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High Density Rician Noise Removal for Medical Images using Median Filter

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ABSTRACT: In the Transmission of pictures over channels, Images are debased by salt and pepper commotion, because of defective correspondences. Salt and Pepper clamor is likewise alluded to as Impulse commotion. The target of sifting is to evacuate the driving forces so that the clamor free picture is completely recouped with least flag twisting. The best-known and most broadly utilized non-straight advanced channels, in light of request measurements are middle channels. Middle channels are known for their ability to evacuate motivation clamor without harming the edges. Middle channels are known for their ability to expel drive commotion and in addition save the edges. The compelling expulsion of drive regularly prompts to pictures with obscured and twisted elements. At high clamor densities, their execution is poor. Another calculation to evacuate high-thickness salt and pepper commotion utilizing altered Median Filter is proposed.

KEYWORDS: Salt Noise, Pepper Noise, Median Filter, High Density

I. INTRODUCTION

A straightforward middle channel [1] works pleasantly to denoising 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 sifting 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 info information, and can stay away from issues, for example, the development of clamor and flag contortion amid preparing [5].

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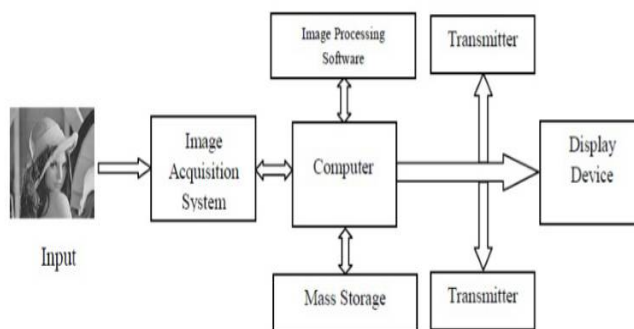


Figure 1: Typical Image Processing System

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 sift 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 sifting 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 (however see dialogue under). 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 reshaped, 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:

- o Avoid handling the limits, with or without trimming the flag or picture limit a while later,
- o Fetching sections from different places in the flag. With pictures for instance, sections from the far flat or vertical limit may be chosen,
- o 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.
- c) Interference in the transmission channel may also corrupt the photo.
- d) If dirt debris is gift at the scanner display screen, they also can introduce noise inside the photograph.

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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.

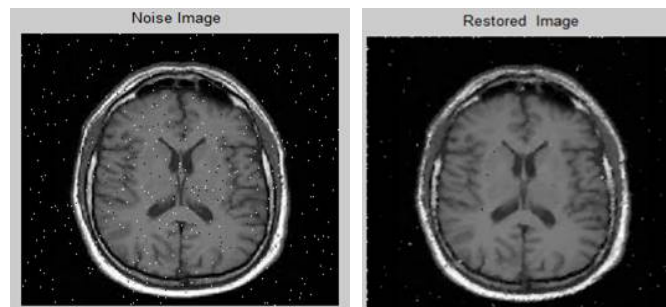


Figure 2: Salt and Pepper noise and original image

So we 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).

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.

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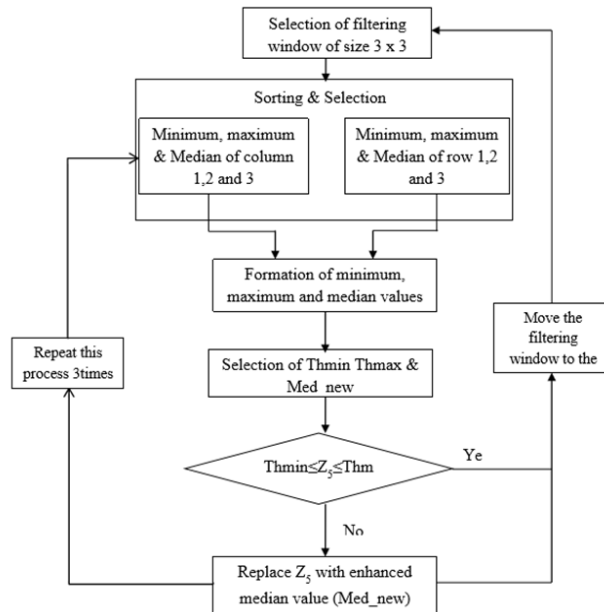


