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Mammogram image with Wiener filter and CLAHE

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Abstract

Many of the women in worlds die because of breast cancer and early detection will save the lives of many women. A mammogram is a special medical image in the breast. The mammogram image contains artifacts and wedge.

In this paper the mammogram image enhances by applied the Wiener filter to remove noise and apply Contrast Limited Adaptive Histogram Equitation (CLAHE) to improve a quality of mammogram image. Before applying them made number step to remove artifacts and wedge, background and pectoral muscle these know. The result indicted obtain mammogram image only breast profile, with a nice smooth, safe edge, and high quality.

These results prove that effective and convenient assistance for medical diagnosis. Hence, the proposed method definitely can be considered for automated detection of abnormality like benign, malignant and micro calcifications.

Keyword: breast cancer, Contrast Limited Adaptive Histogram Equitation, mammogram, wiener filter.

1. Introduction

In recent days, the great development in the medical images prompted researchers to study and provide computerized methods that provide support and assistance to people who deal with diagnosis medical images [1].

A common breast cancer has become a widespread disease around the world in young women and leading cause of cancer death and caused 22.9% of all types of cancers in women[2، 3].

In D.Surya Gowri focused on Image enhancement techniques like smoothing, filtering, denoising, and histogram equalization. Contrast enhancement is frequently referred to as one of the most important issues in image processing. Histogram equalization (HE) is one of the common methods used for improving contrast in digital images [4].

In they investigated the use of the Anscombe transformation and the adaptive Wiener filter for mammography denoising and an MTF-based inverse filter for mammographic image restoration. This image restoration technique could be used as a preprocessing module in computer aided detection systems to improve the detection of tumor in breast cancer screening [5].

In this paper, we enhancement the suspicions region by using wiener filter and CLAHE by improve a quality of mammogram image and remove noise.

2. Method and Marital

2.1 DATASET USED

For testing and analysis of the proposed algorithm, randomly selected number of Mammographic Image Analysis Society (mini-MIAS) database, organized by J Suckling et al.in 1994 [6]

2.2 Wiener filter

It is a discrete time linear filter. This has been widely used in reconstruction of one-dimensional signals and two-dimensional images. Although Wiener filter is sensitive to noise, yet it can be used for good restoration of the original image. The elegance of Wiener filter lies in the fact that it incorporates the prior knowledge about the noise embedded in the signal and the spectral density of the object being imaged. As a result, Wiener filter provides a better and improved restoration of original signal since it takes care of the noise process involved in the filtering. The discrete version of the Wiener filter is a straightforward extension to the continuous Wiener filter.

$$e^2 = \{[f(x,y) - \hat{f}(x,y)]^2\} \quad (1)$$

is minimized, where E{.} is the expected value of the argument. The resulting estimate is also called MMSE estimate.

$$g(x,y) = h(x,y) * f(x,y) + n(x,y) \quad (2)$$

$$\hat{f}(x,y) = w(x,y) * g(x,y) \quad (3)$$

Since we have assumed that H is linear shift invariant and f is stationary, applying fourier transform leads to

$$\hat{F}(k.l) = \left[\frac{H*(k,l)}{|H(k,l)|^2 + S_u(k,l)/S_x(k,l)}\right] G(k,l) \quad (4)$$

where S_x is the signal power spectrum and S_u is the noise power spectrum.The Wiener filtered result. This will help in making use of the information content in other frames in restoring a particular frame[7].

2.3 Contrast Limited Adaptive Histogram Equalization

The properties of pixels vary spatially, thus using a single global histogram mapping does not enhance the local contrast optimally. In medical imaging local details are important. Local histogram approach working on small sub-windows is effective in such applications. Ketcham et al. [28] were the first to propose a local technique called Adaptive Histogram Equalization (AHE). This method first divides the image into blocks, then mapping functions for each block is used to improve the contrast. The main disadvantage of this approach is slow speed and the presence of histogram spikes. The variation of this approach CLAHE overcomes over-enhancement and noise amplification by clipping spikes and also improves computation speed[8].

the procedure of CLAHE is started br the following steps:

i. The image is divided into blocks.

ii. Histogram is computed for each block

iii. The derived histogram for each block is clipped and renormalized.

iv. The desired mapping function is calculated only at a sample of pixels and the mapping function for other pixels is obtained by interpolating mapping functions associated with its four neighboring blocks.

v. The mapping functions are applied to get a contrast enhanced image[8].

