www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 4 Issue 7 July 2015, Page No. 13026-13034

Improved Gradient & Multiple Selection Based Sorted Switching Median Filter

Kanchan Bali, Er. Prabhpreet Kaur
Student, Dept. of CSE
M.Tech CSE 4th
Guru Nanak Dev University, Amritsar
Assistant Professor
Guru Nanak Dev University,
Amritsar, Punjab

ABSTRACT:- ABSTRACT:- This research work has proposed a improved gradient based sorted switching median filter for highly corrupted medical images. It has the capability to decrease the high thickness of noise from medical photos and also conduct better around the others when input picture is noise-less. The proposed technique has additionally capability to conserve the edges by usage of the gradient based smoothing. The proposed approach has been developed and executed in MATLAB 2013a tool using image processing toolbox. Various kinds of the medical photos have been taken for experimental purpose. Comparative examination has shown that the proposed algorithm is efficient compared to available techniques.

Keywords:- Sorted Swithcing Based Median Filter, Gradient Smoothing, Medical Images, Noise

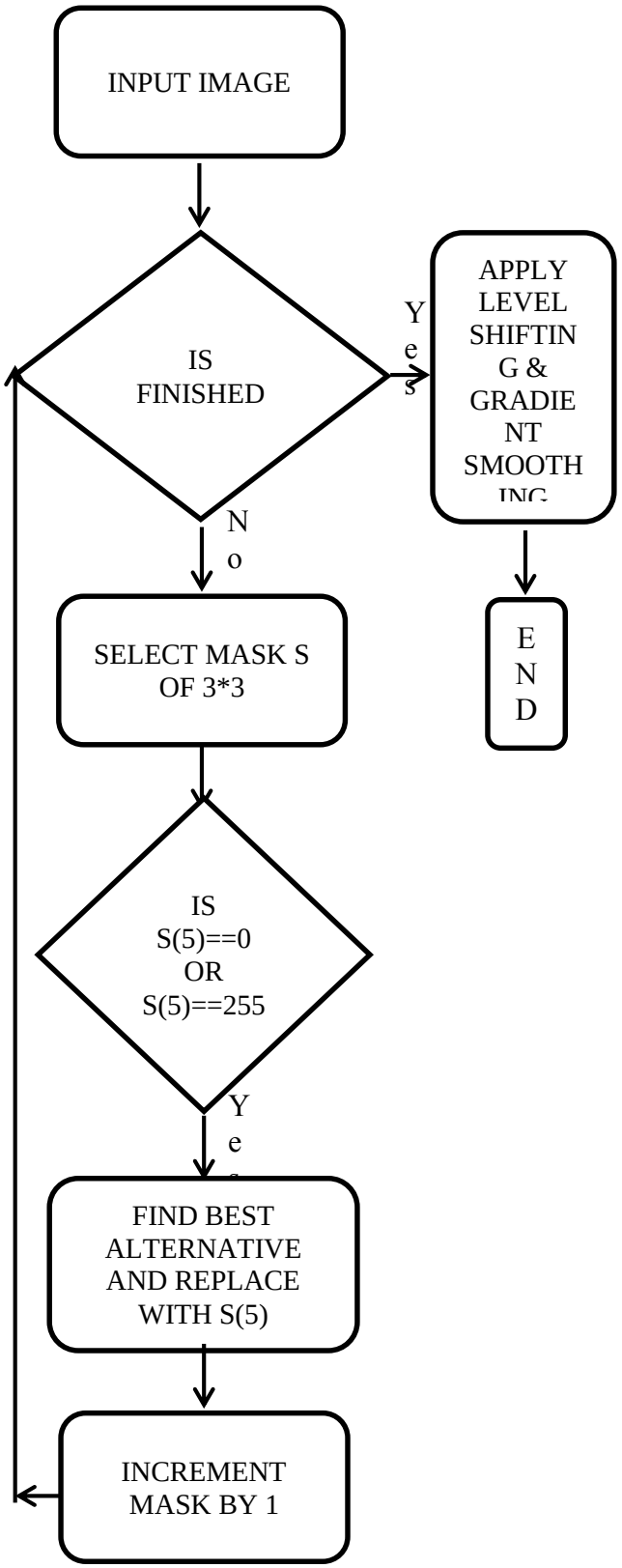
Introduction

LITERATURE SURVEY

PriyankaKamboj et al. (2013) [1] described that Enhancement of a noisy image is necessary task in digital image processing. Filters are used to remove noise from the images. Various types of noise models and filters techniques have been described in this paper. Filters techniques are divided into two parts linear and non-linear techniques. After studying linear and non-linear filter each of have limitations and advantages. Shanmugavadivu P et al. (2011) [2] defined a newly devised noise filter namely, Adaptive Two-Stage Median Filter (ATSM) is used to denoise the images corrupted by fixed-value impulse noise. The performance of the proposed filter is better in terms of Peak Signal-to-Noise Ratio and human visual perception. This filter is effective in denoising the highly corrupted image.

