

An Approach For Removing Salt And Pepper Noise From Mammogram Images

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Abstract: The uses of digital images have been increasing day by day due to advancements in the field of telemedicine. Various techniques are used for acquiring digital images such as ultrasound, CT scan, X-ray etc. mammogram images are used for detecting breast cancer in women. While acquiring and transmitting the image is corrupted by various kinds of noise such as Gaussian noise, salt and pepper noise, Poisson noise etc. a hybrid filter is proposed for the elimination of salt and pepper noise from mammogram images. The principal component analysis along with adaptive median filter is used for removal of noise. The performance of the filter is depicted in terms of PSNR and MSE..

Index Terms: Mammogram images, salt and pepper noise, PCA, Adaptive median filter.

1. INTRODUCTION

DIGITAL images are used in hospitals and clinics every day. But the major obstacle is that digital image gets degraded by noise such as Gaussian noise, salt and pepper noise while transmission and acquisition [1]. Many types of digital images are used such as MRI, X-ray, Mammograms and many more. Mammograms are used for detection of breast cancer in women. The main reason of death among women is Breast Cancer. The breast cancer is developed in the tissues of breast. If it is detected at the starting stage than it can be cured properly [2]. Denoising of digital images is an important pre-processing task [3]. Digital images corrupted by salt and pepper noise are denoised by Median filter [4], Wiener filter [5], but the existing techniques fails to keep the important details of image. A new technique has been proposed for denoising of mammogram images

2 LITERATURE REVIEW

Different methods used for pre-processing of mammogram images are reviewed in this part. In [6] a filter was proposed to eliminate the salt and pepper noise from medical images using the combination of fuzzy median filter and Kalman filter. [7] introduced a filter for removal of noise from brain images using werner filter along with histogram approach. The adaptive weighted median filter is proposed in [8] for abolishing salt and pepper noise from the medical ultrasound images. It exchanges the central pixel of the kernel with the evaluated median value. In modified weighted average filter (MWAP) which is introduced in [9] uses the mean filter along with weights. It first detects the noisy pixel and then average filter performs on the noisy pixels which further calculates the weights in accordance to the similarities between the noisy and noise free pixels. In [10] a modified filter was proposed which median filter for noise removal. The window of this filter gives different weights to the neighboring pixels of central processing pixels. After the product of pixels with the allotted weights, the median value is calculated. A two stage noise removal approach is developed in [11] which adaptive filtering is the first step and then regularizations are applied only to the corrupted pixels.

3 PROPOSED METHOD

The pertinent aim of denoising should be to remove noise from the image without any loss of important information. The proposed method consists of two stages. In first stage noise is removed with the help of selective adaptive median filter. In second stage the edges and details are conserved with the

help of Principal Component Analysis. The steps of the both stages are discussed below

Stage I: Selective Adaptive Median filter is used for salt and pepper removal. The various steps of stage I are listed below:

1. Window of size 3×3 is used initially used. And it checks whether the pixel is corrupted or not.
2. If the pixel is not noisy, the minimum, median and maximum values of pixels are calculated from the window.
3. If median value is greater than minimum and smaller than maximum, the value of central pixel from the window is exchanged with the median value.
4. If the pixel is not noisy, the size of window is increased by one and steps 1,2,3 are repeated.

Stage II

1. Split the whole image into number of blocks. Principal component analysis algorithm is applied on the image blocks.
2. The eigen values and eigen vectors are evaluated for the patches.
3. Then similarity of each block is checked with the affinity matrix. Unwanted blocks or the blocks which are dissimilar are removed.
4. After all unwanted blocks are removed then denoised image is obtained by merging all the similar blocks together.
5. Otherwise the numbers of the dissimilar blocks are put into array and the blocks are merged after removing the unwanted blocks.

