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Original Research Article

Rician Noise Reducing Using Hybrid Technique in Magnetic Reasoning Image

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Abstract: The aim of this study was to determine the possibility of using filters and wavelet technique image processing to enhancement MRI image from noise. The test carried out in this study consist of three steps step one concern with apply the filters on the images and get result , step two get the calibration indicators (peak noise signal ratio PNSR, RMES, MES), finally apply wavelet with the best filter's result and get the ratio again. Using hybrid technique get more good resolution, high degree of filtration images and high level of PSNR. Applying the filter it can be reducing the noise by high ratio of PSNR while low ratio of MSE & RMES and this ratios different from filter to other and from image to other depended on the feature and histogram of image.
Keywords: MRI, Noise Reducing Hybrid Technique, wavelet technique.

INTRODUCTION

Image processing is a form of signal processing for which the input is an image such as a photograph or video frame and the output of image processing may be either an image or the image parameters. MRI is the investigative tool of choice for neurological cancers, as it has better resolution than CT and offers better visualization of the posterior fossa. The contrast provided between grey and white matter makes it the best choice for many conditions of the central nervous system, including demyelinating diseases, dementia, cerebrovascular disease, infectious diseases and epilepsy [1]. Image enhancement, which is one of the significant techniques in digital image processing, plays an important role in many fields [2]. Estimation of the noise variance of a magnetic resonance (MR) image is important for various post-processing tasks. In the literature, various methods for noise variance estimation from MR images are available and noising of magnetic resonance images remains a critical issue [3]. There were many image processing literature presents a number of de-noising methods which using different techniques and equations [4-7].

RELATED WORK

There were many various research papers related to medical image denoising are studied. Rupinder, *et al.*, conducted one study about A Hybrid Technique for Medical Image Denoising using NN, Bilateral filter and LDA, In this paper Bilateral filter is defined for its effectiveness in edge preserved image Denoising. Bilateral filter improves the Denoising efficiency, preserves the fine structures and also reduces the Rician noise [8].

Sandeep *et al,* A hybrid method for image denoising based on wavelet thresholding and RBF network, were used a hybrid based method on multi scale wavelet edge detection was used for achieving a better Denoising quality. PSNR was set to achieve the target and visual quality [9].

Zainab A. Mustafa. K[11] Modified Hybrid Median filter for image denoising. This paper proposes a statistical filter, which is a modified version of Hybrid Median filter for noise reduction, which computes the median of the diagonal elements and the mean of the diagonal, horizontal and vertical elements in a moving window and finally the median value of the two values will be the new pixel value. The results show that our proposed method outperforms the classical implementation of the Mean, Median and Hybrid Median filter in terms of denoising quality [10]. N. Sasirekha and K. R. Kashwan. Improved Segmentation of MRI Brain Images by Denoising and Contrast

Enhancement. The simulation tests show that the denoising and contrast enhancement improves the segmentation of images. The performance of the proposed approach is improved by 29% in segmentation of synthetic images compared to the existing similar techniques. Similarly, an improvement of 22% in segmentation is observed for real-time images. Application/Improvements: This approach shows comparable improvement in with respect to processing of MRI. The same procedure may be adopted for other imaging techniques [11]. Vyacheslav V *et al.* Determine the possibility of using wavelet techniques analysis for processing images of cytology preparations and hematological cell structure study [6, 7, 12].

MATERIALS AND METHODS

The test carried out in this study consist of three steps .step one concern with apply the filters on the images and get result, step two get the calibration indicators (peak noise signal ratio PNSR,' RMES, MES), finally apply wavelet with the best filter's result and get the ratio again.

Step one

Apply the filters: From previous studies has been assumed using this filters, Hybrid median, SRAD, TV de-noise, Bilaterall, NLmeansfilter and get results on figures blow.

Step two

Get PSNR, RMES ,MES on for each filtered images and results on table one blow.

Finally

From result of PSNR, RMES, MES I choosing hybrid median filter to apply the wavelet before using it and apply it in high-high sub-band and low-low sub-band and get the result after filtering in tables one and two and figures blow.

RESULTS AND DISCUSSION

As stated before main object of this study is evaluate the potentiality using filters and wavelet for enhancement MRI with Rician noise. To achieve this objective through apply multi filters and choosing the filter with best result and apply wavelet on the images and filtered, resulted image are recalibration with original image.

