

Optimization of High Density Rician Noise by Modified Median Filter for Improved MRI Images

Mohd Tahir, Anas Iqbal, Abdul Samee Khan

M. Tech. Scholar, Dept. of Electronics & Communication, All Saints' College of Technology, Bhopal, M.P, India

Assistant Professor, Dept. of Electronics & Communication, All Saints' College of Technology, Bhopal, M.P, India

Assistant Professor, Dept. of Electronics & Communication, All Saints' College of Technology, Bhopal, M.P, India

ABSTRACT:- In MRI images noise removal techniques have become an essential exercise in medical imaging applications, for the study of anatomical structures. MRI images are affected by Rician noise due to the magnitude image formation. Presence of Rician noise can significantly affect the image quality and contrast ratio of an image. In this paper Modified Median Filter technique is used for de-noising Rician noise. Rician noise displays varying distribution characteristic depending on the SNR of the image. Based on the probability distribution function of noise and SNR information obtained from the image, the proposed filter uses selection of filtering window of size 3X3 to perform de-noising. The proposed filtering technique has been implemented on MRI images. The efficiency of the proposed filtering technique is verified with a study of the PSNR characteristic of the de-noised and noisy image with respect to the true image. The proposed de-noising technique shows an improvement in the contrast ratio and PSNR of the noisy image

KEYWORDS: Rician noise, Modified Median Filter, De-noising

I. INTRODUCTION

A straightforward middle channel [1] works pleasantly to de-noising rash commotion of low thickness and is anything but difficult to execute. Yet, the cost paid for it is twists edges and fine subtle elements of a picture. The contortion increment as the sifting window size is expanded to smother high thickness commotion. Middle Filter is a nonlinear sifting procedure broadly utilized for expulsion of motivation commotion [2]. In spite of its adequacy in smoothing commotion the middle channel tends to evacuate fine subtle elements when it is connected to a picture consistently. Be that as it may, some specific middle channels, for example, Weighted Median Filter [3] and Recursive Weighted Median Filter RWMF [4], Center Weighted Median Filter are proposed in writing to enhance the execution of the middle channel by giving more weight to some chose pixels in the shifting window.

The area images processing the two principal applications are the improvement of pictorial information for human interpretations. The way toward getting and investigating visual data by advanced PCs is called computerized picture preparing. A picture might be depicted as a two dimensional capacity $f(p, q)$ where p and q are spatial directions. Sufficiency off at any combine of co-ordinates (p, q) is known as the force or dim level of the picture by then. The picture made out of a limited number of components each of which has a specific area and qualities. That implies the components of picture are pixels. Pixel is the term most broadly used to mean the components of computerized picture.

Performing some mechanical operation (robot motion) is the goal of the Image processing. In the Figure 1 typical blocks diagram of image processing system. This consists of the center part is the computer system, one image acquisition, image processing software, storage devices, transmitters and display devices. Advanced picture preparing has many preferences over simple picture handling. It permits a much more extensive scope of calculations to be connected to the information, and can stay away from issues, for example, the development of clamor and flag contortion amid preparing [5].

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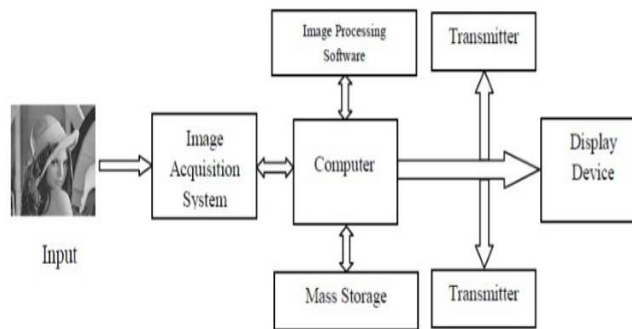


Figure 1: Typical Image Processing System

II. MEDIAN FILTER

In sign processing, it's far often proper that allows you to carry out some type of noise reduction on a photograph or sign. The middle shift through is a nonlinear advanced separating system, every now and again used to evacuate commotion. Such clamor rebate is a normal pre-handling venture to enhance the results of later preparing (for instance, side location on a picture). Middle shifting could be generally utilized as a part of computerized photo processing due to the fact, beneath certain situations; it preserves edges even as doing away with noise

The guideline idea of the middle get out is to gone through the sign section through get to, supplanting every passage with the middle of neighboring passages. The example of colleagues is known as the "window", which slides, access with the guide of access, over the total flag. For 1D sign, the most extreme clear window is essentially the essential couple of past and taking after sections, while for 2d (or higher-dimensional) cautions including photos, more intricate window examples are reasonable (which incorporate "holder" or "go" designs). Know that if the window has an odd wide assortment of passages, then the middle is anything but difficult to characterize: it is essentially the inside esteem after every one of the sections inside the window is sorted numerically. For an even wide assortment of passages, there is several suitable middle, see middle for additional data.