V. Jayaraj et al. (2010) [3] described the new method which introduces the concept of substitution of noisy pixels by linear prediction prior to estimation. A novel simplified linear predictor is developed for this purpose. The aim of the scheme and algorithm is the removal of high-density salt and pepper noise in images. GnanamballIlango et al. (2011) [4] introduced various hybrid filtering techniques for removal of Gaussian noise from medical images. The performance of Gaussian noise removing hybrid filtering techniques is measured using quantitative performance measures such as RMSE and PSNR. The experimental results indicate that the Hybrid Max Filter performs considerably better than many other existing techniques and it gives the best results after successive iterations. This method is simple and easy to implement. ZinatAfrose (2012) [5] described a method to remove Salt & pepper, Gaussian and Speckle noise from compound images using median filter, relaxed median filter, wiener, centre weighted median and averaging filter. The performance of the various filters with the applied noises using compound images are compared and analyzed according to PSNR value. Yen, E.K. et al.(1996) [6] have stated that Pearson's linear correlation coefficient is widely used for comparing images in their paper. Pearson's correlation coefficient is used in statistical analysis, pattern recognition and image processing. Generally, the correlation coefficient is used to compare two images of the same object taken at different times. The r value indicates whether the object has been changed or moved. Benefit of correlation coefficient is that it condenses the comparison of two two-dimensional images to a single scalar r. Correlation coefficient is also insensitive to uniform variations in brightness or contrast across an image. In spite of its advantages, the correlation coefficient has many problems and limitations. The most recognized disadvantage is that it is computationally intensive. Michailovich,O.V. et al.(2006) [7] have elaborated the concept of speckle noise. Speckle noise is a phenomenon that accompanies all coherent imaging modalities in which images are produced by interfering echoes of a transmitted waveform that emanate from heterogeneities of the studied objects. Although speckle noise is a random process, it is not devoid of information. A novel method for enhancing the performance of homomorphic despeckling methods has been presented in this paper. The basic idea underpinning this class of speckle reduction techniques consists of using the log-transformation in order to convert multiplicative speckle noise into an additive noise process, followed by suppressing the latter using certain filtering procedures. Sudha, S. et al.(2009) [8] have found that in medical image processing, image denoising has

became a very essential exercise all through the diagnose in their paper. Negotiation between the preservation of useful



diagnostic information and noise suppression must be treasured in medical images. In some cases, for instance in Ultrasound images, the noise can restrain information which is valuable for the general practitioner. The success of ultrasonic examination depends on the Image quality. In case of ultrasonic images a particular type of acoustic noise known as speckle noise, is the main factor of image quality degradation. This paper presents the performance analysis of many schemes for suppressing speckle noise in Ultrasound images in terms of the assessment parameters PSNR and Equivalent Number of Looks (ENL). Simulations of this paper shows that Bayes Shrink clearly performs the best. The Sure Shrink performed worse than Bayes Shrink but it adapts well to sharp discontinuities in the signal. Abrahim,B.A. et al.(2011) [9] have described the importance of ultrasound imaging. A new speckle reduction method and coherence enhancement of ultrasound images based on method that combines total variation (TV) method and wavelet shrinkage is discussed. A noisy image is decomposed into subbands of LL, LH, HL, and HH in wavelet domain in this method . LL subband contains the low frequency coefficients along with less noise, which can be easily eliminated using TV based method. The present hybrid method takes full advantage of TV-based method to denoise the low frequency subband without losing textures, and uses the wavelet shrinkage method based on local variance information to find textures from noise in the high frequency sub-bands. Ruikar, S.D. et al.(2011) [10] have proposed different approaches of wavelet based image denoising methods. The search for effective image denoising methods is still a valid challenge at the crossing of functional analysis and statistics. Despite of the sophistication of the recently proposed methods, most algorithms have not yet attained a desirable level of applicability. Wavelet algorithms[11] are useful tool for signal processing such as image compression and denoising. Multi wavelets are considered as an extension of scalar wavelets. The main objective is to change the wavelet coefficients in the new basis, the noise can be removed from the data. In this paper, the existing technique is extended and a comprehensive evaluation of the proposed method is presented. Various types of noise such as Gaussian, Poisson's, Salt and Pepper, and Speckle are considered in this paper. Rangaraju, K.S. et al.(2012) [12] have described that quality of an image is a characteristic of an image that best measures the perceived image degradation. When it comes to point of image quality assessment there are two types of assessment which are subjective Image Quality Assessment and Objective Image Quality Assessment. Subjective Image Quality Assessment [13] is concerned with how image is perceived by a viewer and gives his or her opinion on a particular image. Objective Image Quality Assessment is concerned with developing quantitative measures that can automatically predict the perceived image quality. Hedaoo, P.S. (2012) [14] has given that in modern age, visual information transmitted in the form of digital images is becoming a major method of communication, but the image obtained after transmission is often corrupted with noise. For getting the high quality image from original noisy image data manipulation is required. In this paper noise is eliminated by wavelet based approach & it is proved that wavelet based approach is best when the image is corrupted by Gaussian noise, salt and pepper noise, speckle noise and Brownian noise. Quantitative measures