In this research, experiments are conducted on five different MRI medical images (Fig.1). The noise type is Rician noise level $\sigma = .05$. The filters (Hybrid median, SRAD, TV de-noise, Bilaterall, NLmeansfilter) (Fig 2 to 7). Apply on the noisy images and from table one we observed that; the hybrid median have a high (PSNR) and low (MSE, RMES) (Table I). Haar wavelet transforms and Hybrid median are applied for decomposition & de-noising; Different PSNR MSE and RMES values are calculated on each image .It is clear from the table one; that using wavelet to decomposition image before filtering and filtering using hybrid median is better than using Hybrid median directed for the purpose of de-noising in the MRI medical images (Table II). De-noising is performed at Rician noise $\sigma=.05$, on MRI images by using Haar wavelet with Hybrid median filter in high-high sub-band is the best result (the value of PSNR is increase while MSE and RMES are decrease)from using Hybrid median on all images except on hemispheric coronal II (image 5) we observed that, apply Hybrid median in low-low sub-band is best result that refer to; Hybrid median is smoothing filter and it effect on the edges and the LL is contents the main feature of image more filtration of LL in all images in test (or image in general) may lead to blurring image and decreasing the quality of image (as general) but in brain–hemispheric coronal II image (image 5) it is very noisily image and more smoothing enhance it.

Table1: show the comparative resulted of filter using MES RMES PNSR with the same images

Images	FILTER	MES	RMES	PSNR
brain–hemispheric transaxial I	hybrid median	15.1203	3.8885	36.3692
brain–hemispheric transaxial I	srad	6.0863E+03	78.0149	10.3213
brain–hemispheric transaxial I	tvdenoise	207.0762	14.3901	25.0035
brain–hemispheric transaxial I	bilateral	231.8027	15.2251	24.5136
brain–hemispheric transaxial I	NLmeansfilter	24.5530	4.9551	34.2638
brain–hemispheric transaxial I	hybrid median in low-low sub-band	37.9404	6.1596	32.3738
brain–hemispheric transaxial II	hybrid median	48.8090	6.9863	31.2798
brain–hemispheric transaxial II	srad	5.1997e+03	72.1087	11.0050
brain–hemispheric transaxial II	tvdenoise	189.4590	13.7644	25.3896
brain–hemispheric transaxial II	bilateral	211.4540	14.5415	24.9126
brain–hemispheric transaxial II	NLmeansfilter	73.2183	8.5568	29.5186
brain–hemispheric transaxial II	hybrid median	117.2592	10.8286	27.4733

	in low-low sub-band			
brain–hemispheric transaxial III	hybrid median	81.6286	9.0349	29.0464
brain–hemispheric transaxial III	srad	1.3127e+04	114.5743	6.9831
brain–hemispheric transaxial III	tvdenoise	187.2312	13.6832	25.4410
brain–hemispheric transaxial III	bilateral	210.6434	14.5136	24.9293
brain–hemispheric transaxial III	NLmeansfilter	167.6370	12.9475	25.9211
brain–hemispheric transaxial III	hybrid median in low-low sub-band	177.0425	13.3057	25.6840
brain–hemispheric coronal I	hybrid median	165.1362	12.8505	25.9864
brain–hemispheric coronal I	srad	1.3742E+04	117.2254	6.7844
brain–hemispheric coronal I	tvdenoise	182.2653	13.5006	25.5578
brain–hemispheric coronal I	bilateral	202.5255	14.2311	25.1000
brain–hemispheric coronal I	NLmeansfilter	297.4014	17.2453	23.4314
brain–hemispheric coronal I	hybrid median in low-low sub-band	252.8244	15.9005	24.1366
brain–hemispheric coronal II	hybrid median	557.8386	23.6186	20.6997
brain–hemispheric coronal II	srad	4.3116E+03	65.6628	11.8184
brain–hemispheric coronal II	tvdenoise	196.6553	14.0234	25.2277
brain–hemispheric coronal II	bilateral	208.0289	14.4232	24.9836
brain–hemispheric coronal II	NLmeansfilter	845.0563	29.0699	18.8959
brain–hemispheric coronal II	hybrid median in low-low sub-band	192.6686	13.8805	25.3167

Table 2: show the comparative resulted of hybrid median filter after using the wavelet by MES RMES PNSR

Images	MES	RMES	PSNR
brain–hemispheric transaxial I	1.9434	1.3933	45.2840
brain–hemispheric transaxial II	5.3083	2.3040	40.9153
brain–hemispheric transaxial III	13.8581	3.7226	36.7478
brain–hemispheric coronal I	24.0048	4.8995	34.3618
brain–hemispheric coronal II	149.1810	12.2140	26.4277