See that, in the case above, in light of the fact that there is no get to past the principal esteem; the essential expense is rehashed, as with a definitive charge, to procure adequate passages to fill the window. This is one method for adapting to lacking window passages at the hindrances of the flag, yet there are diverse plans that have outstanding houses that may be fancied particularly examples:

- Avoid handling the limits, with or without trimming the flag or picture limit a while later,
- Fetching sections from different places in the flag. With pictures for instance, sections from the far flat or vertical limit may be chosen,
- Shrinking the window close to the limits, so that each window is full.

III. TYPES OF NOISE

Noise is added inside the picture at the time of photograph acquisition or transmission. Different factors may be accountable for introduction of noise inside the photo. The wide variety of pixels corrupted in the picture will decide the quantification of the noise. The fundamental assets of noise within the virtual image are:

- a) The imaging sensor may be stricken by environmental conditions at some stage in picture acquisition.
- b) Inadequate mild degrees and sensor temperature may additionally introduce the noise in the picture.

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c) Interference in the transmission channel may also corrupt the photo.

d) If dirt debris is left at the scanner display screen, they also can introduce noise inside the photograph.

Noise is the undesirable results produced within the picture. For the duration of photo acquisition or transmission, numerous elements are chargeable for introducing noise in the photo. Depending at the sort of disturbance, the noise can have an effect on the picture to special volume. Commonly our cognizance is to cast off sure kind of noise.

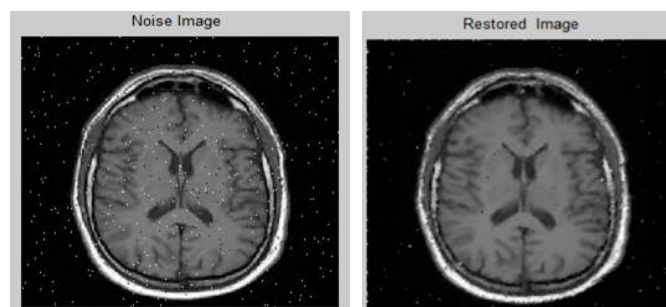


Figure 2: Salt and Pepper noise and restored image

So become aware of sure type of commotion and apply one of a kind calculation to get rid of the clamor. Picture commotion can be sorted as Impulse clamor (Salt-and-pepper clamor).

IV. MODIFIED MEDIAN FILTER

The Modified Median Filter calculation is the point at which a chose window contains just 0 and 255 esteem then the reestablished esteem is either 0 or 255 (again uproarious), drives us to proposed. In this calculation we chose pixel esteem 0 and 255 values then the preparing pixel is supplanted by mean estimation of the chose window. The detail of the calculation is given underneath.

Algorithm:

Step 1: Select a 3 x 3 matrix size according to the 2-D window size. Assume that the processing pixel is P_{ij} , which lies at the center of window.

Step 2: If $0 < P_{ij} < 255$, then the processing pixel or P_{ij} is uncorrupted and left unchanged.

Step 3: On the off chance that $P_{ij} = 0$ or $P_{ij} = 255$, then it is considered as tainted pixel and four cases are conceivable as given underneath.

Case 1: In the event that the chose window has all the pixel esteem as 0, then P_{ij} is supplanted by the Salt clamor (i.e. 255).

Case 2: On the off chance that the chose window contains all the pixel esteem as 255, then P_{ij} is supplanted by the pepper commotion (i.e. 0).

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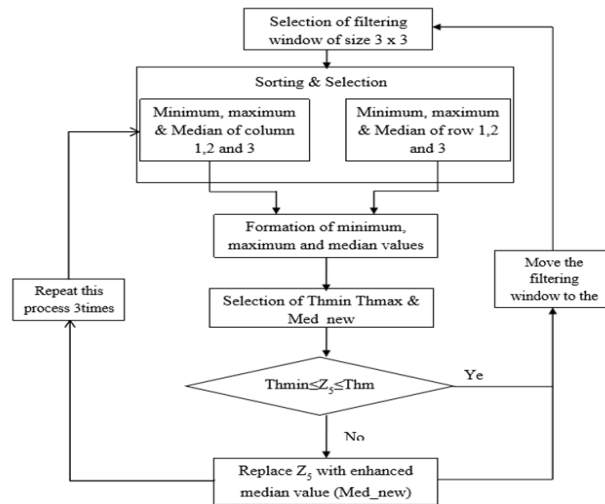


Figure 3: Flow Chart of Proposed Method

Case 3: In the event that the chose window contains all the esteem as 0 and 255 both. At that point the handling pixel is supplanted by mean estimation of the window.