of comparison are provided by the signal to noise ratio of the image. An adaptive threshold for wavelet thresholding images was proposed, based on the generalized Gaussian distribution modeling of sub band coefficients, and test results showed excellent performance. The results shows that Proposed Shrink removes noise considerably. Asari, H.S. et al.(2013) [15] have discussed that Ultrasound is a medical imaging technique that is widely used for diagnostic purposes. Ultrasound is used for x-ray and ultrasonography. A main problem regarding these images is in their inherent corruption by speckle noise. The presence of speckle noises severely hampers and the interpretation and analysis of medical ultrasound images. There structure in the signal, and WT provides a scale-based decomposition. Thus, the noise tends to be represented by the wavelet coefficients at finer scales. Discrete wavelet transform has the advantage of giving a joint time frequency representation of the signal. Denoising performance varies with type of signal under considerations and wavelet chosen. Niveda, P.S. et al. (2014) [17] have described that the procedure of eliminating the noise from the early picture endures to be a tough bother for researchers. The centre of attention of this paper is coupled to the pre procedure of a figure beforehand it will be utilized in applications. The pre procedure is finished by de-noising of pictures. Completely disparate noises such as Gaussian sound salt and pepper sound, speckle sound span constituent used. The way of filtering has been tested to be the

RESULTS AD DISCUSSIONS

In order to implement the proposed algorithm, design and implementation has been done in MATLAB using image processing toolbox. Table 1 shows the various images used in this research work. Images are given along with their formats. All the images are of same kind and passed to proposed algorithm.

TABLE 1: Images taken for experimental analysis

IMAGE NAME	FORMAT
Image 1	.jpg
Image 2	.jpg
Image 3	.jpg
Image 4	.jpg
Image 5	.jpg
Image 6	.jpg
Image 7	.jpg
Image 8	.jpg
Image 9	.jpg
Image 10	.jpg

For the purpose of analysis we have taken 10 different images and passed to proposed algorithm. Subsequent section contains

are lot of algorithms proposed for reducing the mixer of noise in medical ultrasound images. In this paper, speckle noise is eliminated by methods based on wavelet transform and contourlet transform. The two proposed alternative methods are evaluated and compared in terms of filter assessment parameters namely peak Signal to Noise Ratio (PSNR), Signal to Noise Ratio (SNR), Mean Square Error (MSE), Variance and Correlation Coefficient (CC). Joy,J. et al.(2013) [16] have presented a comparative study of different wavelet denoising techniques The major work on denoising is done by Donoho , based on thresholding the DWT of the signal. The method relies on the fact that noise commonly manifests itself as fine-grained

highest after the picture is damaged alongside salt and pepper noise. The rippling chiefly established way has been tested to be the simplest in de-noising pictures contaminated alongside Gaussian noise. A digitized fingerprint picture is normally screeching. In this paper, picture procedure methods are utilized to remove sound inside the fingerprint picture and a substitute enhancement method is projected and tested alongside success.

PROPOSED ALGORITHM

a result of one of the 10 selected images to show the improvement of the proposed algorithm over the other technique.

Figure 2 has shown the input image which is passed to the simulation.

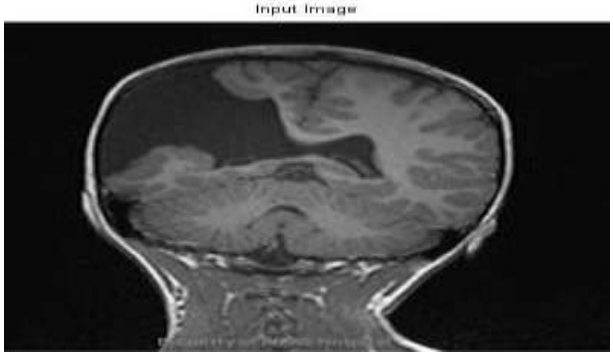


Figure 2 Input image

Figure 3 has shown the noisy image with density =.7. It is clearly shown that the noise has degraded the visibility of the image. The RMSE value of noisy image is 17024 and PSNR value is 3.4431.

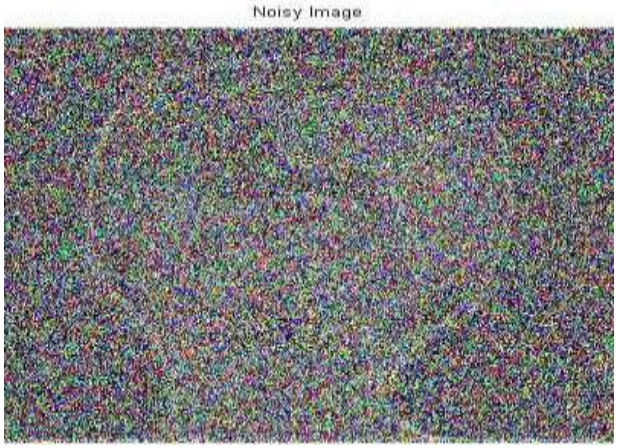


Figure 3 Noisy image

Figure 4 has shown the filtered image using the traditional median filtered image. It is clearly shown that the image is somehow filtered but has not shown the accurate results. The RMSE value of median filtered image is 6001 and BER value is 7.2221. It has better values as compared to noisy image.

