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Study of Noise Detection and Noise Removal Techniques in Medical Images

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***Abstract*— In this work we taken different medical images like MRI, Cancer, X-ray, and Brain and calculated standard derivations and mean of all these medical images. To finding salt & pepper noise and then applied median filtering technique for removal of noise. After removing a noise by using median filtering techniques again standard derivations and mean are evaluated. This experimental analysis will improve the accuracy of MRI, Cancer, X-ray and Brain images for easy diagnosis. The results, which we have achieved, are more useful and they prove to be helpful for general medical practitioners to analyze the symptoms of the patients.**

***Index Terms*— ROI- Region Of Interest, MRI – *Magnetic Resonance Imaging,* Median filter, Adaptive filter and Average filter.**

I- INTRODUCTION

Median Filtering:

Median filtering is similar to using an averaging filter, in that each pixel is set to an 'average' of the pixel values in the neighborhood of the corresponding input pixels. However with median filtering, the value of an output pixel is determined by the median of the neighborhood pixels, rather than the mean. The median is much less sensitive than the mean to extreme values. Median filtering is therefore better able to remove this outlier without reducing the sharpness of the image.

Adaptive Filtering:

The wiener2 function applies a Wiener filter which is a type of linear filter to an image adaptively, tailoring itself to local image variance. Where the variance is large, wiener2 performs little smoothing. Where the variance is small, wiener2 performs more smoothing. This approach often produces better result than linear filtering. The adaptive filter is more selective than a comparable linear filter, preserving edges and other high frequency parts of an image. In addition, there are no design tasks; the wiener2 function handles all preliminary computations, and implements the filter for an input image. Wiener2, however, does require more computations time than linear filtering. Wiener2 works best when the noise is constant-power ("white") additive noise, such as Gaussian noise.

Adaptive median filter:

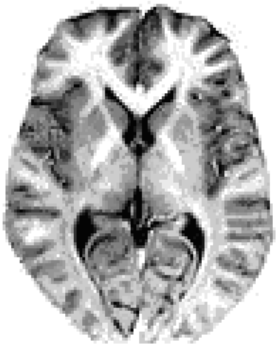
Adaptive median filtering can handle impulse noise with probabilities. The adaptive median filter is that it seeks to preserve detail while smoothing non impulse noise, something that the traditional median filter does not do.

II- METHODOLOGY

Figure shows the different noise which has find in these medical image and after applying the filtering techniques in these medical images and same has been given through histogram.

Table 1.1
Noise removal using Median Filter for Salt & Pepper

Image	Original Image		Noisy Image		Filtered Image	
	Std	**Mean**	**Std**	**Mean**	**Std**	**Mean**
MRI	70.0623	182.2473	74.0267	180.0172	68.8923	182.5818
Cancer	61.2939	62.4918	64.0972	63.9113	53.1813	60.3204
X-Ray	65.4542	145.47576	68.2635	144.9646	64.8242	145.9382
Brain	91.0872	85.9561	92.5692	87.1018	90.5972	85.7115