Figure 3: Flow Chart of Proposed Method

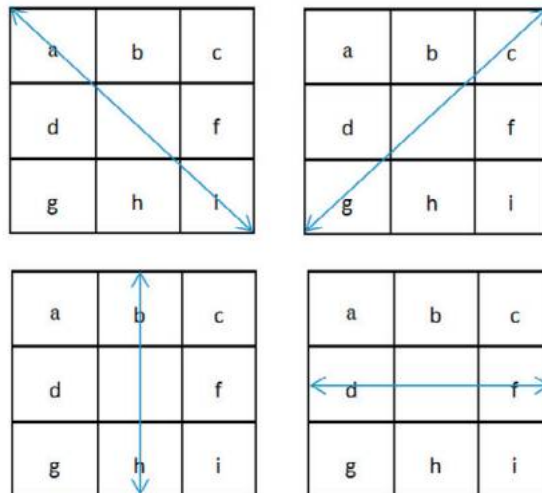


Figure 4: Read the Matrix

V. SIMULATION RESULT

The proposed calculations are tried utilizing 256x256 8bit/pixel picture bike.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).

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Vol. 6, Issue 11, November 2017

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 knows 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.

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

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.

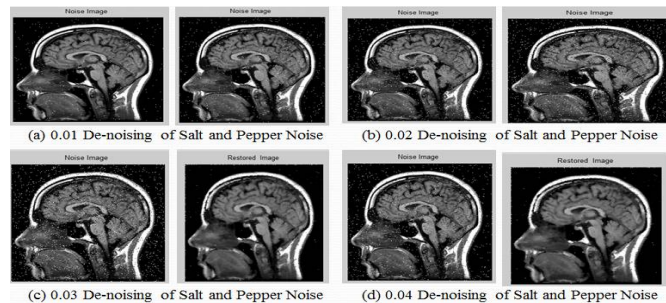


Figure 5: Experimental Results of Proposed Method for real Head Image

Table 1: Comparison of PSNR of Different Density for Head Image

Density	Tian Bai et al. [1]	Prposed Modified Median Filter
0.01	32.36	50.1434
0.02	29.54	47.0639
0.03	27.84	45.2262
0.04	26.55	43.8404
0.05	25.42	42.8793
0.06	24.42	39.999
0.07	23.39	38.4161
0.08	22.37	37.5612
0.09	21.19	36.2986

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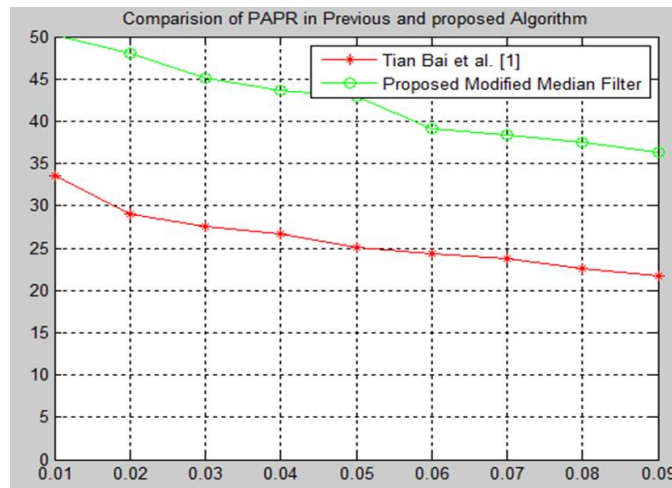
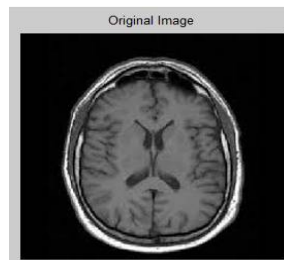
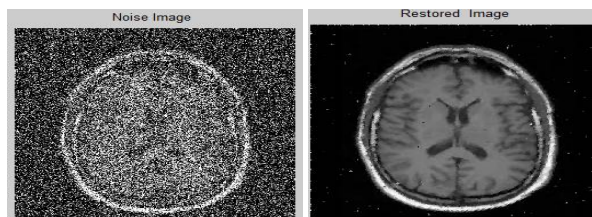


