Comparative Study and Analysis of Different Denoising Methods used in Different Applications

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Abstract- Reducing noise from single image, natural images, etc. is the challenge for the researchers in digital image processing. Several approaches are there for noise reduction. Different noise models including additive and multiplicative types are used. They include gauusian noise, salt and pepper noise, special noise and Brownian noise. In this project we used the denoising techniques to reduce the noise from natural images. This thesis reviews the existing denoising algorithms such as filtering approach, wavelet based approach, multifractal approach, PCA, ICA, Adaptive PCA approach, and performs their comparative study.

I. INTRODUCTION

Denoising of images is a challenging and extremely relevant research problem as the type of images type of noise and amount of noise all are variable in the practical situations. All denoising methods are ultimately a type of low pass filters. Filtering of the images can be done in the spatial domain or in the transform domain. Filtering in the transform domain is more efficient and introduces fewer artifacts. The focus of recent research has been on the higher order statistical methods and the nonlinear transform domain filtering .There are numerous methods and approaches for denoising of images, however only the prominent and relevant methods based on ICA technique are discussed here. First time the ICA technique was presented by [2].The easy and popular low pass filter method smoothens out the image so that the edges are not prominently visible .Denoising techniques based on Fouriertransform method is localized in frequency domain and the wavelet transform method is localized inboth frequency and spatial domain but both the methods are not data adaptive, however if the filtering approach is data adaptive it comes out with promising results, and that is the inherent property of ICA techniques. Data adaptiveness plays an important role in image denoising process because denoising of images is also dependent on the image (type) which is to be denoised. For all the methods discussed here, images are corrupted by additive Gaussian White noise, which is an appropriate representation of noisy images acquired by various image capturing and scanning methods. Gaussian white noise also includes all the frequency.

II. LITRATURE SURVEY

So many researches are worked on this area some work areas follows. Alin Achim, Ercan E. Kuruo˘glu [20]. They projected a good wavelet-domain MAP processor that creates use of quantity -stable distributions to account for the interscale dependencies of natural image subbands. It have tested formula for the Cauchy case and compared it with many alternative results rumored within the recent literature. Sudipta Roy, Nidul Sinha, Asoke K. fractional monetary unit [6] during this paper a brand new model supported the crossbreeding of rippling and bilateral filters for denoising of style of clattering pictures is conferred. The model is experimented on normal pictures, like x-ray pictures, ultrasound and astronomical telescopic pictures and also the performances area unit evaluated in terms of peak signal to noise magnitude relation (PSNR) and image quality index (IQI). Lei Zhang, Paul Bao, Xiaolin Shanghai dialect [21] during this paper, wavelet-based multiscale linear minimum mean square-error estimation (LMMSE) theme for image denoising is projected, and also the determination of the optimum rippling basis with relation to the projected theme is additionally computed. V.V.K.D.V. Prasad, P.Siddaiah, and B.Prabhakara Rao

[22] during this paper shrinkage methodology supported a brand new Thresholding filter for denoising of biological signals is projected. The effectualness of this filter is evaluated by applying this filter for denoising of electrocardiogram signal contaminated with additive mathematician noise. Li Hongqiao, Wang Shengqian [13] this paper presents a brand new image denosing methodology. Firstly, this methodology decomposes the clattering image so as to induce totally different sub-band image. Secondly, unbroken stay the low-frequency rippling coefficients unchanged, and once taking into consideration the relation of horizontal, vertical and diagonal high-frequency rippling coefficients and scrutiny them with Donoho threshold ,it build them enlarge and slender comparatively.

III. ALGORITHEM & IMPLEMENTATION

In this research paper a novel approach to identify the noise type and filtering high impulsive noise by developing an adaptive nonlinear filter is proposed. The algorithm implemented to achieve the proposed task comprises the following steps [6].

Step1: Perform image segmentation by using multithresholding technique.

Step2: Find the set of points corresponding to the local maximums of the histogram. $P0 = \{i, h(i) \mid h(i) > h(i-1) \& h(i) > h(i+1)\}$ (10)

Step3: Consider local neighborhood of consecutive three bins of histogram and find maximum frequency value. $P1 = \{Pi, h(Pi)) \mid h(Pi)>h(Pi-1) \& h(Pi)>h(Pi+1)\ Pi \in P0\}$ (11)

Step4: If a peak is too small compared to the biggest peak, then it is removed.

Find ymax; if yi/ymax<0.02 then remove yi

Step5: Choose one peak if two peaks are too close. h(P1) & h(P2) , P2>P1 ,
P2-P1<10 (12)h = max{h(P1), h(P2)} (13)

Step6: Ignore a peak if the valley between two peaks is not obvious. Havg=sum (counts (P1:P2))/(P2-P1+1) (14)

Step7: Extract valleys as thresholds.

Step8: Perform labeling of image for selection of homo- geneous regions.

Step9: Apply the window of size m*m for each pixel of the observed image and the image of labels.

Step10: Analyze the dynamics D(n) of the grey levels of the M local homogenous regions of the observed image.

Step11: Compute mean and max of dynamics D(n).

Step12: If (mean(D(n))/max(D(n)))>λ then it is an Impulsive noise.

Step13: Else if (A/C)>(B/D) then it is a multiplicative noise.

Step14: Else it is an additive noise.