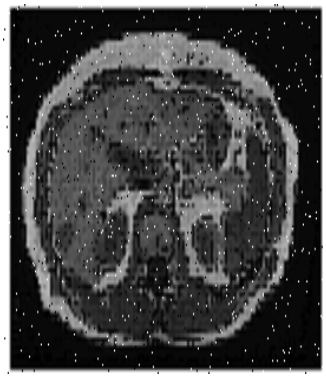


(a)Original MRI image

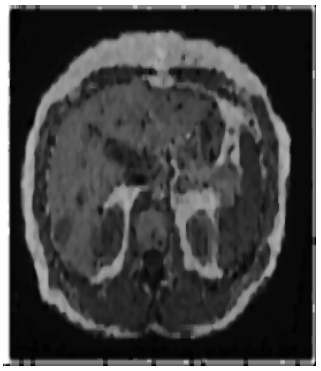
(b) Finding Salt & Pepper Noise

(c) Applying median Filter

(a)Original cancer image

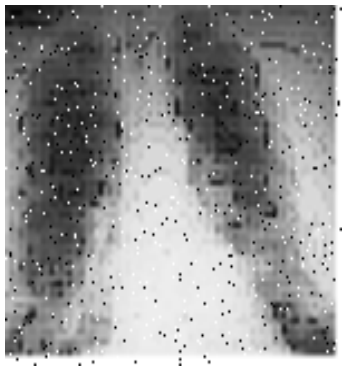


(b) Finding Salt & Pepper

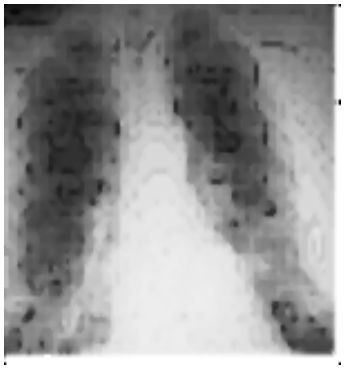


(c) Applying Median Filter

(a) Original x-ray image



(b) finding salt & pepper noise



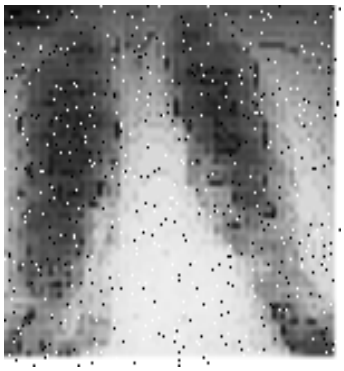
(c) Applying median Filter

(a)Original image (Brain image)

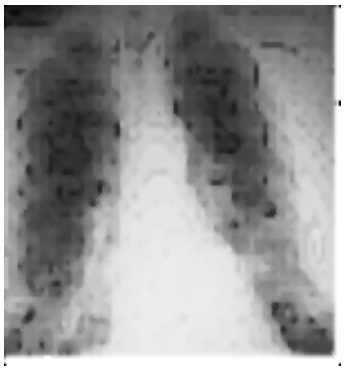
(b) Finding a salt & pepper noise in brain image

(c) Applying Median Filter

(a) Original x-ray image



b) finding salt & pepper noise



(c) Applying median Filter

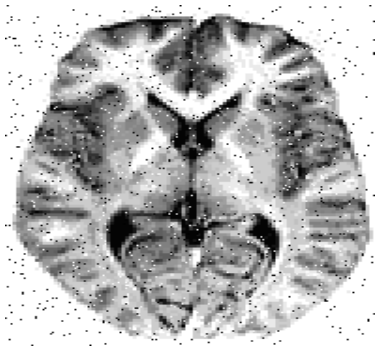
(a)Original image (Brain image)

(b) finding a salt & pepper noise in brain image

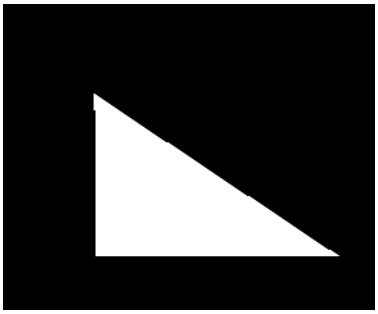
(c) Applying Median Filter

Fig1.1.1 Shows finding the salt and pepper noise in MRI, Cancer, X-ray, Brain images and applying the median filter on these images.

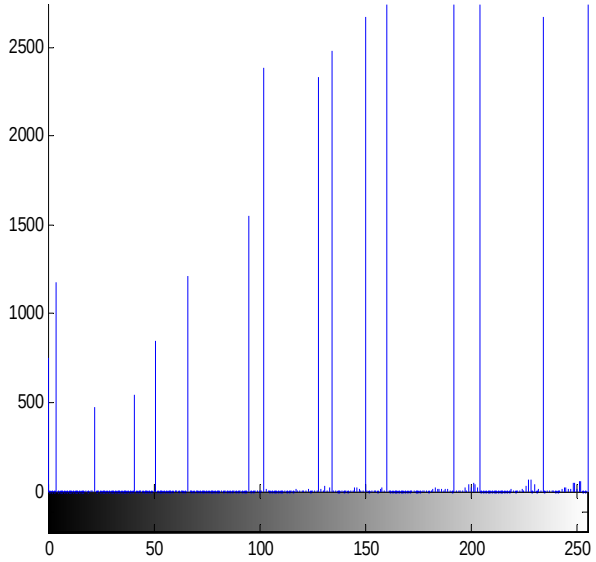
The following figure shows the noise pattern for the MRI, Cancer, X-ray and brain images. In these medical images after finding the salt and pepper noise we have taken a region of interest for noisy images and the histogram shows the noise pattern that is it is the salt and pepper noise.