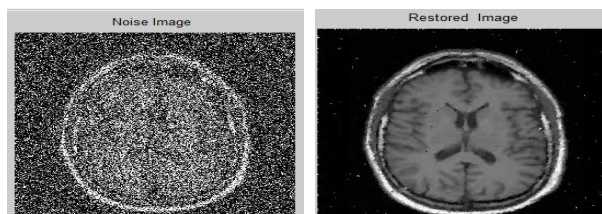
Figure 6: Bar Graph of the Previous Algorithm and Proposed Algorithm in Salt and Pepper Image



(a) Original Image for Heart



(b) 0.3 De-noising



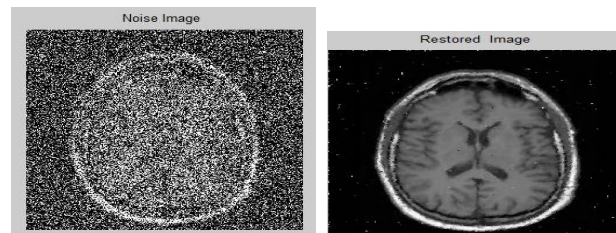
(c) 0.4 De-noising

International Journal of Innovative Research in Science, Engineering and Technology

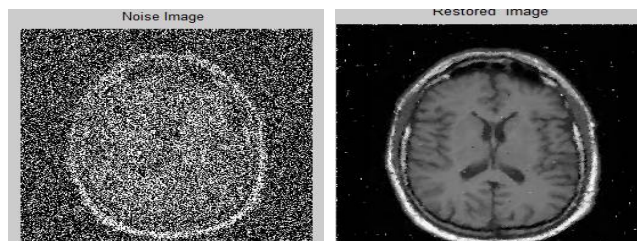
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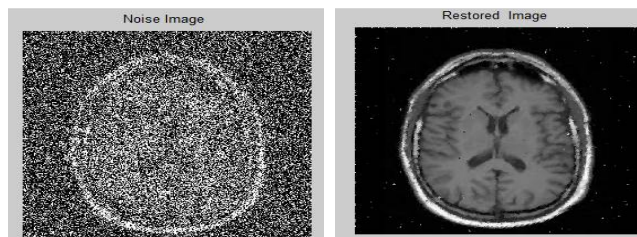
Vol. 6, Issue 11, November 2017



(d) 0.5 De-noising



(e) 0.6 De-noising



(f) 0.6 De-noising

Figure 7: Experimental Results of Proposed Method for real Brain Image

Table 2: Comparison of PSNR of Different Filter for Different Image

Noise Level	Priyanka et al. [2]	Proposed Modified Median Filter
0.3	29.81	31.3259
0.4	26.45	29.5299
0.5	23.24	28.7459
0.6	20.97	28.0601
0.7	19.10	27.1272

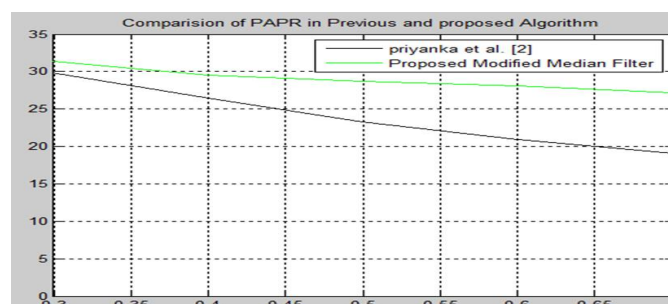


Figure 8: Bar Graph of the Previous Algorithm and Proposed Algorithm in Rician Imag

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 11, November 2017

VI. CONCLUSION

In this work, it can be watched that the execution of the proposed channel is better than the current channels. The fundamental commitment of the paper is a strategy that is fit for reestablishing pictures debased by rician noise commotion with to a great degree high clamor proportion. Light is additionally tossed on the reasons for these commotions and their real sources. In the second area we introduce the different sifting systems that can be connected to de-commotion the pictures. Trial comes about displayed, demands us to finish up middle channels performed well. Adjusted middle channel is the best decision of expelling the rician noise commotion. In this paper is utilized changed middle channel and enhanced PSNR (crest flag clamor proportion) and decreased mean square mistake (MSE) for dim and shading picture.

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