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Using AMixed Image Fusion Algorithm To Reduce Noise Images

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Abstract

The search for an economical image denoising methodology may be a difficult issue within the field of image processing. the most focus of this paper is to outline an experimental methodology to reduce the noise in homogenized space of the image and preserve the perimeters within the image. Within the present work, a denoising methodology supported a hybrid image fusion using DDCT and PCA is projected. Results are evaluated and compared by visual suggests that, MSE, SNR, PSNR, RMSE and SF. Also, the numerical results show that the algorithm projected is superior to ancient denoising filters used.

Keywords: Directional Transform, Discrete Wavelet Transform (DWT), Spatial Frequency, Discrete Cosine Transform (DCT) Principal Component Analysis (PCA), Image Fusion.

1.Introduction

Conventional an image is largely encoded as an matrix of either gray values or color values. every *pair (i,u(i))* represents an image part at purpose *i* [1]. within the case of an gray level image *u(i)* denotes a gray value whose intensity values ranges from zero to 255 . zero indicates minimum intensity value (black color) and 255 indicates most intensity value (white), giving a complete of 256 totally different levels of gray.On the other hand in the caseof classical colorimage *u(i)* denotes triplet of values including red, green and blue components. For simplicity, this paper includes the processing of grey level images.The limitations faced in image processing are usually categorized as Noise and Blur. Blurring of an image mainly happens due to incorrect focus. Again the quality of an image is often affected by the presenceof noise. Therefore denoising in these images must be carried out carefully such that the edges are preserved and noise from the homogeneous area are removed. Noise will be mathematically expressed as an perturbation that affects the particular image(g) to supply a noisy image(f) throughout image acquisition.

$$f(i,j) = g(i,j).n(i.j) + m(i,j). \qquad (1)$$

where , *f(i,j)* is the noisy image, *g(i,j)* is the noise free image ,*n(i,j)* and *m(i,j)* are the additive and multiplicative noise[2].

In this paper as follows , presents a short summary of the literature survey, then presents an outline of the planned approach. In next section , experimental results on denoising of images using a hybrid image fusion

algorithmic program and quantitative results are given. Lastly, Section it will be summarizes our conclusions.

2. Literature Review.

In the few years ago , extensive amount of research tries to reduce the noise laid low with an image, each preprocessing additionally as post-processing techniques are developed including differing types of filters like Lee filter [3], Median filter, Butterworth filter etc. The study in [4] presents an easy filtering technique, during which the central pixel of a moving window is replaced by the window's median value. once more supported the type of noise model and presuming a model of speckle noise, a lot of complicated applied math filters are developed like lee , kaun filters etc. Basically, the lee filter may be a moving-window based mostly filter that involves a linear approximation approach [5]. The study in [6] presents the analysis of different} types of wave based mostly de-noising methods in line with various threshold values applied to input images. Another popular linear filtering methodology among the special filters embody Gaussian low passfilter, that with success removes noise from a distorted image[7].Noise degrades the standard of images i.e; the sting details fine details get suppressed and it should additionally probably blur the image. Therefore, it becomes troublesome to analyze a picture and extract its necessary data. However, developing a denoising algorithm specified its edge and have preservation may be a challenging issue. As a result, such a shot has been proposed supported some denoising filters accompanied by an hybrid image fusion method. Basically, fusion techniques includes the mix of comparable type of images to supply a resultant image. most typically used fusion methods are Principal Component Analysis (PCA) based mostly fusion, Discrete Wavelet Transform (DWT), high-pass filtering method, Directional Discrete Cosine Transform (DDCT) based image fusion [8], [9]. The performance analysis of the denoising method will be measured by image quality parameters as mentioned in [10].

3. Proposed Method .

There has been a rapid growth among the analysis community to develop a sturdy and powerful denoising algorithm capable of each edge and have preservation. within the projected work, a method of denoising supported multi-sensor image fusion is introduced.

The image fusion method relies on a hybrid technique involving the Directional Discrete Cos Transform (DDCT) in addition because the Principal Component Analysis (PCA).

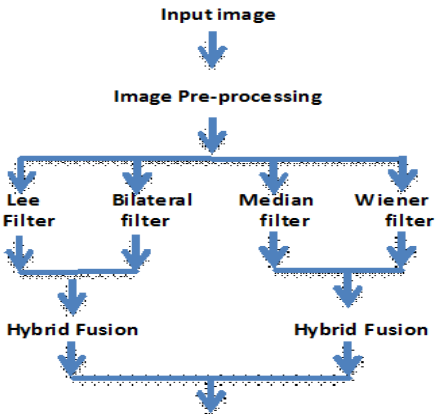

Figure 1: Proposed model

In the start, an input image of various abdominal is loaded and would be regenerate to grey scale image format if needed for additional processing. The second step is image pre-processing, during this step the distinction level of the input image is increased because the loaded image could have low contrast level. After this step, the noisy pictures are subjected to completely different filters for removing the noise from it. once the images are reduce by these filtering techniques, their individual output pictures are coalesced together by using associate hybrid fusion algorithm. This image fusion algorithmic rule is predicated on a combined model (DDCT and PCA). The images to be coalesced are first divided into non overlapping square blocks then the fusion method is distributed over these corresponding blocks[11].