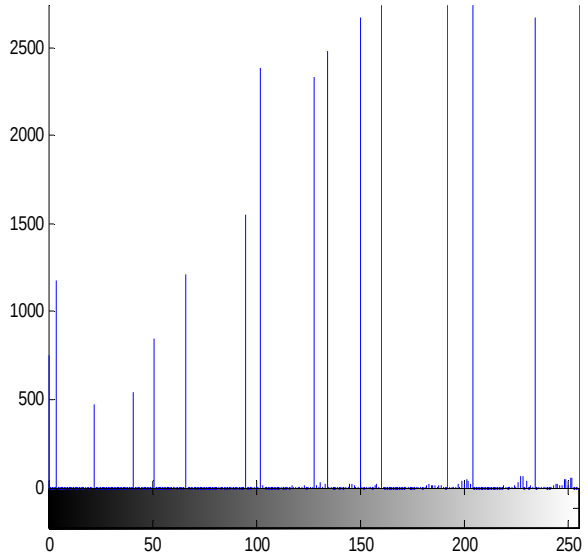
(a)Noisy image (salt & pepper noise)



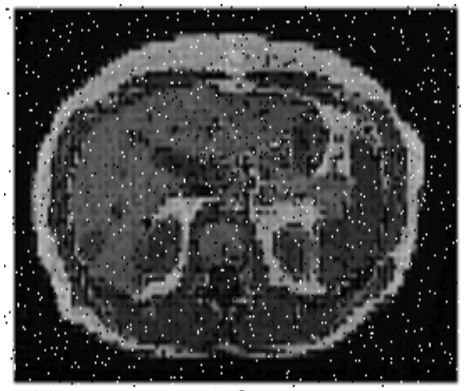
(b) ROI generated for noisy image



(c) Histogram for noisy image

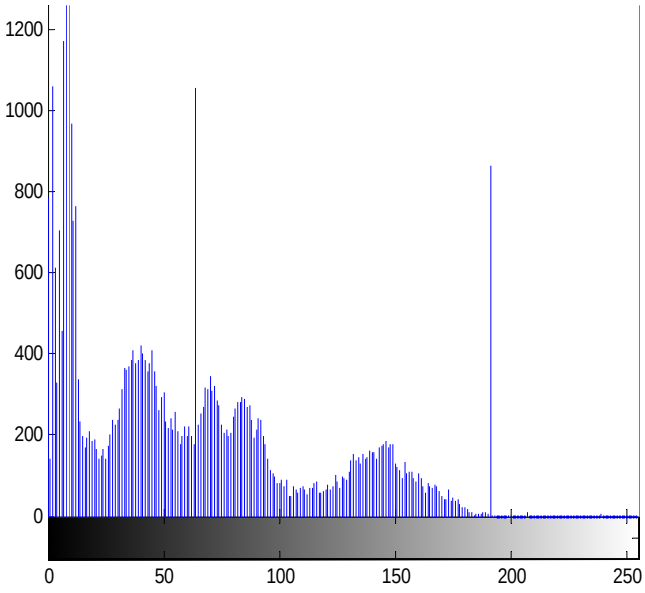


(d) Histogram of ROI

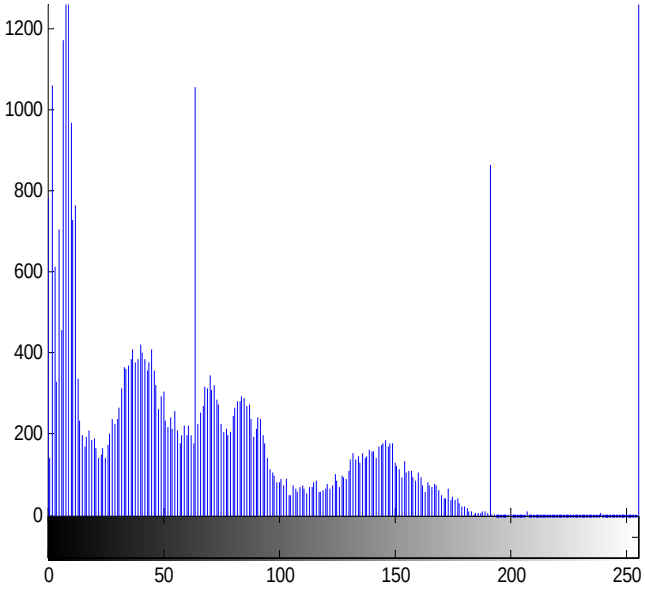