Case 4: On the off chance that the chose window contains not all the component 0 and 255. At that point dispose of 0 and 255 and locate the middle estimation of the rest of the component. Supplant P_{ij} with middle esteem.

Step 4: Rehash step 1 to 3 for the whole picture until the procedure is finished.

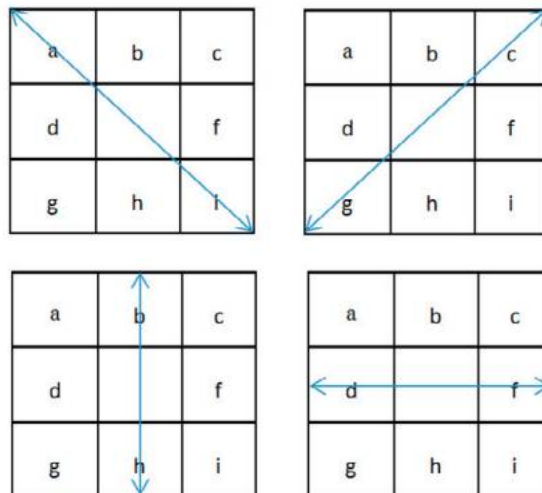


Figure 4: Read the Matrix

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V. SIMULATION RESULT

The proposed calculations are tried utilizing 256x256 8bit/pixel picture brain.jpg. In the reproduction, pictures are tainted by Salt and Pepper commotion. The commotion level shifts from 10% to 90% with augmentation of 10% and the execution is quantitatively measured by Mean square Error (MSE) and Peak Signal to Noise Ratio (PSNR).
Mean Square Error (MSE)

$$= \frac{1}{N_1 N_2} \sum_{j=1}^{N_2} \sum_{i=1}^{N_1} (f(i, j) - g(i, j))^2 \quad (1)$$

Peak Signal to Noise Ratio (PSNR) in dB

$$= 10 \times \log_{10} \left(\frac{255^2}{MSE} \right) \quad (2)$$

Where MSE remains for Mean Square Error, PSNR remains for Peak Signal to Noise Ratio. From the reproduction result appeared in Table I to II, it is watched that the execution of proposed calculation is enhanced PSNR than the current calculations at medium and high clamor level.

Rician noise image is also known as Gaussian noise. Rician noise is statistical noise having a probability density function (PDF) equal to that of the normal distribution, which is also known as the Gaussian distribution. In other words, the values that the noise can take on are Gaussian-distributed.

$$P(Z) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(z-\mu)^2}{2\sigma^2}} \quad (3)$$

The results in the Table 1 clearly show that the PSNR of different method is much better at high density of salt and pepper noise. As the density of noise increasing, the response of proposed filter is becomes better in comparison of other filters.

Table I: PSNR values for different noise density of Brain image

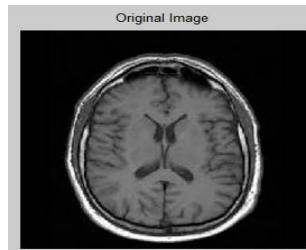
Noise Level	Proposed Modified Median Filter
0.3	31.3259
0.4	29.5299
0.5	28.7459
0.6	28.0601
0.7	27.1272

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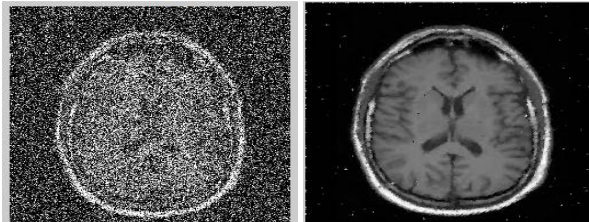
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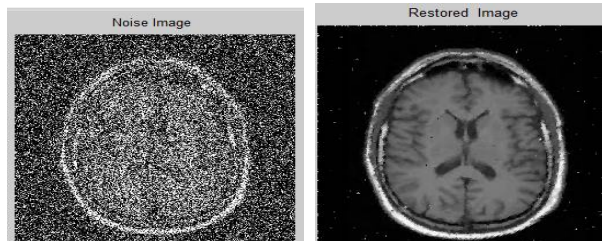
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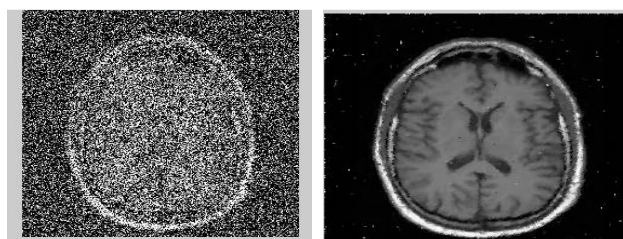
(a) Original Image for Brain