3 Processes and Method

3.1 Preprocessing

The goal of this stage is to decrease the number of objects which must be assessed by extracting the relevant breast region and minimizing the area of the mammogram image to be examined. Figure of (2) shows the subsidiary steps of the preprocessing stage.

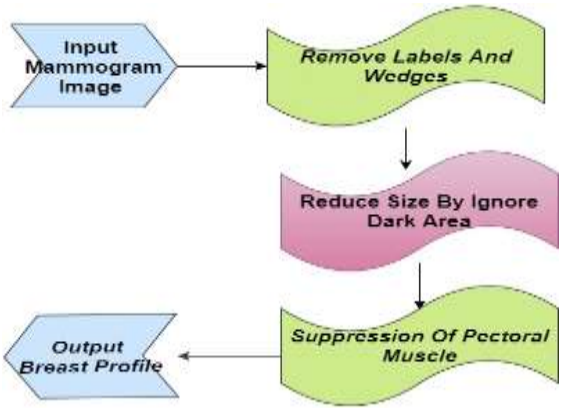

Figure (2) the Preprocessing process

The stage starts with the removal of extraneous objects from the mammography image, such as wedges and labels, by using a global threshold when transforming the image into binary image [0, 1]. To suppress labels and wedges, the physical area of each object in the binary image is calculated, and the object with the largest area is taken to be the breast profile itself. And so, after this, the process is to remove all the objects except the largest one. After the resultant, uncluttered, image is obtained, the area of the image is reduced by ignoring the surrounding dark area .this will reduce the time taken for next operations.

Then third stage was used to reduce the pectoral muscle part by using modified region growing technique. The seeded region growing is one of the image segmentation methods, it works in two ways based on selected pixel locational value and other is selection of seed point. The seed point may be selected adaptively or manually. In the proposed method, seed point is selected automatically by considering the orientation of the mammography. This approach determines the neighboring pixels of seed point and examines whether the next pixels should be added to the region or not. The process is iterated till to extract the complete ROI

3.2 Enhancement

Fourth stage applied the wiener filter, lastly stage applied the CLAHE as shown in figure (3).

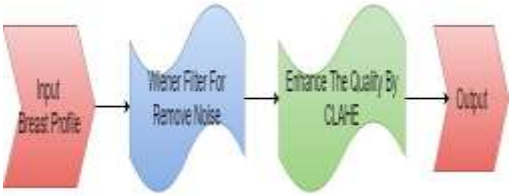

Figure (3) the Enhancement process

i) Wiener filter

It implantation on mammogram image by create a two-dimensional Wiener filter mask size with a SNR 0.2 applied to the image, as show in eq.4 in part of (2.2)

$$\hat{F}(k.l) = \left[\frac{H(k,l)}{|H(k,l)|^2 + S\_u(k,l)/S\_x(k,l)}\right] G(k,l)$$

Where G(k,l) is input image after applied the Fourier transform , H(k, l) *the mask* the $\hat{F}(k.l)$ resulte is of mammogram image, and the $S\_u(k,l)/S_{x(k,l)}$ assume value is equal to 0.2

ii) Contrast Limited Adaptive Histogram Equalization

The CLAHE is an adaptive contrast enhancement method. It is based on adaptive histogram equalization (AHE), where the histogram is calculated for the contextual region of a pixel. The CLAHE can improve the detection of simulated speculations in dense mammograms in a laboratory setting.