(e) Noisy image (salt & pepper noise)

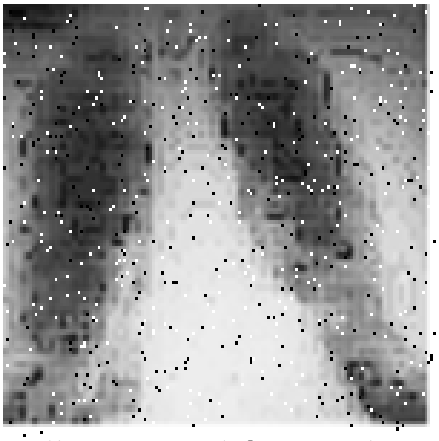
(f) ROI for the noisy image



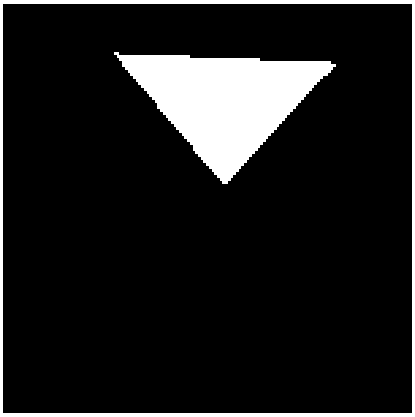
(g) Histogram for the noisy image



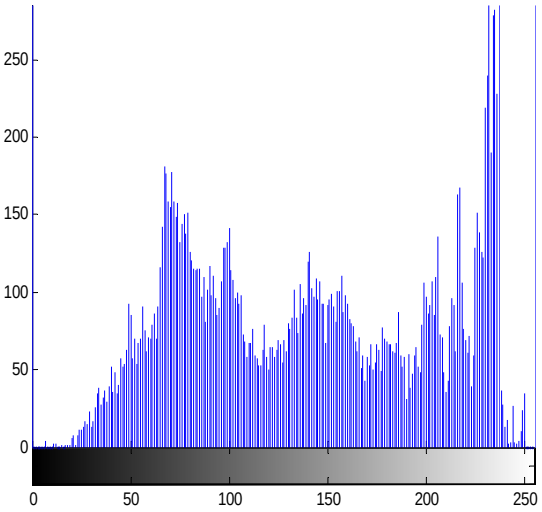
(h) histogram for ROI



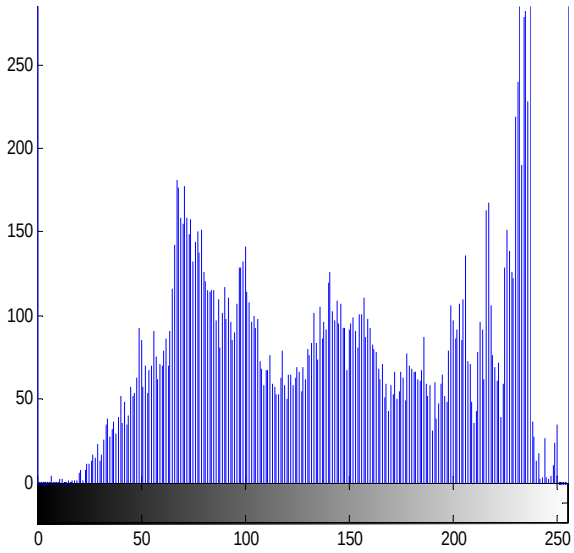
(i) Noisy image (salt & pepper)