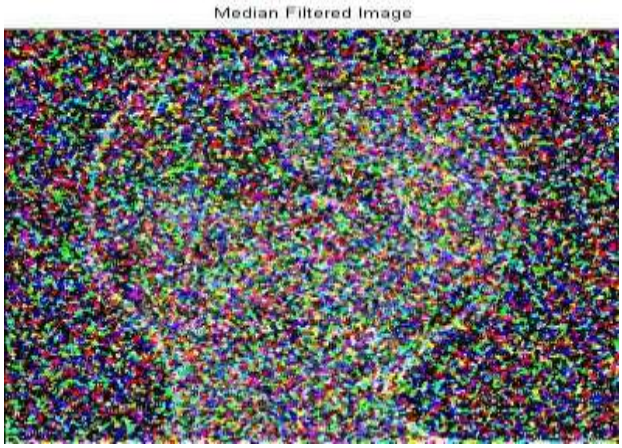


Figure 4 Median filtered image

Figure 5 has shown that the noise has been reduced using the switching median filter but results are not much effective. The RMSE value of base paper is 2053 and BER value is 6.1002. It has better values as compared to median filtered image.

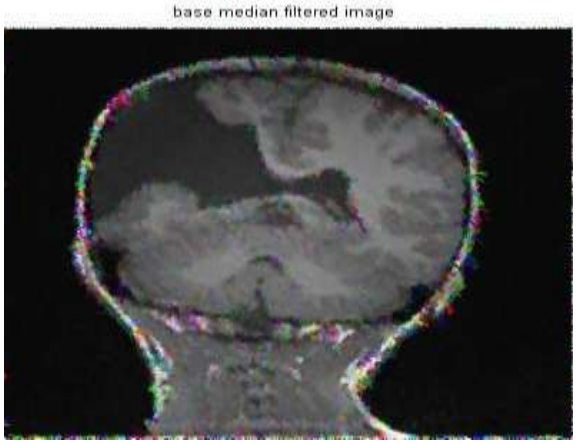


Figure 5 Switching median filtered image

Figure 6 has shown that the results are quite effective and has much more better results than the available methods. Thus the proposed algorithm has shown quite significant improvement over the available methods. The RMSE value of proposed output is 421 and BER value is2.2221. It has better values as compared to base paper.

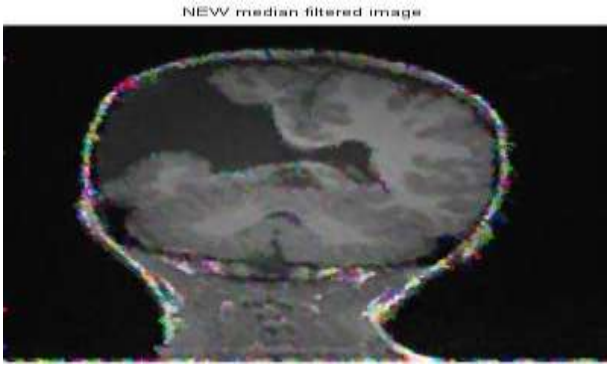


Figure 6 Proposed algorithm's filtered image

5.1 Experiment on chest Scan

Figure 7 has shown the input image which is passed to the simulation.

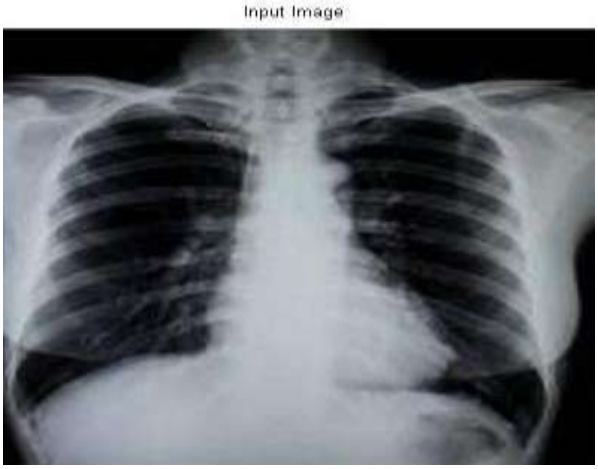


Figure 7 Input image

Figure 8 has shown the noisy image with density =.7. It is clearly shown that the noise has degrades the visibility of the image. The RMSE value of noisy image is 15021 and BER value is 5.6251.

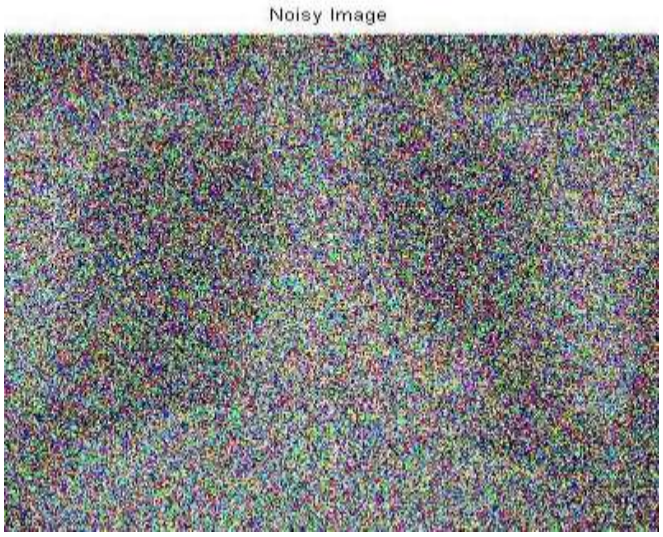


Figure 8 Noisy image

Figure 9 has shown the filtered image using the traditional median filtered image. It is clearly shown that the image is somehow filtered but has not shown the accurate results. The RMSE value of median filtered image is 10726 and BER value is 3.4391. It has better values as compared to noisy image.