The algorithm mainly works in two phases. In the first phase, a total of 9 modes (0 – 8) are performed on the images to be fused. For each mode, the coefficients from these images are used for fusion process and the procedure is repeated for other modes as well. Also, three different fusion rules are used in this fusion process[12] :

1. Average the corresponding coefficients (DDCTav)
2. Choose the corresponding frequency band with maximum energy (DDCTek)
3. Choose the corresponding coefficient with maximum absolute value (DDCTmx) between the images.

After this step, eight fused images are obtained from each mode respectively. Finally, in the second phase these eight fused images are fused again using the principal component analysis method. Also the performance of this algorithm is evaluated using fusion quality metrics such as Root Mean Square (RMSE), Signal to Noise Ratio (SNR), Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE) and Spatial Frequency (SF).

4. Performance Evaluation .

The following parameters are wont to measure the performance of the developed algorithm:

Mean Square Error (MSE):

The lesser the MSE value between the first image and also the output image, better the result. If the MSEvalue is larger, then the denoising isn't reducing noise from the image. It is mathematically expressed as:

$$MSE = \frac{1}{M \times N} \sum \big(g(x,y) - f(x,y)\big)^2 . \qquad (2)$$

Signal to Noise Ratio (SNR) [12]:

SNR may be a common statistical quantity to evaluate the noise reduction effectively. Higher the SNR value indicates the great quality output image. It additionally indicates that the image has additional helpful info. Mathematically is expressed as:

$$SNR\ in\ dB = 10\ log_{10}\ \frac{\sigma_f^2}{\sigma_n^2} . \qquad (3)$$

Where $\boldsymbol{\sigma_f^2}$ $\boldsymbol{and}$ $\boldsymbol{\sigma_n^2}$ are the values of variances in the image and noise respectively.

Peak Signal to Noise Ratio (PSNR) [12,14]:

The PSNR value is that the ratio between the utmost possible power of a signal to the facility of corrupting noise.Mathematically are often expressed as (in dB):

$$PSNR = 10\ log_{10}\ \frac{25\sigma \times 25\sigma}{MSE}. \qquad (4)$$

RMSE is computed because the root mean square error of the corresponding pixels within the reference imagel_r and therefore the final image l_f . The RMSE value are going to be zero when the reference and final pictures area unit exactly same.

$$RMSE = \sqrt{\frac{1}{MN}\sum_{x=1}^{M}\sum_{y=1}^{N}(l_r(x,y) - l_f\ (x,y))^2}\ . \qquad (5)$$

Spatial Frequency indicates the general activity level within the final fused image. it's calculated using each the row frequency and therefore the column frequency. Higher the **SF** value means that better performance.

Row frequency :

$$RF = \sqrt{\frac{1}{MN}\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}(l_f(x,y) - l_f(x,y-1))^2}\ . \qquad (6)$$

Column frequency :

$$\mathrm{CF} = \sqrt{\frac{1}{\mathrm{MN}}\sum_{\mathrm{y}=0}^{\mathrm{N}-1}\sum_{\mathrm{x}=0}^{\mathrm{M}-1}(\mathrm{l_f(x,y)} - \mathrm{l_f\ (x-1,y)})^2}\ . \qquad (7)$$

Spatial frequency

$$SF = \sqrt{RF^2 + CF^2}\ . \qquad (8)$$

5. Experimental Result And Discussion.

This section discusses the experimental results obtained from the proposed rule. All the implementation and analysis work has been administered in MATLAB . The performance measuring was done by calculating some image quality assurance parameters. The planned algorithm is presently applied on an grey cale image with a resolution of 256 x 256 pixels. however may be applied to any or all variety of medical pictures like Ultrasound , CT and MRI pictures affected from speckle noise. The planned technique involves few pre-processing steps once the input image is loaded as mentioned earlier. Then, the image is fed to some filtering techniques and output of every of those filters work because the input for the hybrid technique for fusion of pictures. Finally we get the fused reduce image with better quality.

Figure 2: Noisy Input image

Figure 2 shows the input noisy image, where the information content is not clearly obtained.

Figure 3: DE noised image and its Error image

Figure 3, shows the fused image and the error image(fused image subtracted from reference image), with better results.

FILTER	MSE	SNR	PSNR	RMSE	SF	FILTERED IMAGE
Median Filter	0.114	57.551	57.585	0.338	0.236	
Lee Filter	0.112	57.613	57.647	0.335	0.174	
Wiener Filter	0.087	58.726	58.760	0.295	0.252	
Bilateral Filter	0.041	61.928	61.957	0.204	0.077	
Proposed Filter	0.038	62.247	62.281	0.210	0.112	

The Quantitative values are bestowed in Table 1.

