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Speckle Noise Removal in Magnetic Resonance Imaging (MRI) Image Using Threshold Values

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ABSTRACT: In an advanced imaging technique Magnetic Resonance Imaging (MRI) plays a major role in medical field to create high standard images contained in the human brain. MRI imaging is often used when treating brain, prostate cancers, ankle and foot. Noise elimination is the main constraint in digital image processing and sometimes it is very difficult to find out the origin of the noise.
Keywords: MRI image, various noise, PSNR, MSE

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I. INTRODUCTION

Now a day, most of the information in Computer processing is handled online. This online information is either graphical or pictorial in nature, and the storage and communication requirements are immense. Hence method of compressing the data prior to storage and transmission are of significant practical and commercial interest. Image compression means reducing the redundant amount of data required to represent a digital image. The Digital image compression in mathematical form can be defined as transformation of a 2-D pixel array by image, into a statistically uncorrelated data set. The transformation is applied on image prior to storage and transmission of Digital Image Data. The compressed image is reconstructed into original image by the process of Decompression. Decompressed image can be an original image or approximation of it. Image compression is the technology for handling the increased spatial resolutions of today's imaging sensors and evolving broadcast television standards. Image compression plays an important role in many important and diverse applications including tele video conferencing, remote sensing, document and medical imaging, facsimile transmission and the control of remotely piloted vehicles in military, space, and hazardous waste management applications. The application list is ever expanding on the efficient manipulation storage and transmission of different types of digital image such as binary images, gray-scale images, and color images etc. [1], [2] The Internet, still in its childhood; continues to flourish and impact on our personal and professional lives. Common to these and many other applications is the requirement of huge storage space and communication bandwidth for digital images. Hence digital media is motivated by innovative methods for compression of digital images for efficient utilization of storage space and communication bandwidth [3], [4]. In general context, the image speaking compression techniques can be divided into two broad classes: lossless compression and lossy compression schemes. Lossless Compression (Information preserving): As the name implies, this technique involves no loss of data. The original data can be recovered exactly from the compressed data.

A CT scan are on kind of special x-ray tests which is produce cross-sectional images of the body using computer and x-rays it plugs a major role in diagnosing medical diseases, it is used to know details of human body like chest, belly, pelvis, arm, leg, by using CT scan pictures of organ like liver, pancreas, intestine, kidney, bladder, adrenal gland, lung and heart, and etc. The MRI is a techniques to get a clear picture of organs by using large amount of magnetic and radio waves. It uses to diagnose a variety of conditions from ligaments to tumors and will be used to study brain and spinal cord. In medical image processing De-noising of images plays an important role to obtain precise and accurate images for further diagnosis. Medical images are collected by different sensors and they are also subjected wide variety of distortion, storage, compression, acquisition, processing, reproduction And transmission which causes them to get contaminated by different types of noises are removed using filters as they can produce best results depending upon its parameters. The selection of filters depend upon they type of noise because different type of noise can be removed using different types of noises. In this paper a noised image is considered and it is filtered using Median and Wiener filter and the result is compared on various parameters. Median filter and Wiener filter algorithm will be modified. Various noises and like salt and

pepper noise are added. Wiener filter and median filter are implemented to remove additive noise which is present in MRI and CT scans which also responsible to add density gradually. Superconductive scanner contains refrigeration system and liquid helium pump which is responsible for "thump thump" sound, which is also irritate patient and leads temporary earring loss.

II. MRI IMAGE

MRIs employ powerful magnets which produce a strong magnetic field that forces protons in the body to align with that field. When a radiofrequency current is then pulsed through the patient, the protons are stimulated, and spin out of equilibrium, straining against the pull of the magnetic field. When the radiofrequency field is turned off, the MRI sensors are able to detect the energy released as the protons realign with the magnetic field.

Magnetic polarization .Very strong uniform magnet excitation .Very powerful rf transmitter Acquisition, Location is encoded by gradient magnetic fields .Very powerful audi amps Polarization, Proton have a magnetic moment proton have spins like rotating magnets Body has a lot of protons.

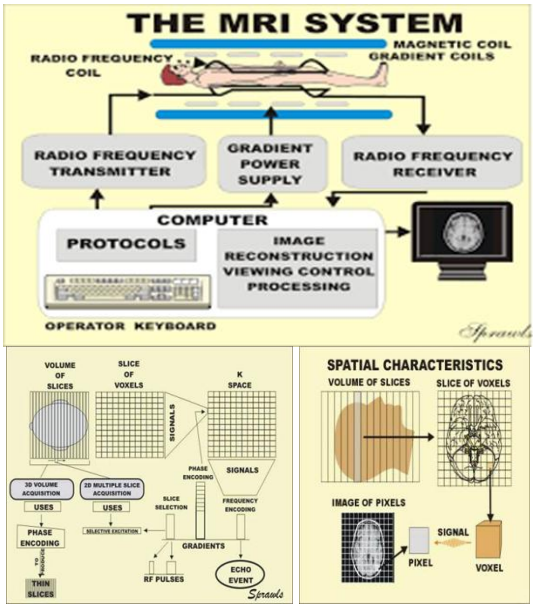


Figure 1: Working of MRI Image

III. 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 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.

IV. 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.

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.

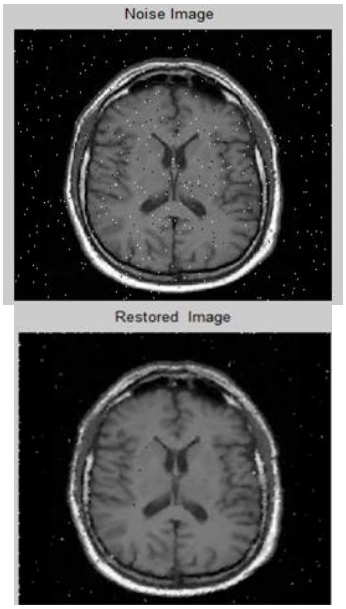


Figure 2: Salt and Pepper noise and original image

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).

