Hybrid detection of malignant breast cancer detection

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Abstract: **Breast cancer is the most common type of disease found in women. It is the most frequent form of cancer and one in 22 women in India is likely to suffer from breast cancer [1].Breast Cancer is the leading cause of death among women in many countries. Detecting a breast cancer at the earliest stage possible has the most important impact on prognosis. Mammography is the most cost effective method to detect early signs of breast cancer [2]. Micro-calcifications are calcium deposit, which can be identified as tiny areas that are slightly brighter than surrounding tissues [3]. In the current work we are performing the modified k means cluster and micro calcification technique. MATLAB has been used for the simulation of this algorithm.**

***Keywords*- image segmentation, seam processing, K-Means clustering, Micro-calcification;**

I. Introduction

Worldwide, breast cancer is the fifth most common cause of cancer death and is the most common cancer among women [4]. A woman born today has about a 1 in 8 chance of being diagnosed with breast cancer at some time during her life. On the other hand, the chance that she will never have breast cancer is 87.6 percent, or about 7 in 8. With advances in screening, diagnosis, and treatment, the death rate for breast cancer has declined by about 20% over the past decade. (3). Breast cancer typically produces no symptoms when the tumor is small and most treatable. Therefore, it is very important for women to follow recommended screening guidelines for detecting breast cancer at an early stage, before symptoms develop. Due to the high probability of the malignancy, early detection and diagnosis of spiculated masses and architectural distortions can significantly improve the chance of survival for patients with breast cancer .When a tumor is detected through a mammogram, it may be a mass or a simple cyst. Even though benign tumors are different from malignant ones in certain ways but no clear-cut boundary could be defined for visual inspection of a mammograph. The patients having probable malignancy category are sent for biopsies. [5]

Mammography is the most effective and one of best technique to detect the lesion from the Breast at an early stage, even in very small in size of lesion, before the woman or a physician can feel it. Because detection process not only guide the doctor for treatment plan but also help to find the marks/ position for taking the biopsy sample from the breast. Automated Lesion Detection in mammography poses many challenges with regard to characteristics of an image. Many techniques are involved to detect the lesion in the medical images such as watershed, image Detection. A mammogram is an x-ray examination of the breasts, used to detect and diagnose breast diseases. There are two main types of mammography: film-screen mammography and digital mammography, also called full-field digital mammography or FFDM. The technique for performing them is the same. What differs is whether the images take the form of photographic films or of digital files recorded directly onto a computer. .

In the current work we are performing the modified k-mean clustering and micro calcification technique. The present application is intended to assist the radiologist in performing an in-depth examination and considerably reduced time. A traditional micro-calcification technique is implemented which consists of two parts: one is for segmentation and other is for micro-calcification detection and results of this technique are compared with proposed work on the basis of performance metrics. For the implementation of the work, mammo images are taken from the MIAS database. The proposed work refines the results and gives greater estimation.

The organization of the paper is as follows: Section 2 and Section 3 cover the Methodology and Methods. Simulation result is discussed in Section 4 Conclusion is given in Section 5 and References in Section 6

II. Methodology

Various steps in proposed algorithm:

Step 1: Take input images to perform detection of lesion..
Step 2: Enhancement of images using Gaussian filter
Step 3: Detecting the seam using horizontal and vertical paths in input image.
Step 4: K-Mean clustering technique is used for segmentation.
Step 5: Calculation of the mean and standard deviation of pixel values in nodule.

Step 6: As the luminance of the micro calcification is brighter than normal pixel so it is easy to distinguish the effect Area from segmented Mass.
step 7: Results are obtained.
Step 8: To check the performance of both the methods quality parameters are used (Energy and Standard deviation)

III. Methods

3.1Enhancment:

For the enhancement of images Gaussian Filter is used. In Gaussian filter, the image is convolved with the Gaussian function to reduce image noise. In digital image processing, a kernel window defines the effective neighborhood pixels. So, larger window size creates more blurred image. Fourier transform of a Gaussian function is another Gaussian, so Gaussian blur has the effect of reducing the high frequency components i.e. low pass filter.

