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Enhancement of mammogram for detection of breast cancer using adaptive median filter

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***Abstract*—:** Digital mammogram becomes the most effective technique for early breast cancer detection modality and processing these images requires high computational capabilities. Computer image processing techniques will be applied to enhance images. This paper attempts to study about pre-processing is the most important step in the mammogram analysis due to poor captured mammogram image quality. Pre-processing is very important to correct and adjust the mammogram image for further study and processing. Different types of filtering techniques are available for pre-processing. Filters are used to improve image quality, remove the noise, preserves the edges within an image, enhance and smoothen the image. The experimental results concludes that the adaptive median filter is best for mammogram image noise removal and gives better performance by estimating the PSNR values Keywords: Median filter, Adaptive median filter, Peak Signal to Noise Ratio, Mean Squared Error.

Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION

Cancer is not a single disease. It is a group of more than 200 different diseases. Cancer can be generally described as an uncontrolled growth and spread of abnormal cells in the body. Cells are basic units of life. All organisms are composed of one or more cells. Normally, cells divide to produce more cells only when the body needs them. Sometimes cells keep dividing and thus creating more cells even when they are not needed. When this happens, a mass of tissue forms. This mass of extra tissue is called a tumor. Tumors are found in all kinds of tissue, and can be benign or malignant .Malignant tumor is cancer causing while benign is harmless.

Breast cancer is the second most common cancer in Indian women. In the united states alone a most recent survey estimated 2, 07,090 new cases of breast cancer and 39,840 death in women during 2010.The average incidence rates varies from 22-28 per 10,00,000 women per year in urban setting to 6 per 1,00,000 women per year in rural areas.

Cancer starts when cells begin to grow out of control. Cells in nearly any part of the body can become cancer, and can spread to other areas of the body. Breast cancer is a malignant tumor that starts in the cells of the breast. A malignant tumor is a group of cancer cells that can grow into (invade) surrounding tissues or spread (metastasize) to distant areas of the body. The disease occurs almost entirely in women. Breast cancer is found rarely in men.

II. METHODOLOGY

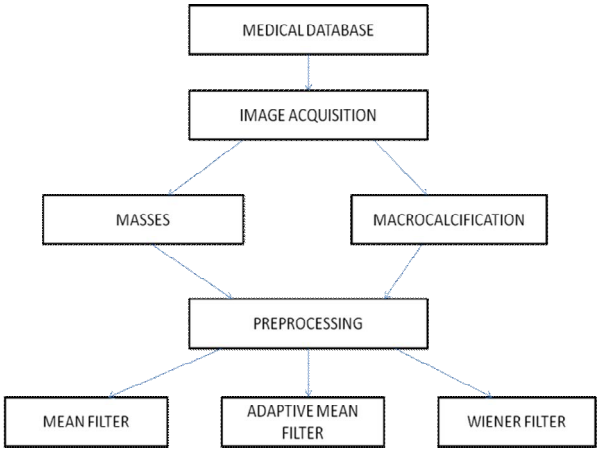


Fig. Methodology for mammogram preprocessing

1.IMAGE ACQUISITION:

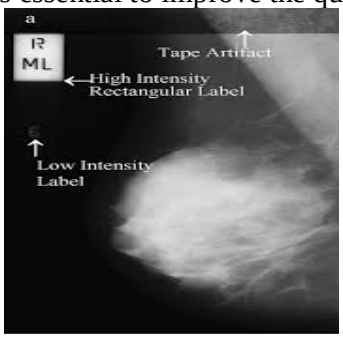
In this step we have collected mammograms of cancerous and non-cancerous patients from hospitals. There are two types of mammograms;

1.Masses

2.Microcalcification.

2.PREPROCESSING:

The main goal of the pre-processing is to improve the image quality to make it ready to further processing by removing or reducing the unrelated and surplus parts in the background of the mammogram images Mammograms are medical images that complicated to interpret. Hence pre-processing is essential to improve the quality. [3]



Types of noise observed in mammogram.

We can use different filters for preprocessing such as:

1.Mean filter
2.Adaptive mean filter
3.Wiener filter

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1 .Mean filter:

The goal of the mean filters used to improve the image quality for human viewers. In this, filter replaced each pixel with the average value of the intensities in the neighborhood. It locally reduced the variance, and easy to carry out . Limitations of average filter:

- Averaging operations lead to the blurring of an image, blurring affect features localization.
- If the averaging operations applied to an image corrupted by impulse noise, the impulse noise attenuated and diffused but not removed.
- A single pixel with a very unrepresentative value affected the mean value of all the pixels in neighborhood significantly.