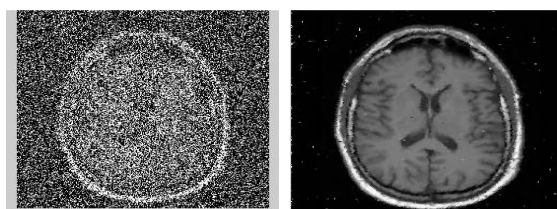
(b) 0.3 De-noising



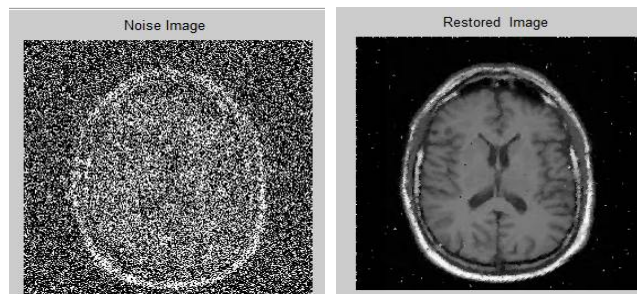
(c) 0.4 De-noising



(d) 0.5 De-noising



(e) 0.6 De-noising



(f) 0.6 De-noising

Figure 5: Experimental Results of Proposed Method for real Brain Image

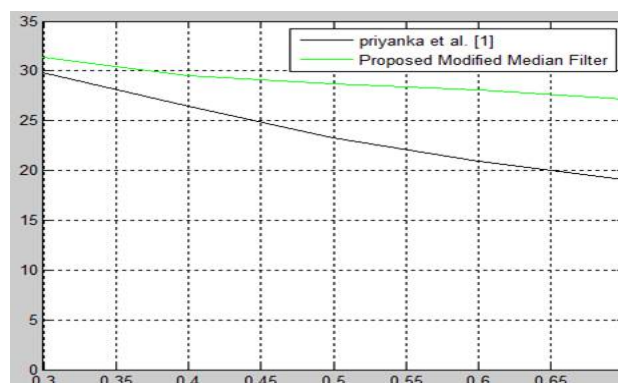


Figure 6: Bar Graph of the Previous Algorithm and Proposed Algorithm in Rician Image

VI. CONCLUSION

The proposed filter has proved that it is very efficient for random valued impulse noise because practically noise is not uniform over the channel. In this dissertation the used concept of maximum and minimum threshold to detect both positive and negative noise. It produces improve PSNR (Peak Signal to Noise Ratio) and very small MSE (Mean Square Error) for highly corrupted images, especially for more than 50% noise density.

REFERENCES

- [1] Arabinda Dash and Sujaya Kumar Sathua, "High Density Noise Removal by using Cascading Algorithms", 2015 Fifth International Conference on Advanced Computing & Communication Technologies 2327-0659/15 \$31.00 © 2015 IEEE.
- [2] Ashutosh Pattnaik, Sharad Agarwal and Subhasis Chand. "A New and Efficient Method for Removal of High Density Salt and Pepper Noise Through Cascade Decision based Filtering Algorithm" in 2nd International Conference on Communication, Computing & Security, Volume 6, Pages 108-117. ICCCS-2012.
- [3] Chauhan, Arjun Singh, and Vineet Sahula. "High density impulsive Noise removal using decision based iterated conditional modes" in Signal Processing, Computing and Control (ISPC), 2015 International Conference on, pp. 24- 29. IEEE, 2015.
- [4] Dash, Arabinda, and Sujaya Kumar Sathua. "High Density Noise Removal by Using Cascading Algorithms" in Advanced Computing & Communication Technologies (ACCT), 2015 Fifth International Conference on, pp. 96- 101. IEEE, 2015.
- [5] Esakkirajan, S., T. Veerakumar, Adabala N. Subramanyam, and Prem CH Chand. "Removal of high density salt and pepper noise through modified decision based unsymmetric trimmed median filter" in Signal Processing Letters, IEEE 18, no. 5 (2011): 287-290.
- [6] Madhu S. Nair and G. Raju. "A new fuzzy-based decision algorithm for high-density impulse noise removal" in Signal, Image and Video Processing, November 2012, Volume 6, Issue 4, pp 579-595.
- [7] Raza, Md Tabish, and Suraj Sawant. "High density salt and pepper noise removal through decision based partial trimmed global mean filter" in Engineering (NUiCONE), 2012 Nirma University International Conference on, pp. 1- 5. IEEE, 2012.
- [8] Utaminingrum, Fitri, Keiichi Uchimura, and Gou Koutaki. "High density impulse noise removal based on linear meanmedian filter" in Frontiers of Computer Vision,(FCV), 2013 19th Korea-Japan Joint Workshop on, pp. 11-17. IEEE, 2013.