4 EXPERIMENTAL RESULTS

The proposed method is used for denoising of mammogram images. Its performance is checked at low, medium and high noise density. The peak signal to noise ratio and mean square error are used to depict the quality of denoised image. These are the important parameters of image which tells about the

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efficiency of the method. The proposed filter is compared with MAAF in terms of PSNR and MSE.

$$\text{PSNR in Db} = 10 \log_{10} \frac{255^2}{\text{MSE}}$$

$$\text{MSE} = \frac{1}{M \times N} \sum_{i=0}^{M-1} \sum_{j=0}^{N-1} (Y(i, j) - \hat{Y}(i, j))^2$$

in which $M \times N$ is the size of the image to be denoised. Y is the original image and $\hat{Y}$ is the denoised image. The PSNR and MSE of the proposed method and Modified Weighted Average Filter are shown in the table 1 and 2 at varying values of noise density. The tables depict that the results of proposed method are better even at low, medium and high noise density.

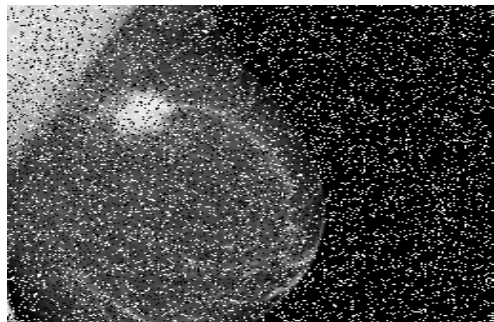


Figure 1 Noisy Mammogram with 80% noise



Figure 2 Denoised by Proposed Method

Table 1: Comparison of PSNR

Noise density	Proposed method	MWAF
10	44.173	43.012
20	41.124	41.029
30	39.363	38.502
40	38.116	36.298
50	37.142	34.911

60	36.355	33.598
70	35.677	32.701
80	35.098	29.119
90	34.098	24.988

Table 2: Comparison of MSE

Noise density	Proposed method	MWAF
10	2.5068	3.2491
20	5.0582	5.1307
30	7.5821	9.1807
40	10.1123	15.2503
50	12.6554	20.9882
60	15.1667	28.3975
70	17.7310	34.9121
80	20.2584	79.6490
90	22.7708	206.196

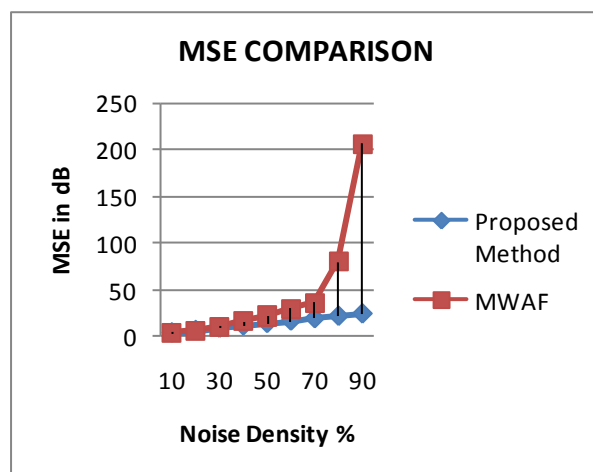


Figure 3 Comparison of PSNR

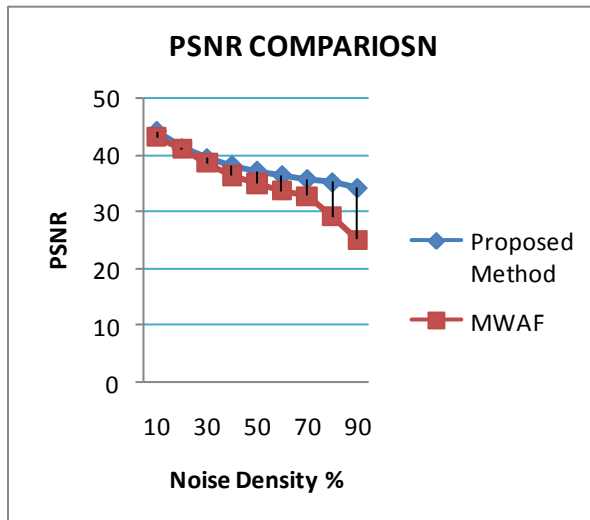


Figure 4 Comparison of MSE

7.2 Conclusion

There are various filters which have been proposed for denoising of mammograms. The proposed method is compared with the Modified Weighted Average Filter. The filter proposed in this paper shows better results for PSNR and MSE at different values of noise density. The edges of the image are conserved at high density of noise also.

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