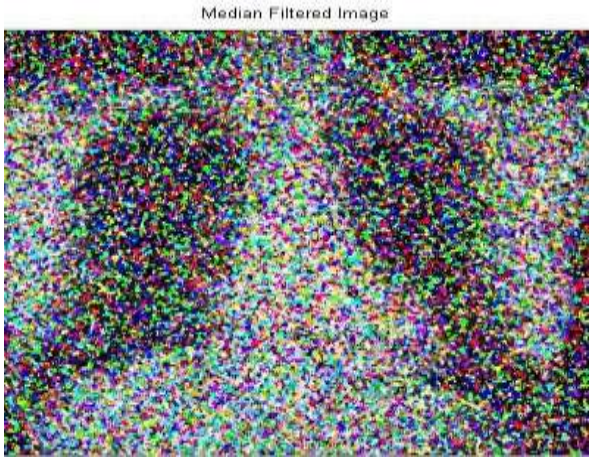


Figure 9 Median filtered image

Figure 10 has shown that the noise has been reduced using the switching median filter but results are not much effective. The RMSE value of base paper is 81 and BER value is 1.212. It has better values as compared to median filtered image.

Figure 10 Switching median filtered image

Figure 11 has shown that the results are quite effective and has much more better results than the available methods. Thus the proposed algorithm has shown quite significant improvement over the available methods. The RMSE value of proposed output image is 241 and BER value is 0.1111. It has better values as compared to base paper output.

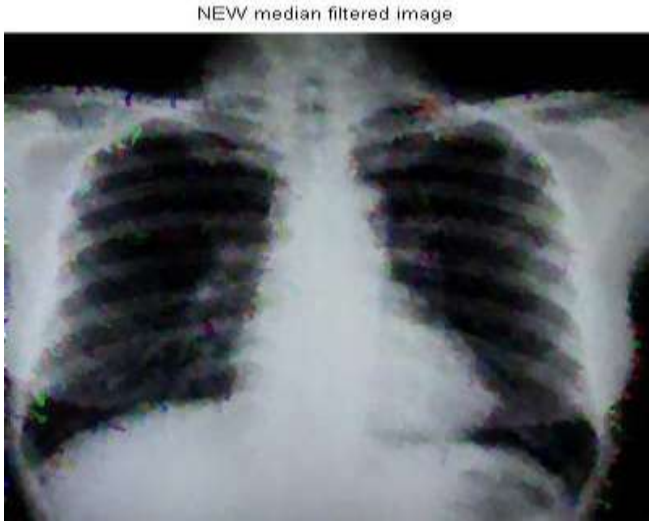


Figure 11 Proposed algorithm's filtered image

5.2 Experiment on MRI cancer

Figure 12 has shown the input image which is passed to the simulation.

Figure 12 Input image

Figure 13 has shown the noisy image with density =.7. It is clearly shown that the noise has degrades the visibility of the image. The RMSE value of noisy image is 15021 and BER value is 5.2121.

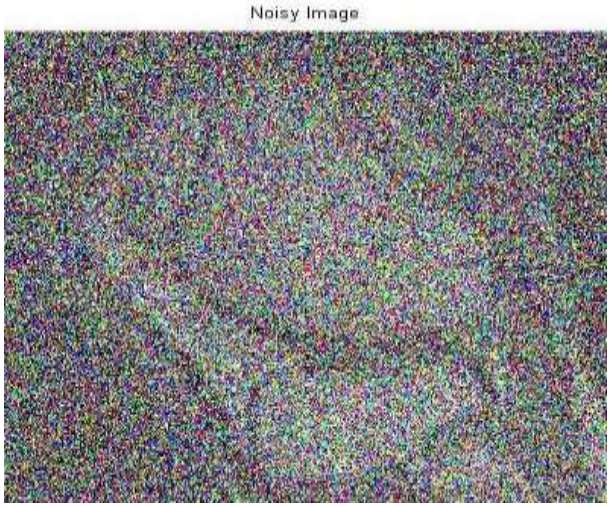


Figure 13 Noisy image

Figure 14 has shown the filtered image using the traditional median filtered image. It is clearly shown that the image is somehow filtered but has not shown the accurate results. The RMSE value of median filtered image is 921 and BER value is 3.2141. It has better values as compared to noisy image.