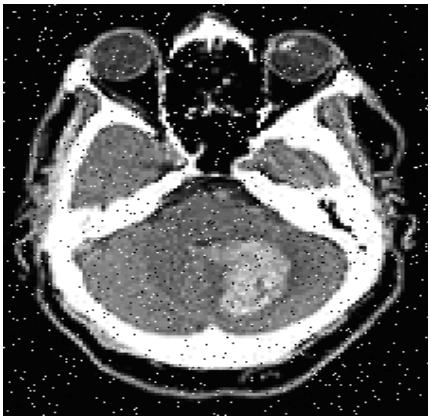
(j) ROI for noisy image



(k) Histogram for the noisy image

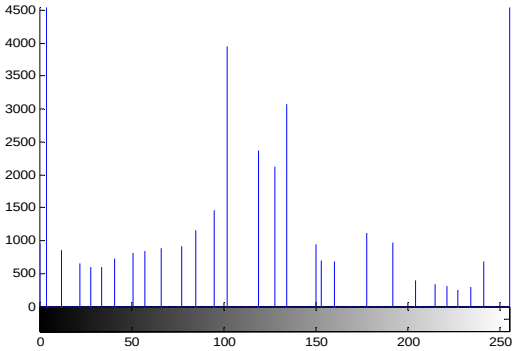


(l) Histogram for the ROI

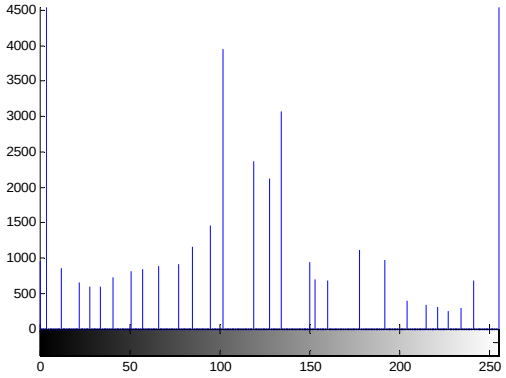


(m) Noisy image (salt & pepper)

(n) ROI of noisy image



(o) Histogram for the noisy image



(p) histogram for the ROI

Fig 4.2.2 shows the Histogram for the noisy image and histogram for the selected ROI for salt & pepper noise.

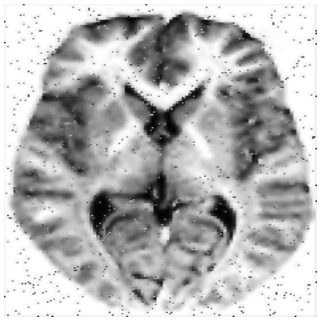
After finding the speckle noise in MRI, Cancer, X-ray and brain images and applying the median filter for these images.

Table 4.6
Noise removal using Adaptive Filter for Salt & Pepper.

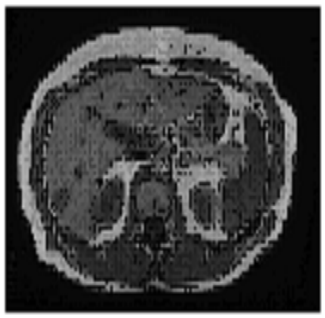
Image	Original Image		Noisy Image		Filtered Image	
	Std	**Mean**	**Std**	**Mean**	**Std**	**Mean**
MRI	70.0623	182.2473	74.0267	180.0172	65.7016	179.8383
Cancer	61.2939	62.4918	64.0972	63.9113	55.4636	63.7529
X-Ray	65.4542	145.47576	68.2635	144.9646	65.4814	144.7277
Brain	91.0872	85.9561	92.5692	87.1018	89.1596	87.1165