The metrics showed in table with bold font represent the planned rule and illustrate to be higher as compared to the individual filters .For analyzing and quantifying its performance some parameters like MSE, SNR, PSNR etc. are calculated. While this algorithm is dispensed, the projected method presents higher results in despeckling medical pictures in addition. algorithmic program is additional extended to denoise color images and images with high resolution thereby getting better results in a brief span of time interval.

Conclusion

In this paper, a novel and hybrid image fusion technique exploitation directional discrete cosine transform and principal part analysis has been given and its performance is evaluated. it's terribly easy, simple to implement and will be used for real time applications. it's concluded that filtering method in the middle of this fusion method provides higher quality denoised pictures while not losing any useful info.

References

[1] Maity, A.; Pattanaik, A.; Sagnika, S.; Pani, S., "A Comparative Study on Approaches to Speckle Noise Reduction in Images," 2015 International Conference on Computational Intelligence and Networks (CINE),vol., no., pp.148,155, 12-13 Jan. 2015

[2] S. k. ZHAO, D. Y. LI.,"Review of Filtering Algorithms for Medical Ultrasonic Images," Journal of Biomedical Engineering. 2001, vol.18(001):145-148.

[3] Jong-Sen Lee, "Digital Image Enhancement and Noise Filtering by Use of Local Statistics,"IEETransactions on Pattern Analysis and Machine Intelligence, vol.PAMI-2, no.2, pp.165,168, March 1980.

[4] Huang, T.; Yang, G.; Tang, G., "A fast two-dimensional median filtering algorithm," IEEE Transactions on Acoustics, Speech and Signal Processing, vol.27, no.1, pp.13,18, Feb 1979.

[5] J. S. Lee, "Speckle analysis and smoothing of synthetic aperture radar images," Comput. Graph. Image Process., vol. 17, no. 1, pp. 24–32, 1981.

[6] Hakur, A., &Anand, R. S. (2005), "Image quality based comparative evaluation of wavelet filters in ultrasound speckle reduction," Digital Signal Processing, vol.15, no.5, 455–465.

[7] Md.RobiulHoque and Md.Rashed-Al-Mahfuz, "A new Approach in Spatial Filtering to Reduce Speckle Noise," International Journal of Soft Computing and Engineering. IJSCE 2011, vol. 1, Issue 3, pp:29-30.

[8] S.S.Bedi, Agarwal J., Agarwal P, "Image Fusion Techniques and Quality Assessment Parameters for Clinical Diagnosis: A Review", International Journal of Advanced Research in Computer and Communication Engineering, vol. 2, Issue 2, February 2013, ISSN : 2278-1021, pp. 1153-1157.

[9] Bing Zeng; Jingjing Fu, "Directional Discrete Cosine Transforms for Image Coding," 2006 IEEE International Conference on Multimedia and Expo, vol., no., pp.721,724, 9-12 July 2006.

[10] Faten A. Dawood, Rahmita W. Rahmat, Suhaini B. Kadiman, Lili N. Abdullah, Mohd D. Zamrin, "Effect Comparison of Speckle Noise Reduction Filters on 2D-Echocardigraphic Images", World Academy of Science, Engineering and Technology, International Science Index 69, vol.6, no.9, 2012.

[11] Jingjing Fu; Bing Zeng, "Directional Discrete Cosine Transforms: A Theoretical Analysis,"IEEEInternational Conference on Acoustics, Speech and Signal Processing, 2007. ICASSP 2007.vol.1, no.,pp.I-1105,I-1108, 15-20 April 2007.

[12] VPS Naidu, "Discrete Cosine Transform based Image Fusion Techniques", Journal of Communication, Navigation and Signal Processing (January 2012),vol. 1, no. 1, pp. 35-45.

[13] Raman Maini, and Himanshu Aggarwal. "PEFORMANCE EVALUATION OF VARIOUS SPECKLENOISE REDUCTION FILTERS ON MEDICAL IMAGES". International Journal of Recent Trends in Engineering ACEEE. REVIEW PAPER, 2009, vol 2, no. 4, pp: 22-25.

[14] VPS Naidu and J.R. Raol, "Fusion of Out Of Focus Images using Principal Component Analysis and Spatial Frequency", Journal of Aerospace Sciences and Technologies, vol. 60, no. 3, pp.216-225, Aug.2008.

[15] VPS Naidu and J.R. Raol, "Pixel-Level Image Fusion using Wavelets and Principal Component Analysis – A Comparative Analysis" Defence Science Journal, vol.58, no.3, pp.338-352, May 2008.

[16] Shutao Li, James T. Kwok., Yaonan Wang., 2001."Combination of images with diverse focuses using the spatial frequency, Inf. Fusion, vol.2, no.3, pp. 169-176.