Gaussian Noise

Gaussian distribution which is also known as normal distribution whose Probability Density Function is equal to statistical noise known as Gaussian Noise. This noise is removed from the digital images by smoothening of the image pixels which helps in reducing the intensity of the noise present in the image which is caused due to acquisition but the result maybe sometime undesirable and also which can result in blurring edges of the high-quality images [2].

Speckle Noise

The Speckle Noise is defined as a noise which is present in the images and which degrades the quality of an image. Speckle Noise is a phenomenon that convoys all coherent imaging modal quality in which images are produced by interfering echoes of a transmitted waveform that originate from diversity of the studied objects [5].These are the granular noises that are fundamentally present in the image and reduce the quality of the active radar and Synthetic Aperture Radar (SAR) images or Magnetic Resonance [6]. Imaging (MRI) images is referred to as Speckle Noise. If Speckle Noise is present in the conventional radar results from random variations in the return signal from an object which is no longer image process signal increases the mean grey level in an image. A Speckle Noise is the coherent imaging of objects in the image. In fact, it is caused due to errors in data transmission. This kind of noise affects the ultrasound images and MRI images.

V. PROPOSED METHODOLOGY

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 < Pij< 255, then the processing pixel or Pij is uncorrupted and left unchanged.

Step 3: On the off chance that Pij = 0 or Pij = 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 Pij is supplanted by the Salt clamor (i.e. 255).

Case 2: On the off chance that the chose window contains all the pixel esteem as255, then Pij 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 Pij with middle esteem.

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

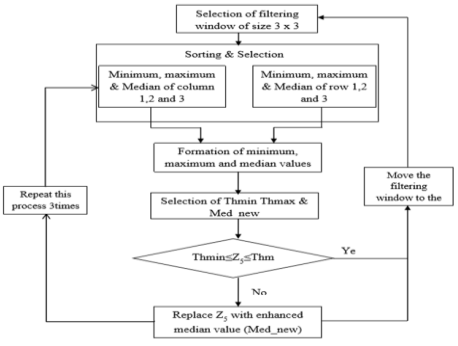


Figure 3: Flow Chart of Proposed Method

VI. 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).
Mean Square Error (MSE)

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

(1)
Peak Signal to Noise Ratio (PSNR) in dB

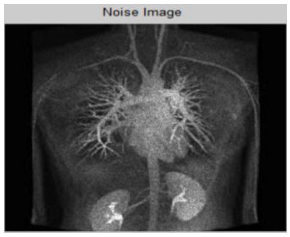
$$= 10 \times \log_{10}(\frac{255^2}{MSE})$$

(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.

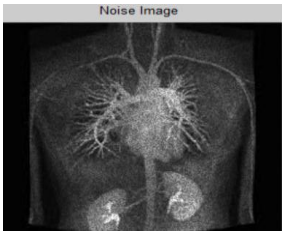
(a) Original Image

(b) 0.01 Noise Density

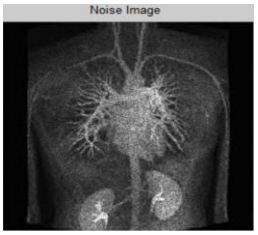


(c) 0.02 Noise Density

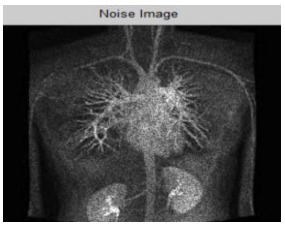
(d) 0.03 Noise Density



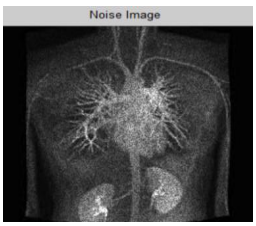
(e) 0.04 Noise Density



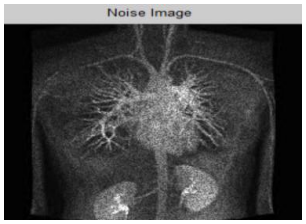
(f) 0.05 Noise Density



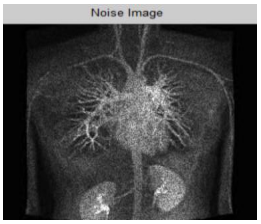
(g) 0.06 Noise Density



(h) 0.07 Noise Density



(i) 0.08 Noise Density



(j) 0.09 Noise Density

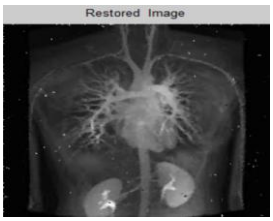


Figure 4: Experimental Speckle Noise Image for Different Noise Density

Table 1: PSNR and MSE Value for Different Noise Density

Image Density	MSE	PSNR (dB)
0.01	0.7640	49.2998
0.02	1.3754	46.7465
0.03	1.9929	45.1359
0.04	2.4775	44.1906
0.05	3.3191	42.9207
0.06	4.0572	42.086
0.07	4.4223	41.6743
0.08	5.4013	40.8058
0.09	5.4709	40.7502

Table 2: Comparison Result

Filter	PSNR (dB)	MSE
Previous Algorithm	25.07191	203.8369
Proposed Algorithm	40.7502	5.4709

VII. 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 speckle 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 speckle 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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