3.2Seam Detection

Seam detection is a process that searches for horizontal and vertical seams in the input image, and a seam is defined as a path that contains a certain degree of edge information [6]. An energy map is generated by using the morphological gradientTo detect *M* horizontal seams, the input image is first divided into *M* horizontal and overlapped slices, and the path with the highest energy in each slice is chosen by using the technique of dynamic programming, which is based on the following equation of the accumulated energy *F*(.):

$$F_{(i,j)} = e_{(i,j)} + \max(F_{(i-1,j-1)}, F_{(i-1,j)}, F_{(i-1,j+1)}) \quad (1)$$

where *i* and *j* represent the horizontal and vertical coordinates, respectively, and *e*(.) denotes the energy function, which corresponds to the energy map in. Based on this formula, the optimal seam in each slice can be selected, and similarly, the vertical seam can be found by dividing the input image into *N* vertical slices Since there are some seams that do not contain enough energy or edge information, the seams that meet the following criterion are removed

$$\mu F_i - \mu_F - \overline{F}_i > a.\sigma_F \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where *Fi* is the accumulated energy of the last pixel in the *i*-th seam, and it is also equivalent to the summation of the energy of all the pixels in the *i*-th seam. μF and σF represent the mean and variance of the energy summations of all the detected seams in the input image respectively

3.3 K-Means Clustering

Results of the seam detection are taken as the input for K-Mean clustering. After the clustering process draws to an end, the post processing technique [7] to eliminate small regions can also be applied to this stage. Finally, each region of the segmentation result is labeled

3.4 Calculation of Mean and Standard Deviation

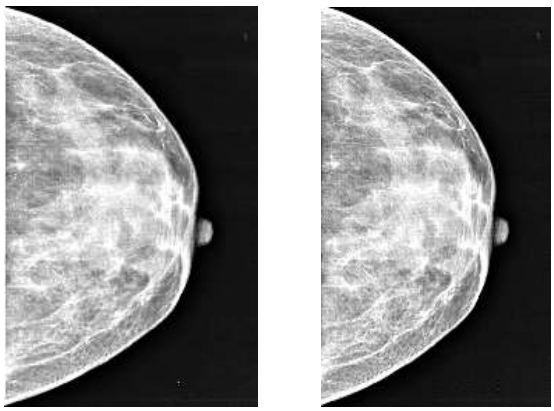
Calculation of Mean(M_m), Standard Deviation (σ) of pixels in the nodule and threshold value computes using this formula:

$$T = M_m + K.\sigma.$$

As the luminance of the micro- calcification is brighter than normal pixel so it is easy to distinguish the effect Area from segmented Mass

IV. Results and Discussion

Validity of the proposed algorithm is simulated using MATLAB.
Figure 1 display the original image, image after unsharp-masking, calcification extracted from the nodule.



(a) (b)

(c)

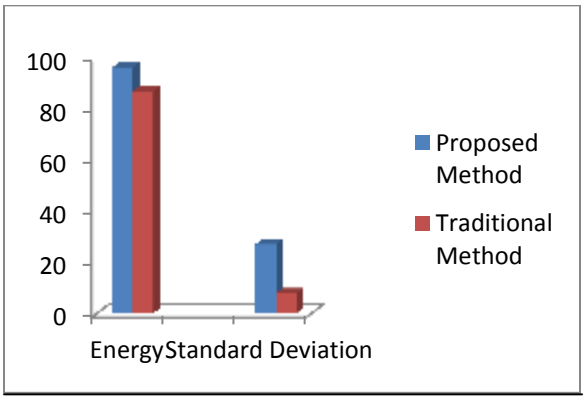
Figure 1 (a) original image, (b) enhanced image (c) Calcifications extracted

A total of 15 gray scale images are used as the testing data. According to the basis of our result, the hybrid detection method have the maximum energy and standard deviation which performs better detection of mammography images taken from MIAS database to traditional micro-calcification detection method which have the minimum standard deviation and energy which is not better to perform the detection of malignant breast cancer. Table 1 and figure 2 shows that higher value of performance metrics are obtained from the proposed obtained than the traditional method.

Table 1 Comparison of efficiency of proposed and traditional method on the basis of performance parameters

Performance Metrics	Proposed Method	Traditional Method
Energy	96.11	86.83
Standard Deviation	27.02	7.81

* Database values calculated on average basis



V. Conclusion

In this paper, K-Mean clustering techniques combine with micro-calcification to propose new hybrid detection technique. The experiments show that the proposed method can achieve better results as compared to the traditional technique. Results are compared on the basis of performance parameters: Energy and Standard Deviation.

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