The test data used in this study normal brain MRI images

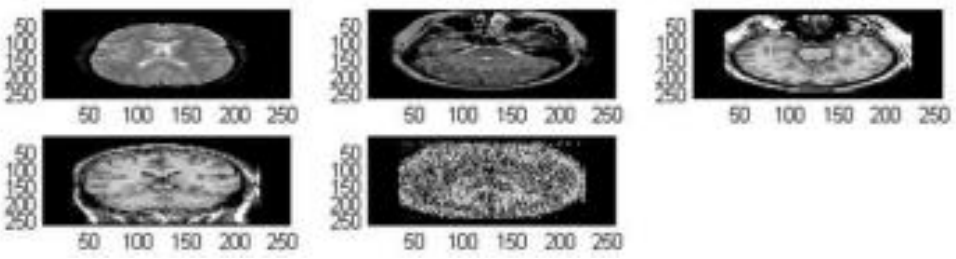

Fig-1: Original images without noise

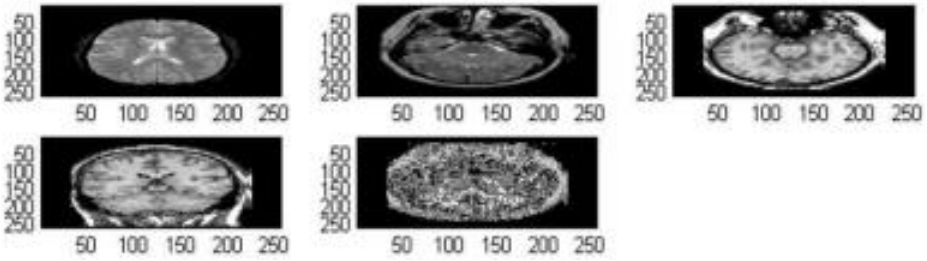

Fig-2: Hybrid median filtered images

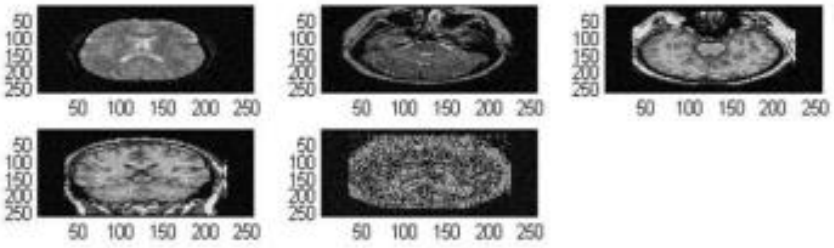

Fig-3: Bilaterall filtered images

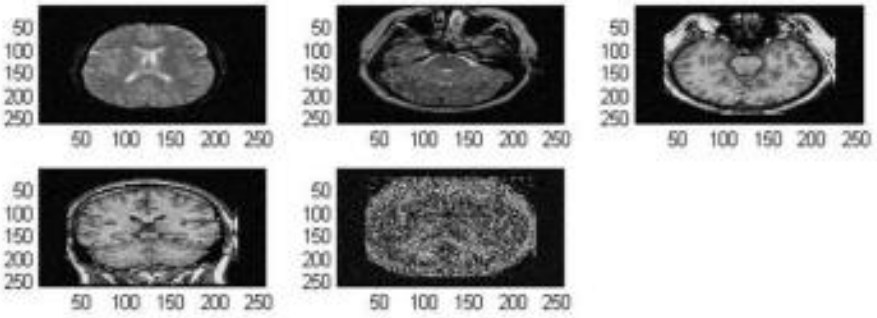

Fig-4: TV de-noise filtered images

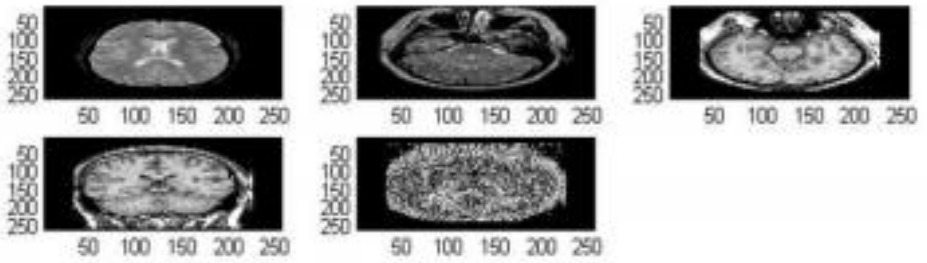

Fig-5: Srad filtered images

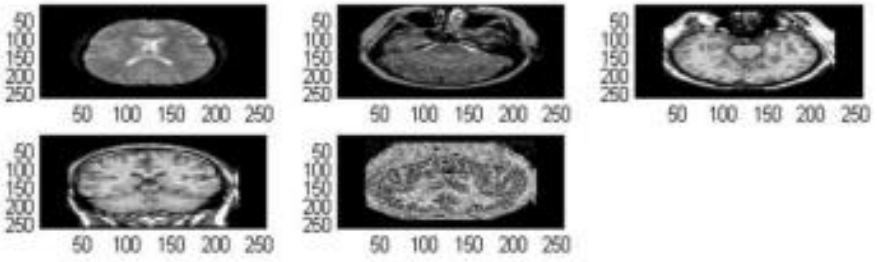

Fig-6: NLmeans filtered images

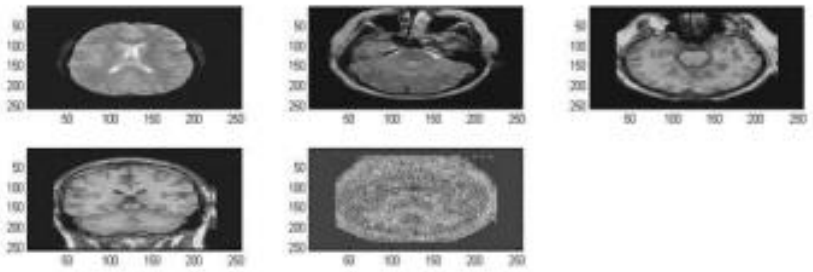

Fig-7: Hybrid median with wavelet (in low-low)

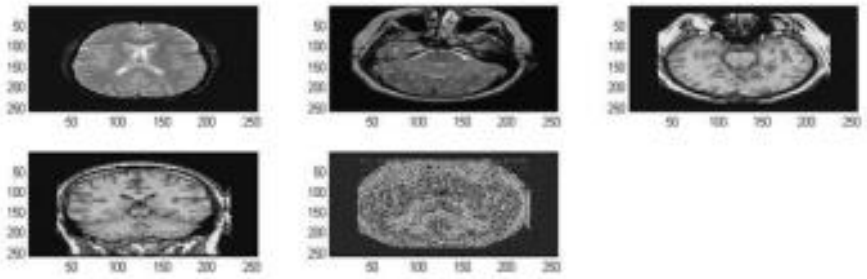

Fig-8: Hybrid median with wavelet (in high-high)

CONCLUSIONS

The Rician noise is a major type of noise embedded with MRI image. Applying the filter it can be reducing the noise by high ratio of PSNR while low ratio of MSE & RMES and this ratios different from filter to other and from image to other depended on the feature and histogram of image. apply the wavelet technique it enhancement the results in all filters . The low-low sub-band contain the details of image and more filtration can be lead to blurring image while the high-high sub-band contain the noise and more filtration lead to enhancement results. The hybrid median give us the best result that means the hybrid median is effective Rician noise.

REFERENCES

1. American Society of Neuroradiology; ACR-ASNR Practice Guideline for the Performance and Interpretation of Magnetic Resonance Imaging (MRI) of the Brain, 2013.
2. Gonzalez R, Woods R; Digital Image Processing, 2nd edn., Prentice- Hall, New York, 2002.