(a)Original MRI image

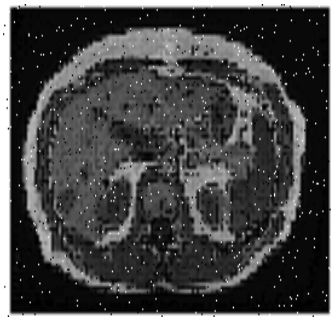
(b) Finding Salt & Pepper Noise



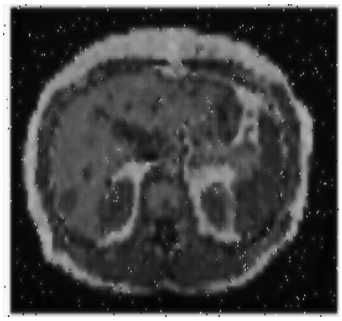
(c) Applying Adaptive Filter



(a)Original Cancer image

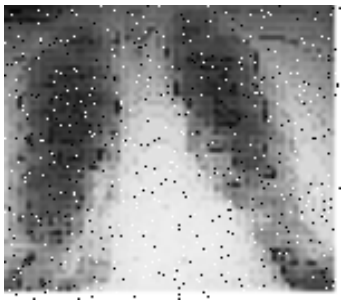


(b) Finding Salt & Pepper Noise

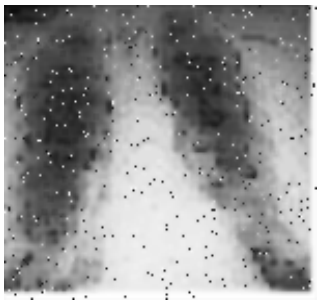


(c) Applying Adaptive Filter

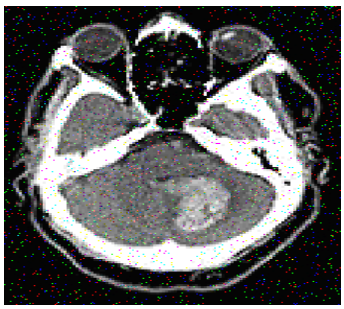
(a) Original x-ray image



(b) finding salt & pepper noise



(c) applying Adaptive Filter



(a)Original image(Brain image)

(b) Finding a salt & pepper noise in brain image

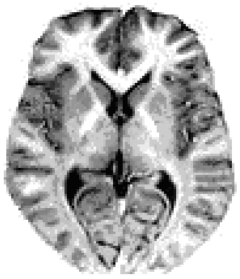
(c) Applying Adaptive Filter

Fig4.6.1 Shows finding the salt and pepper noise in MRI, Cancer, X-ray, Brain images and applying the adaptive filter on these images.

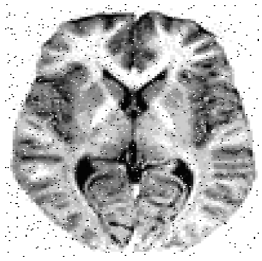
After finding the salt and pepper noise and applying the average filter on these images.

Table 4.10
Noise removal using Average Filter for Salt & Pepper.

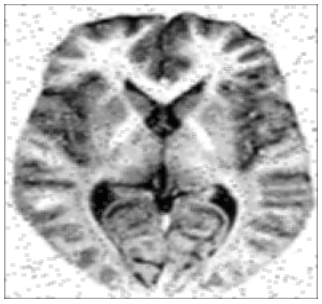
Image	Original Image		Noisy Image		Filtered Image	
	Std	Mean	Std	Mean	Std	Mean
MRI	70.0623	182.2473	74.0267	180.0172	0.2518	0.6999
Cancer	61.2939	62.4918	64.0972	63.9113	0.2073	0.2446
X-Ray	65.4542	145.47576	68.2635	144.9646	0.2409	0.5613
Brain	91.0872	85.9561	92.5692	87.1018	0.6649	0.3414



