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Impact & Analysis of Lazy-Median Filter on Tem Images

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Abstract: TEM image is rapidly gaining prominence in various fields. Since high resolution TEM image captures huge amount of information, it is important to understand image segmentation techniques on it. Image denoising on such images is very important image processing step. This paper proposes a new variation of median filter which is giving an apt result in comparison to basic median filter mainly on the parameters of signal to noise ratio(SNR) and peak signal to noise ratio(PSNR).

Keywords: TEM, denoising, SNR, PSNR

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I. INTRODUCTION

TEM (Transmission Electron Microscopy) is an important morphological characterization tool for Nano-materials. Quite often a microscopy image gets corrupted by noise, which may arise in the process of acquiring the image, or during its transmission, or even during reproduction of the image. Removal of noise from an image is one of the most important tasks in image processing. Denoising techniques aim at reducing the statistical perturbations and recovering as well as possible the true underlying signal. Depending on the nature of the noise, such as additive or multiplicative type of noise, there are several approaches towards removing noise from an image. Image De-noising improves the quality of images acquired by optical, electro-optical or electronic microscopy.

The type of noise introduced in the images in this paper is data dropout noise (commonly referred to as intensity spikes, speckle or salt and pepper noise). Here, the noise is caused by errors in the data transmission. The corrupted pixels are either set to the maximum value (which looks like snow in the image) or have single bits flipped over. In some cases, single pixels are set alternatively to zero or to the maximum value, giving the image a `salt and pepper' like appearance. Unaffected pixels always remain unchanged. The noise is usually quantified by the percentage of pixels which are corrupted.

II. LITERATURE SURVEY

In median filter, there is window sliding over data.i.e pixels of image, find its median, and identifies the outliers to proceed with filtering process. Over the research done it is found that for impulsive type of noise nonlinear filters are better than linear filters especially in terms of edge preservation. Though median filter cannot be coined as a perfect filter as it has some consequences. It removes fine thin lines and sharp corners of the image. Many improved versions of median filter have been proposed over the time like unsharp adaptive masking [1], local contrast method [2][6], switching median filter [3][5], decision based median filter [4], adaptive median filters [7-10].

In this paper a median based filter called lazy median filter is introduced, having similar properties as the above mentioned filters, while being simpler and easier to implement than them.

III. ALGORITHM

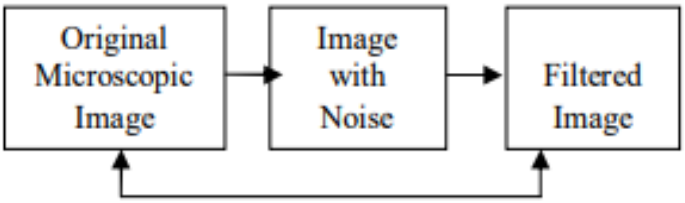
This algorithm follows two bounds, lower bound and upper bound. It also identifies and maintains a special list of gray levels which do not require any filtering. While tracing the input, it identifies if the input belongs to this special list or not. If it belongs to this list, it is kept as it is unfiltered and if it does not belong to the list, it is filtered using standard median filter thus named lazy median filter.

Step1: Read Image
Step2: Convert to data type double,
img=double(img);
Step3: n=img;
Step4:[x y]=size(im2);

Step5: By default assumes lower and upper sizes of window as 3 and 5
Step6: nt=medfilt2(img);
Step7: l=medfilt2(im2,[3 3])
Step8: u=medfilt2(im2,[5 5]);
Step9: for i=1:x
for j=1:y
if (n(i,j)~=l(i,j) & (n(i,j)~=u(i,j)))
n(i,j)=nt(i,j);
end end endStep10: Display Result

IV. METHODOLOGY

The complete simulation is carried in Matlab R2017a. The original biomedical image is taken. Salt & Pepper type of noise is added to the original image. This distorted image is then filtered using some algorithm and is compared with the statistics of original image tointerpret that to what extent filter is able to denoise the image as shown in figure 4.1



V. SIMULATION RESULTS

The algorithm is simulated and the performance is measure in terms of signal to noise ratio and peak signal to noise ratios respectively.

Noise Intensity	SNR before Filter	PSNR before Filter	SNR after Filter	PSNR after Filter
0.001	15.0941	34.9843	15.3413	35.5144
0.002	13.925	32.6465	15.326	35.4839
0.003	13.1291	31.0523	15.3315	35.4946
0.004	12.2752	29.3389	15.3124	35.4564
0.005	11.6153	28.0182	15.289	35.4096
0.006	11.3548	27.4897	15.2883	35.4079
0.007	11.0128	26.8056	15.2662	35.3638
0.008	10.8661	26.5111	15.272	35.3759
0.009	10.258	25.284	15.2182	35.2679

Table 5.1: SNR & PSNR ratios before and after applying Denoising Filter

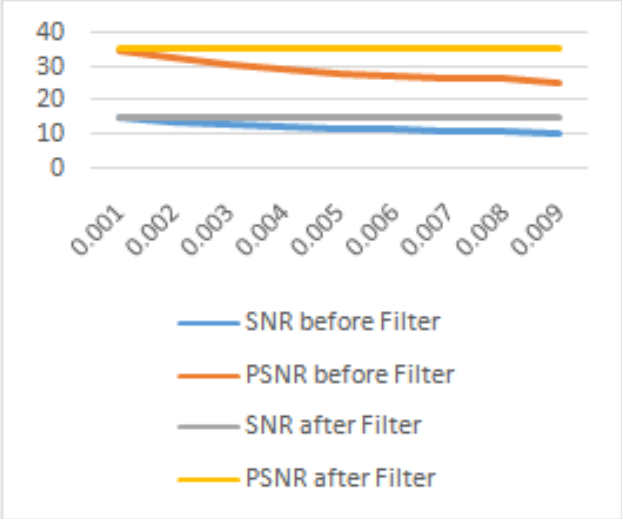


Figure 5.1:SNR& PSNR ratios before and after applying Denoising Filter

VI. CONCLUSION

An Image is denoised with four types of noise. For each type of noise the noise intensity variation taken is 0.001 to 0.009 i.e 1% to 9% . For each of these images four parameters SNR & PSNR. Simulation results clearly indicates that this improved version of median filter is giving consistent high signal to noise ratio inspite of increase noise level. Also PSNR ratios obtained after applying filter is significantly high. It is capable of preserving edges while removing outliers.

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