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4. Result

In this paper, enhancement the mammogram image to help radiology for detection tumor, The input mammogram image consists of a background (a dark area), an extraneous object (label), a pectoral muscle, and a breast profile, as shown in figure(3)

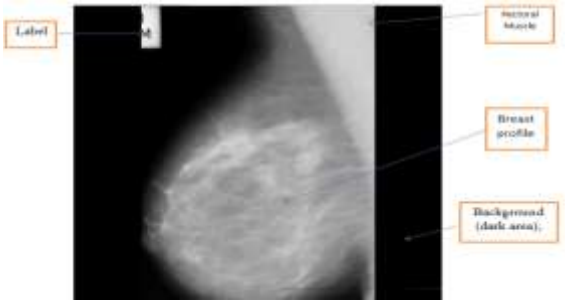
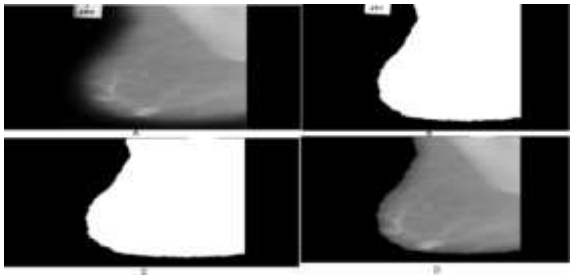


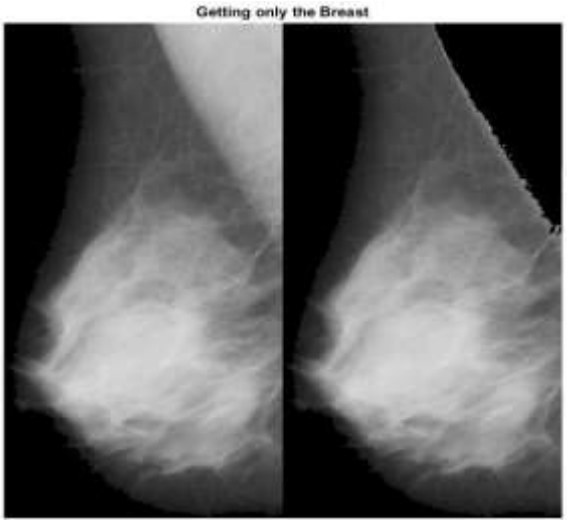
Figure (3) architecture of mammogram image

the first step remove extra objects convert to binary image then calculate area of each object then delete all object except the largest object as shown in figure(4)



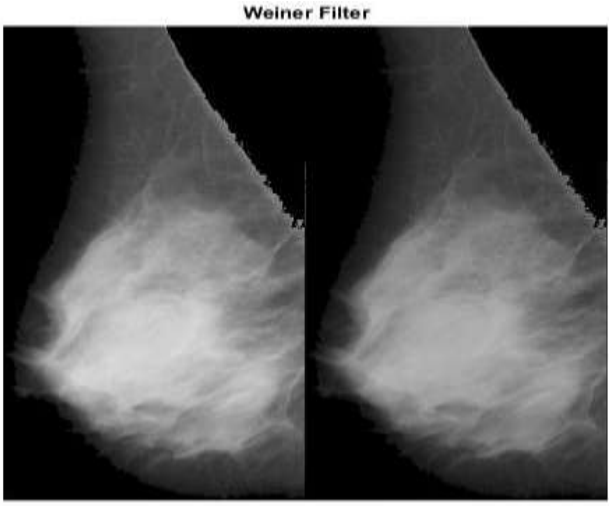
Figure(4) (a) Original image, (b) Binary Image (c) Extract breast profile (d) multiplied image c with image a.

second step ignore dark area as shown, third step elimination the pectoral muscle by used seed region growing by select position as refer in (2.1)in figure(5).



Figure(5) Get ROI from mammogram image

then using wiener filter by choose array of convolved [3 3] , and PSNR equal =0.2 PSF=fspecial('average',[3 3]); is the point-spread function with which I was NSRP=0.2; is the noise-to-signal power ratio of the additive noise. NSR can be a scalar or a spectral-domain array of the same size as I, J=deconvwnr(I, PSF,SNR); returning deblurred image J, as shown in figure (6).