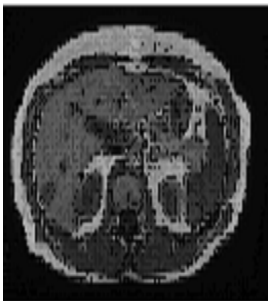
(a) Original MRI image



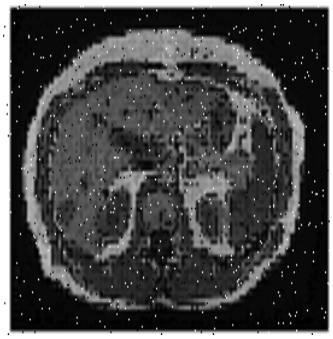
(b) Finding Salt & Pepper Noise



(c) Applying Average



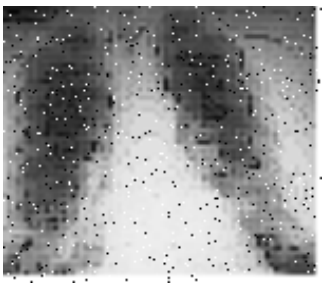
(a) Original Cancer image



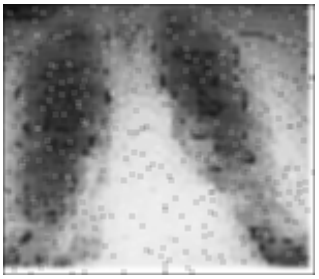
(b) Finding Salt & Pepper Noise

(c) Applying average Filter

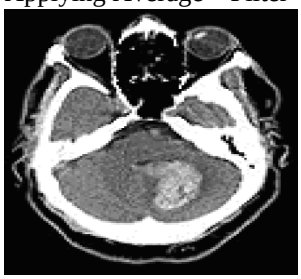
(a) Original x-ray image



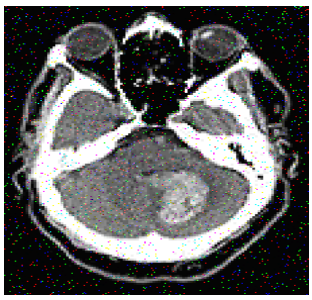
(b) finding salt & pepper noise



(c) Applying Average Filter



(a)Original image (Brain image)



(b) Finding a salt & pepper noise in brain image

© Applying Average filter

Fig4.10.1 Shows finding the salt and pepper noise in MRI, Cancer, X-ray, Brain images and applying the average filter on these images.

III- DISCUSSION:

As per discussed in Different medical images like MRI, Cancer, x-ray and brain images have been studied. After finding the salt and pepper noise in MRI image various filtering techniques have been applied and it is found that the adaptive filter works better for the noisy image. The standard derivation for the noisy image is 74.0267 and the standard derivation for the adaptive filtered image is 65.7016.

After finding the salt and pepper noise in Cancer image various filtering techniques have been applied and it is found that the median filter works better for the noisy image. The standard derivation for the noisy image is 64.0972 and the standard derivation for the adaptive filtered image is 53.1813.

After finding the salt and pepper noise in X-ray image various filtering techniques have been applied and it is found that the median filter works better for the noisy image. The standard derivation for the noisy image is 68.2635 and the standard derivation for the adaptive filtered image is 64.8242.

After finding the salt and pepper noise in Brain image various filtering techniques have been applied and it is found that the adaptive filter works better for the noisy image. The standard derivation for the noisy image is 92.5692 and the standard derivation for the adaptive filtered image is 89.1596

IV- CONCLUSION:

In this work we have taken different medical images like MRI, Cancer, X-ray and Brain for detecting noises. We have detected Salt & Pepper noises and also removed these noises from the above medical images by applying the various filtering techniques like Median Filtering, Adaptive Filtering and Average Filtering. The results are analyzed and compared with standard pattern of noises and also evaluated through the quality metrics like Mean, and Standard deviation. Through this work we have observed that the choice of filters for de-noising the medical images depends on the type of noise and type of filtering technique, which are used. It is remarkable that this saves the processing time. This experimental analysis will improve the accuracy of MRI, Cancer, X-ray and Brain images for easy diagnosis. The results, which we have achieved, are more useful and they prove to be helpful for general medical practitioners to analyze the symptoms of the patients.

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