2. Wiener filter:

The wiener filter tries to build an optimal estimate of the original image by enforcing a minimum mean square error constraint between estimate and original image. The wiener filter is an optimum filter. The objective of a wiener filter is to minimize the mean square error. A wiener filter has the capability of handling both the degradation function as well as noise.[2]

3. Adaptive median filter:

Adaptive median filter works on a rectangular region Sxy. Each output pixel contains the median value in the 3-by-3 neighborhood around the corresponding pixel in the input images. Adaptive Median filtering used to smooth the non-repulsive noise from two-dimensional signals without blurring edges and preserved images. This makes, it particularly suitable for enhancing mammogram images. The preprocessing involved in creating masks for pixels with highest intensity, to reduce resolutions and to segment the breast. we are going to see effect of adaptive mean filter on mammogram in this paper.

Adaptive median filter works on a rectangular region Sxy. It changes the size of Sxy during the filtering operation depending on certain conditions as listed below. Each output pixel contains the median value in the 3-by-3 neighborhood around the corresponding pixel in the input images. Zeros however, replace the edges of the images [19]. The output of the filter is a single value, which replaces the current pixel value at (x, y), the point on which S is centered at the time. The following notation is used:

Zmin = minimum pixel value in Sxy
Zmax = maximum pixel value in Sxy
Zmed = median pixel value in Sxy
Zxy= pixel value at coordinates (x, y)
Smax = maximum allowed size of Sxy

Adaptive Median filtering used to smooth the non-repulsive noise from two-dimensional signals without blurring edges and preserved images. This makes, it particularly suitable for enhancing mammogram images. The preprocessing techniques used in mammogram, orientation, label, artifact removal, enhancement and segmentations. The preprocessing involved in creating masks for pixels with highest intensity, to reduce resolutions and to segment the breast. [1]

III. PARAMETER EVALUATION

The objective measures of picture quality that are based on computable distortion measures like mean square error, peak signal to noise ratio, average distance, maximum difference, normalized correlation, mean absolute error, normalized error, structural correlation are considered for study in this work on the original image f(i, j) and on the decompressed image
f'(i, j)[3]

A. Mean Square Error

The Mean Square Error is most common form of image quality for any images. The simplest of distortion measurement is Mean Square Error (MSE), defined as,

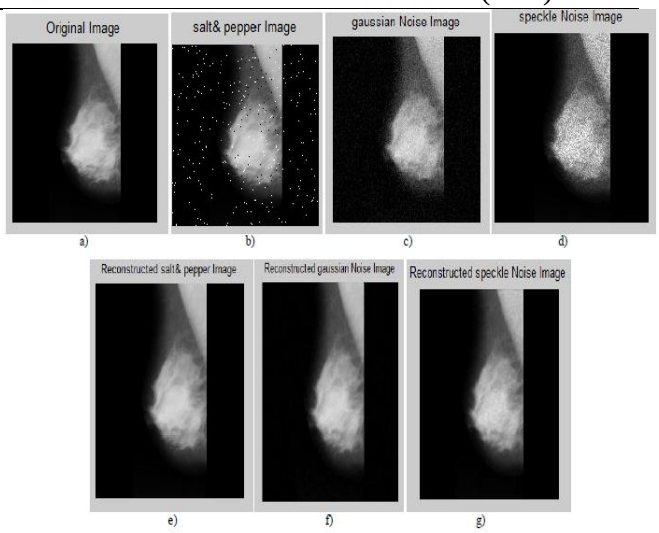
$$MS = \frac{1}{MN} \sum_{i=1}^{M} \cdot \sum_{j=1}^{N} (f(i,j) - f'(i,j))^2$$

The original image f (i, j) and the segmented or reconstructed image f'(i,j). The higher of MSE value refers to the lower image quality.[1]

B. Peak Signal – to – Noise-Ratio

Bigger SNR and PSNR point out a smaller difference between the original (without noise) and reconstructed or segmented image. This is the most widely used objective image quality/ distortion measure. The most important advantage of this measure is ease of calculation but it does not reflect perceptual quality.[1] The small value of Peak Signal to Noise Ratio (PSNR) means that image is poor quality. PSNR is defined as follow:

$$PSNR = 20 \log_{10} \left(\frac{1}{RMSE} \right) db$$



Adaptive Median Filter for mammogram images and simulation results for mdb001.jpg [(a), (b), (c), (d), (e), (f), and (g)] input images, salt and pepper noise image, Gaussian noise image, speckle noise image, reconstructed salt and pepper image, reconstructed Gaussian image, reconstructed speckle image, respectively.

TABLE

Table shows values of MSE and PNSR if different noises are applied on mammograms

Noise	MSE	PNSR
Salt and paper	6.7584	39.8323
Gaussian	8.4131	38.8812
specular	11.2664	37.6126

CONCLUSION

Pre-processing stage is an application dependent technique for enhancing the content of medical image based on removal of special markings and speckle noise. Removal of special markings and speckle noise existing in medical images will increase the quality of image segmentation.

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