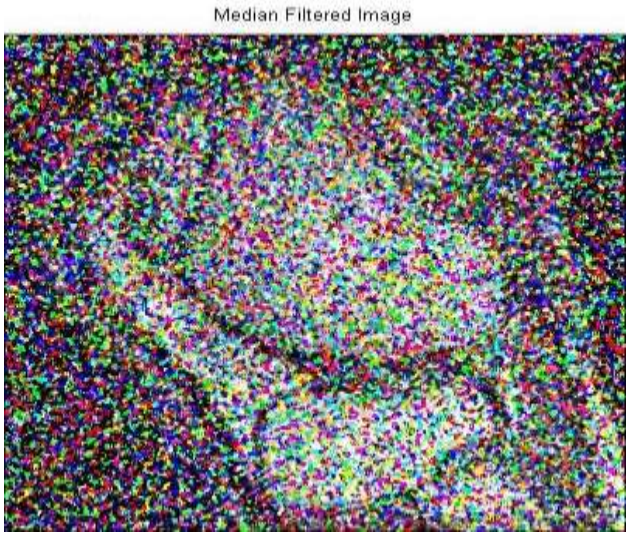


Figure 14 Median filtered image

Figure 15 has shown that the noise has been reduced using the switching median filter but results are not much effective. The RMSE value of switching median filtered image is 425 and BER value is 1.2121. It has better values as compared to median filtered image.

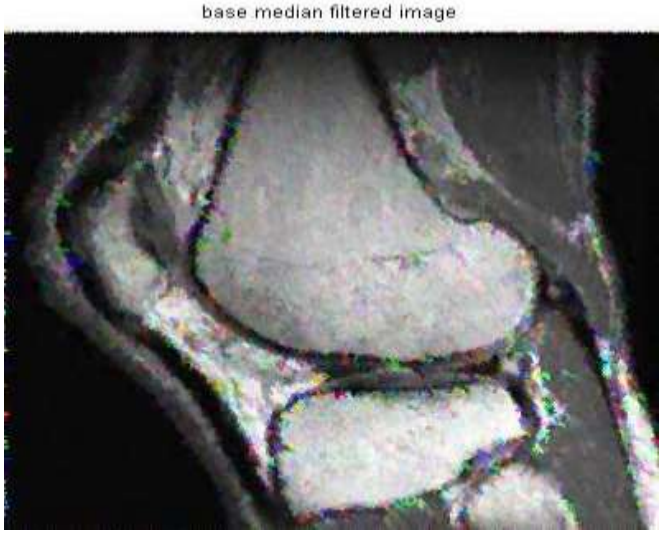


Figure 15 Switching median filtered image

Figure 16 has shown that the results are quite effective and has much more better results than the available methods. Thus the proposed algorithm has shown quite significant improvement over the available methods. The RMSE value of proposed algorithm is 151 and BER value is 0.2246. It has better values as compared to base paper.

Figure 16 Proposed algorithm's filtered image

Table 2 shows the quantized analysis of the mean square error. As mean square error need to be reduced consequently the proposed algorithm shows better results than the available methods as mean square error is less.

Table 2: MSE analysis at the different noise density for image 1

IMAGE	NOISY IMAGE	MEDIAN FILTER	Existing Technique	New Technique
Image1	18233	11480	692	221
Image2	19243	10867	442	324
Image3	19702	10844	479	339
Image4	16088	11287	779	662
Image5	19723	12479	1277	1093
Image6	18619	11929	689	440
Image7	19803	11348	820	723
Image8	17723	10479	1277	1093
Image9	14219	1129	349	140
Image10	19803	12448	520	213

Table 3 shows comparative analysis of the Peak Signal to Noise Ratio (PSNR). As PSNR need to be maximized; so the main goal is to enhance the PSNR as much as possible. Table 3 has clearly shown that the PSNR is maximum in the case of the proposed algorithm therefore proposed algorithm is providing better results than the available methods.

Table3: PSNR analysis at the different Images

IMAGE	NOISY IMAGE	MEDIAN FILTER	SSMF	Proposed
Image1	6.2210	9.9292	19.9110	19.8636
Image2	8.6898	13.3894	21.6492	22.4021
Image3	8.6806	9.3988	21.3294	21.9062
Image4	6.0688	9.8831	19.8231	23.8231
Image5	5.1892	8.9296	29.0689	30.3644
Image6	7.6910	9.3839	19.9486	20.8069
Image9	8.8969	11.8816	15.8366	18.9968
Image8	6.1892	9.9296	19.0689	19.3644
Image9	8.6910	9.1839	18.9436	20.8069
Image10	7.8969	12.8816	15.8236	18.9268

Table 4 shows comparative analysis of the Root Mean Square Error (RMSE). As RMSE need to be minimized; therefore the main aim is to decrease the RMSE as much as possible. Table 4 clearly shown that the RMSE is minimum in the case of the proposed algorithm therefore proposed algorithm provides better results than the available methods.

