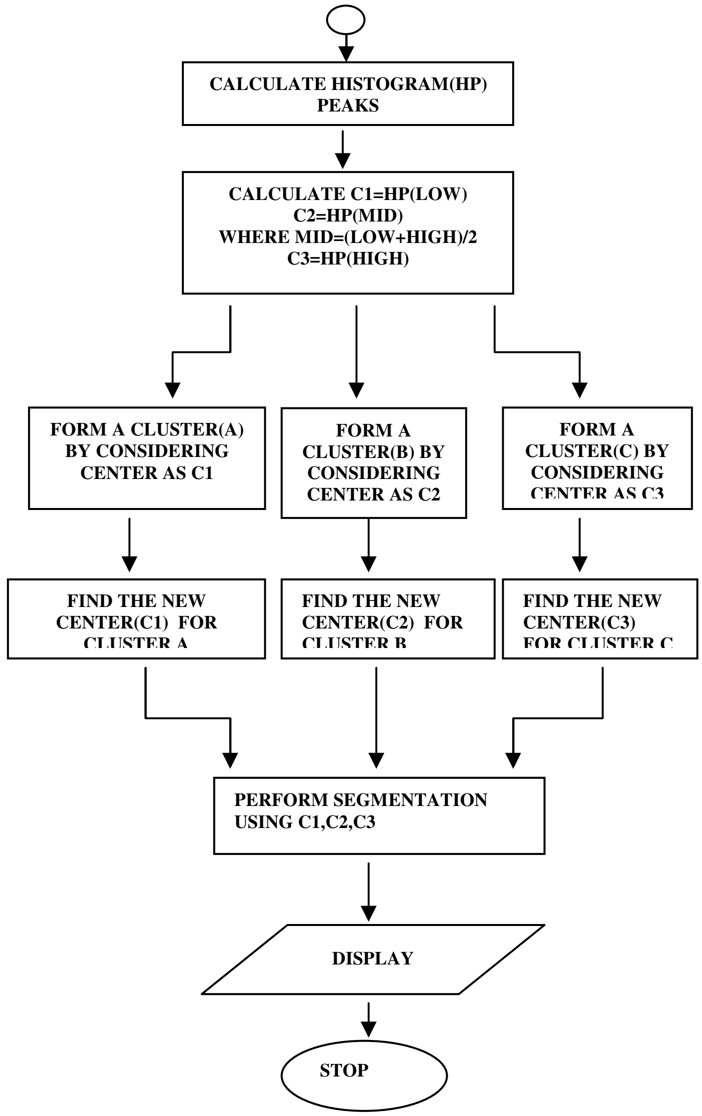


Figure 5: Flowchart of the proposed method

V. PREPROCESSING:

At first the input image has been converted to gray scale image. It is necessary because in gray scale images every pixel carries only one intensity, which facilities simple computation. Noise of an image is nothing but the random variations of brightness or color of that image[9]. Here the median filter has been used to remove such thermal noise.

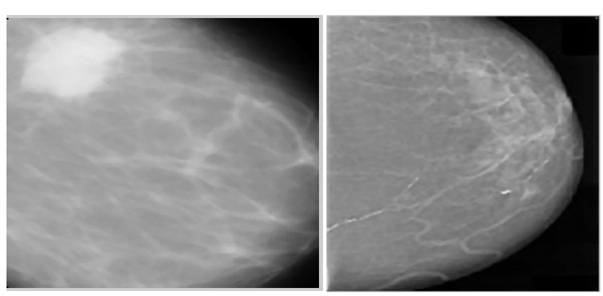


Figure 6: Filtered image of Figure 3 and Figure 4

A. CALCULATE HISTOGRAM PEAKS:

The Histogram of filtered image has been calculated. From the Histogram peak values we can find the highest intensity which has the maximum count from the range between of 20 to 255. Then the left hand sided intensities are replaced with zero intensities value.

This process is repeated until all the intensities have the value zero.
At the end some intensity with their count are obtained and it is considered as histogram peak array[10].