3. Sijbers J, Poot D, den Dekker AJ, Pintjens W; Automatic estimation of the noise variance from the histogram of a magnetic resonance image. Physics in medicine and biology, 2007; 52(5):1335.
4. Nowak RD; Wavelet based Rician noise removal for magnetic resonance images IEEE Trans. Image Process, 1999; 10: 1408–19.
5. Zhang Y, Brady M, Smith S; Segmentation of brain MR images through a hidden Markov random field model and the expectation-maximization algorithm. IEEE transactions on medical imaging, 2001; 20(1):45-57.
6. Lyashenko VV, Babker AMAaa, Kobylin OA; Using the methodology of wavelet analysis for processing images of cytology preparations. Natl J Med Res., 2016; 6(1): 98-102.
7. Lyashenko VV, Babker AMAA, Kobylin OA; The methodology of wavelet analysis as a tool for cytology preparations image processing. Cukurova Med J., 2016; 41(3): 453-463.
8. Singh RP, Varma V, Chaudhary P; A Hybrid Technique for Medical Image Denoising using NN, Bilateral filter and LDA. IJFRS, 2012; 1(1):1-5.
9. Dubey S, Hasan F, Shrivasrava G; A hybrid method for image denoising based on wavelet thresholding and RBF network. International Journal of Advanced computer Research, 2012.
10. Zeinab MA, Abrahim BA, Kadah YM; K11. Modified Hybrid Median filter for image denoising. Radio Science Conference (NRSC), 2012 29th National. IEEE, 2012.
11. Sasirekha N, Kashwan KR; Improved segmentation of MRI brain images by denoising and contrast enhancement. Indian Journal of Science and Technology, 2015; 8:22.
12. Lyashenko VV, Babker A, Lyubchenko VA; The study of blood smear as the analysis of images of various objects. Med-Science, [cited July 30, 2016]; Online First: 21 Jul, 2016. doi:10.5455/medscience.2016.05.8502.