Table 4: RMSE analysis for different images

IMAGE	NOISY IMAGE	MEDIAN FILTER	SSMF	Proposed
Image1	104.5911	100.1719	06.1609	05.9017
Image0	110.4500	108.9158	01.0950	19.1191
Image1	111.0489	108.8101	01.8861	00.9501
Image4	106.8185	78.8911	58.0666	27.6586
Image5	105.5110	100.1670	15.7151	14.5198
Image6	110.7166	109.1570	06.0488	01.0179
Image7	109.6064	46.5070	9.1548	7.6880
Image8	130.4500	118.9158	41.0950	19.1191
Image9	115.5110	89.1670	25.7151	14.5198
Image10	104.5911	40.1719	6.1609	5.9017

Table 5 shows comparative analysis of the BIT ERROR RATE (BER). As BER need to be minimized; so the main goal is to decrease the BER as much as possible. Table 5 clearly shown that the BER is minimum in the case of the proposed algorithm therefore proposed algorithm is providing better results than the available methods.

Table 5: BER analysis for different images

IMAGE	NOISY IMAGE	MEDIAN FILTER	SSMF	Proposed
Image1	0.1403	0.1241	0.0503	0.0403
Image2	0.1358	0.1354	0.0442	0.0344
Image3	0.1330	0.1352	0.0449	0.0341
Image4	0.1449	0.1249	0.0523	0.0418
Image5	0.1424	0.1241	0.0284	0.0534
Image6	0.1343	0.1340	0.0504	0.0481
Image7	0.1302	0.1319	0.0531	0.0423

Image8	0.1334	0.1301	0.0491	0.0256
Image9	0.1124	0.1042	0.0684	0.0234
Image10	0.1413	0.1141	0.0803	0.0503

Table 6 shows comparative analysis of the Mean Difference (MD). As MD needs to be minimized; so the main goal is to decrease the MD as much as possible. Table 6 clearly shown that the MD is minimum in the case of the proposed algorithm therefore proposed algorithm is providing better results than the available methods.

Table 6: MEAN DIFF analysis for different images

IMAGE	NOISY IMAGE	MEDIAN FILTER	SSMF	Proposed
Image1	2.7562	2.7710	0.1125	0.0051
Image2	46.6041	25.0811	1.5101	1.6451
Image3	18.7140	11.4705	0.2526	0.0185
Image4	22.6774	11.8251	2.5140	2.6145
Image5	21.1560	11.6506	1.7150	1.0468
Image6	16.1208	21.4670	2.0162	1.4074
Image7	25.2246	15.1710	0.6711	0.5144
Image8	24.1208	21.4670	2.0162	1.4074
Image9	19.1560	11.6506	1.8150	1.0468
Image10	5.7562	3.7710	0.2125	0.0040

Figure 1 shows analysis of the mean square error. As mean square error need to be reduced therefore the proposed algorithm is showing the better results than the available methods as mean square error is less in every case

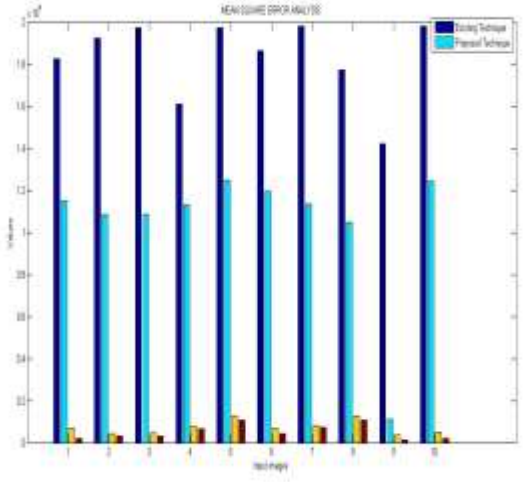


Fig 1: MSE Evaluation

Figure 2 shows comparative analysis of the Peak Signal to Noise Ratio (PSNR). As PSNR need to be maximized; so the main goal is to increase the PSNR as much as possible. Figure 2 has clearly shown that the PSNR is maximum in the case of the proposed algorithm therefore proposed algorithm is providing better results than the available methods.

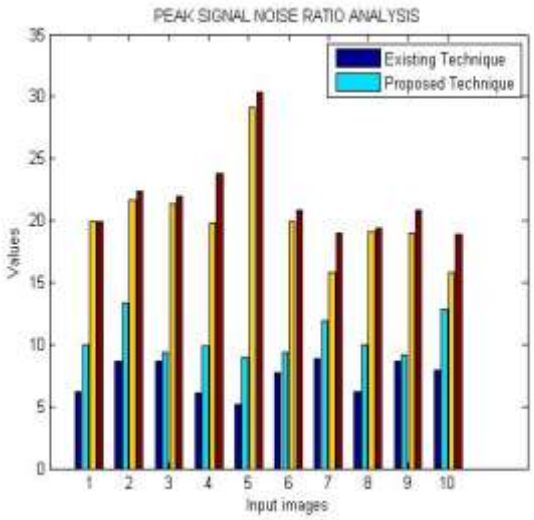


Fig 2: PSNR Evaluation

Figure 3 shows comparative analysis of the Root Mean Square Error(RMSE). As RMSE need to be minimized; so the main goal is to decrease the RMSE as much as possible. Figure 3 has clearly shown that the RMSE is minimum in the case of the proposed algorithm therefore proposed algorithm is providing better results than the available methods.