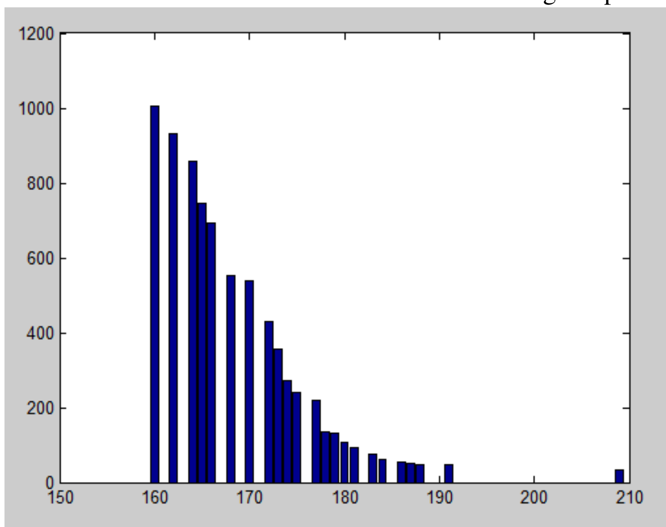


Figure 7 : Histogram peak array of Figure 3

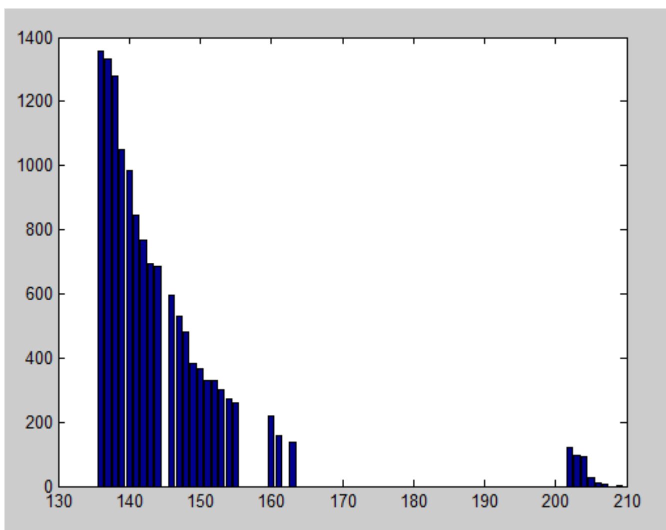


Figure 8 : Histogram peak array of Figure 4

B. SLICING THE HISTOGRAM:

Form the cluster :From the peak array three peaks has beenchosenas the centers of three clusters. The maximum peak has been considered as center(C1) of the first cluster. The minimum peak has been considered as center(C2) of the third cluster. The mid element of histogram peak array has been considered as the center(C3) of the third cluster. Where mid is calculated as follows :

MID=(LOW+HIGH)/2;

Where LOW is 1 and HIGH is size of the histogram peak array. Then the distance between each peak from each center have been calculated. The correspondent peak is added to the cluster which have the minimum distance.

Calculate New Centers : From the value of each cluster new center is obtain by following :

AVG_C=SUM OF COUNT OF THE PEAKS / NUMBER OF PEAKS

The intencity in the peak array which is closer to AVG_C is considered as new center(C1) of the cluster.

C2 and C3 are calculated by using same.

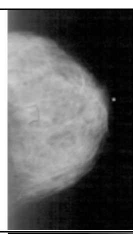
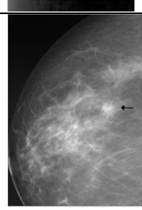
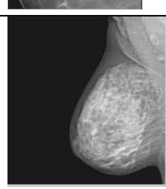
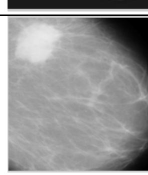
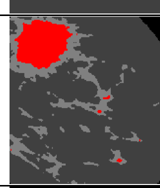
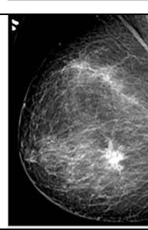
C. SEGMENTATION USING THRESHOLD VALUES:

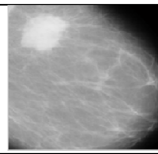
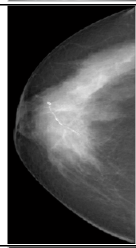
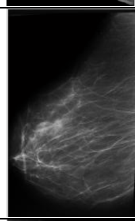
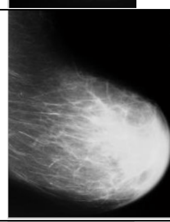
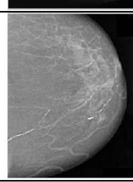
The entire image has been segmented by four different colors by using the threshold values obtain in the previous step. Then compare the count values of the images with threshold values to create segment. Intensities which have the value less then C1 is formed a segment. The intensities which have the values less than C2 are formed another segment. The intensities which have the

Value less than C3 formed another segment and at last the intensities which have the values greater than C3 is formed another segment which is the segment of Tumor.

VI. RESULT:

Table 1

Sl. No.	Mammographic image	Segmented Image	Expected Output	Actual Output	Remarks
1			Clean	Tumor is not present	Ok
2			Tumor present	Tumor present	Ok
3			Clean	Tumor is not present	ok
4			Tumor present	Tumor present	ok
5			Tumor present	Tumor present	Ok

6			Tumor present	Tumor present	ok
7			Tumor present	Tumor present	ok
8			Tumor is not present	Tumor is not present	ok
9			Tumor is not present	Tumor is not present	ok
10			Clean	Tumor is not present	ok

VII. LIMITATIONS:

The success of determining tumor of a mammogram is depend on the size of the tumor and , the density of the breast tissue, and the skill of the radiologist administering and reading the mammogram. Mammography is less likely to reveal breast tumors in women younger than 50 years than in older women. This may be because younger women have denser breast tissue that appears white on a mammogram. Likewise, a tumor appears white on a mammogram, making it hard to detect.

VIII. FUTURE WORK:

In future Artificial Neural network can be invoked to produce proper segmentation. In future MRI image along with Mammography can be used for more precise result. ArtifitialNueral network can also be invoked for a better result.

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