Figure(6) apply wiener filter

The CLAHE applied adapthisteq (i); with a default value with num_tiles equal[8 8] with clip levels 0.01, Nbin is 255, as shown in figure (7).

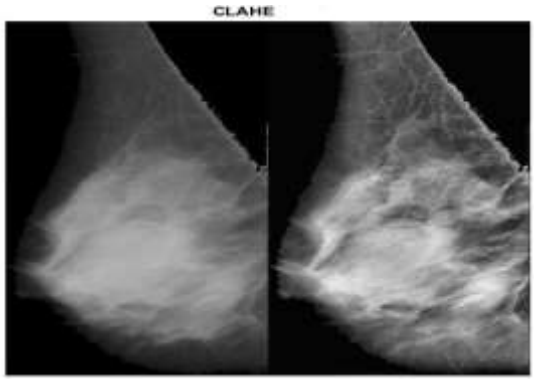


figure (7) apply the CLAHE

The figure (8) comparing among the wiener filter , gaussian filter and median filter base on single to noise, It show the wiener filter best than gaussian filter , median filter.

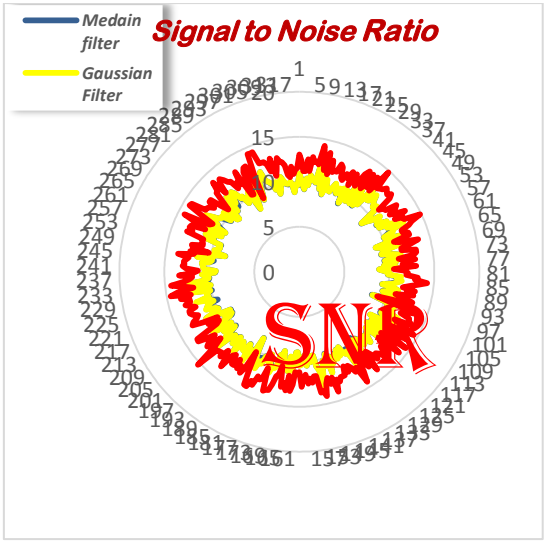


Figure 8 Comparison (wiener filter, gaussian filter , median filter)

5. CONCLUSIONS

Breast cancer is leading cause of death for women. This early detection may save the life of the patient. The proposed method of pre-processing presented with removal of background artefacts, pectoral muscle suppression and image quality helps much in early detection. Our results show that, significant wiener filter and CLAHE are influencing factors for enhancement of mammography. The complete pectoral muscle was reduced by modified region growing techniques. The proposed method tested on images of MIAS database, ROI extracted from all the images accurately and proved to be suitable for CAD system of early detection of breast cancer. Collectively, these results prove that effective and convenient assistance for medical diagnosis. Hence, the proposed method definitely can be considered for automated detection of abnormality like benign, malignant and micro calcifications.

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صور الماموجرام مع فلتر Wiener وCLAHE

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المستخلص :

العديد من النساء في العالم يموتون بسبب سرطان الثدي والكشف المبكر سينقذ حياة العديد من النساء. التصوير الشعاعي للثدي هو صورة طبية خاصة في الثدي. الصورة الماموجرام يحتوي على اجزاء خلفية تكون مناطق اسود ،وعلامات الدعائية الشركة المصنعة لجهاز الماموجرام و عضلات الصدرية و منطقة الثدي . في هذه البحث تحسن صورة الماموجرام بتطبيق فلتر wiener لإزالة الضوضاء , زياجددة نقاوة الصور وتطبيق (CLAHE) لتحسين تباين والاضائة الصور الماموجرام و لتحسين الصورة الماموجرام يجب قيام بعمليات Preprocessing وهي ازالة الكائنات الاضافية (العلامات الدعائية والخلفية والعضلات الصدرية) .هذه النتائج تثبت أنها فعالة للتشخيص الطبي. وبالتالي، فإن الطريقة المقترحة بالتأكيد يمكن أن يستخدم في الكشف الآلي عن المناطق الغير سليمة مثل الحميدة، الخبيثة والجزئيات الدقيقة.