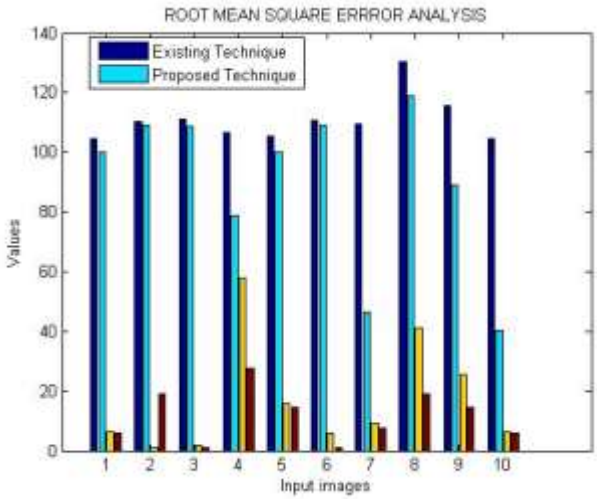


Fig 3: RMSE Evaluation

CONCLUSION & FUTUREWORK

A variety of median based filters are used for the filtering of the noisy images contaminated by salt and pepper noise. The size of the filter controls degree of smoothing. The switching

median filter based algorithm eliminates impulse noise even in case of high noise density and moreover generate enhanced results over existing filters but it does not conserve edges or boundaries of the digital images. To rise above this problem, a novel switching median filter has been proposed in this paper which has the ability to reduce the high density of the noise from images and also performs better over others when input image is noise free.

The proposed method also has the ability to conserve the edges by using the gradient based smoothing. The proposed technique has been designed and implemented in MATLAB 2013a tool using image processing toolbox. Several types of medical images have been taken for experimental purpose. Comparative analysis has shown that the proposed algorithm is very valuable over the available techniques.

In future, this can be modified further using fuzzy set theory to estimate the best alternative to change the noisy pixel value. As only salt and pepper noise is considered in this work, in near future we will use other kinds of noises too like Gaussian and random noise. Moreover hybridization can be done of given technique by usage of bilateral filter.

REFERENCES

[1] PriyankaKamboj, Versha Rani. 2013 Image Enhancement Using Hybrid Filtering Techniques. International Journal of Science and Research.Vol 2, No. 6, June 2013.

[2] Shanmugavadivu P and EliahimJeevaraj P S. 2011 Fixed–Value Impulse Noise Suppression for Images using PDE based Adaptive Two-Stage Median Filter. ICCCET-11 (IEEE Explore), pp. 290-295.

[3] V. Jayaraj and D. Ebenezer. 2010 A new switching-based median filtering scheme and algorithm for removal of high-density salt and pepper noise in image.EURASIP J. Adv. Signal Process.

[4] GnanamballIlango and R. Marudhachalam. 2011 new hybrid filtering techniques for removal of Gaussian noise from medical images.ARPN Journal of Engineering and Applied Sciences.

[5] Afrose. 2011 Relaxed Median Filter: A Better Noise Removal Filter for Compound Images. International Journal on Computer Science and Engineering (IJCSE) Vol. 4 No. 07

[6] Yen, Eugene K., and Roger G. Johnston. "The ineffectiveness of the correlation coefficient for image comparisons." Vulnerability Assessment Team, Los Alamos National Laboratory, MS J 565 (1996).

[7] Michailovich, Oleg V., and Allen Tannenbaum. "Despeckling of medical ultrasound images." Ultrasonics, Ferroelectrics and Frequency Control, IEEE Transactions on 53.1 (2006): 64-78.

[8] Sudha, S., G. R. Suresh, and R. Sukanesh. "Comparative study on speckle noise suppression techniques for ultrasound images." International Journal of Engineering and Technology 1.1 (2009): 1793-8236.

[9] Abrahim, Banazier A., and Yasser Kadah. "Speckle noise reduction method combining total variation and wavelet shrinkage for clinical ultrasound imaging."Biomedical Engineering (MECBME), 2011 1st Middle East Conference on. IEEE, 2011.

[10] Ruikar, Sachin D., and Dharmpal D. Doye. "Wavelet based image denoising technique." IJACSA) International Journal of Advanced Computer Science and Applications 2.3 (2011).

[11] Kashyap Swathi Rangaraju, Dr, Kishor Kumar, and C. H. Renumadhavi. "Review Paper on Quantitative Image Quality Assessment–Medical Ultrasound Images."International Journal of Engineering Research and Technology. Vol. 1. No. 4 (June-2012). ESRSA Publications, 2012.

[12] Hedaoo, Pankaj S. "Design Approach of Colour Image Denoising Using Adaptive Wavelet" International Journal of Engineering 1.7 (2012): 01-05.

[13] Asari, H. S., A. Shah. "Research Paper on Reduction of Speckle Noise in Ultrasound Imaging Using Wavelet and Contourlet Transform."Journal of Information, Knowledge and Research in Electronics and Communication Engineering (2013).

[14] Joy, Jeena, Salice Peter, and Neetha John. "Denoising using soft thresholding."International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 3, March 2013.

[15] Niveda, P. S., S. Vinodhini, and K. Malathi. "Denoising a Image Using Different Filters." International Journal of Innovative Research and Development 3.5 (2014).