Step15: If the noise present in the image is impulsive then read pixels of 3x3 moving window of the noisy image.

Step16: Identify the corrupt pixel by using proposed adaptive noise identification technique of a noisy pixel.

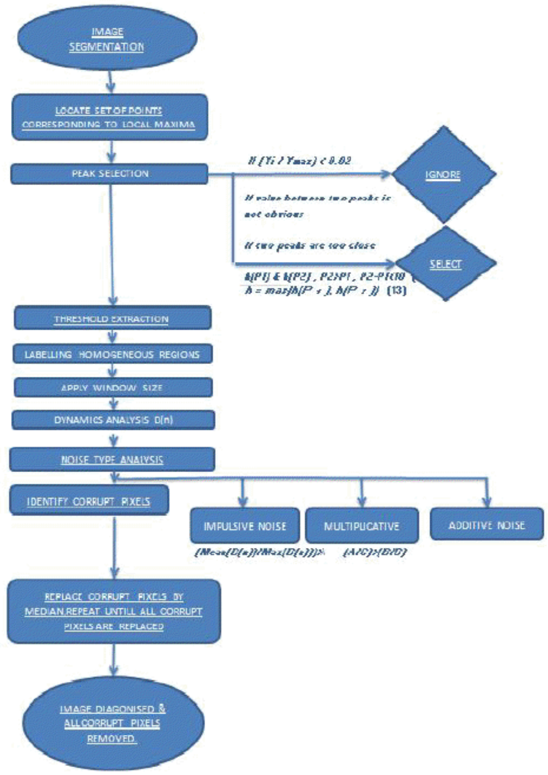
Step17: If the central pixel is corrupt then identify the number of corrupt pixels in the window.

Step18: If the numbers of corrupt pixels in the window are less than five then replace the corrupt pixel by the median of the pixels in the widow.

Step19: If the numbers of corrupt pixels in the window are greater than four and less than thirteen then replace the corrupt pixel by the median of the pixels of 5x5 moving window.

Step20: Repeat the steps 15 to 18 for all corrupt pixels of the noisy image in nature.

Flow Chart of Showing This Is As Follows-



IV. RESULTS

In order to overcome the ill influence of noise and shading, there is a need to take them into consideration when selecting the threshold being used. On the other hand, this is an impossible mission in a global context, since no one threshold can fit the entire image. This leads to the conclusion, that a more local threshold must be used. The locality property can allow a few cautious assumptions, and according to them produce a suitable threshold for the pixels in the environment.

Discussion, data and analysis which carried out for four different images (Salt & pepper, Gaussion, Speckle and Poisson noise) for standard variance of 0.01 and different values of PSNR, MSE, WPSNR, SSIM for various noise types are found. We observed that the test images has shown some improvement in most of the parameter in consideration (PSNR, MSE,

4.1 original image and the noisy image:-

Fig 4.1 Original image + noisy image

4.2 noisy Image and the image obtained by the Adaptive PCA:-

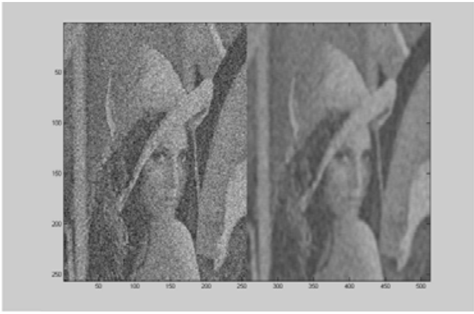


Fig 4.2 Noisy image + image obtained after Adaptive PCA

4.3:- noisy image and image obtained by PCA:-

Fig 4.3 Noisy image + image obtained by PCA

4.4 noisy image and image obtained by ICA:-

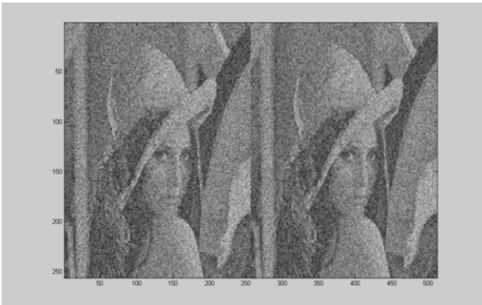


Fig 4.4 Noisy image + image obtained by ICA

Comparison with previous work-

Method/parameter	PSNR	MSE
Wiener2	20.42063	375.333
Median2	15.47557	1857.474
CWM	14.6842	2228.741
ACWM	15.79021	1727.661
Wavelet	31.2354	1472.231
HF	21.49234	34.84196
PCA	28.98	25.96
ICA	29.01	31.65

V. CONCLUSION

Denoising of natural images by ICA methods are strongly data adaptive as denoising processes do not require the noise free image in general which is uniqueness of this method and makes it more efficient than wavelet and other transform domain filtering methods. PCA is the second order blind source separation method based on the covariance of the data and mainly used for the dimensional reduction and whitening of the data for further processing. The PCA and the Adaptive PCA method selects 2D locally adaptive basis sets, thereby reducing high frequency components and improving denoising algorithms. This method performs best with the high frequency content or texture. However selection of the actual denoising procedure plays an important role, it is essential develop to experiment and compare the methods. Finally it is also possible to combine our method with other to get high quality of result. Along with these points we can also consider some points as a future work.

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