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IMAGE RESTORASI SPINE CITRA COMPUTED TOMOGRAPHY SCAN

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Abstract

The spine is considered one of the important imaging parts of the body in all age groups.. In the event of damage to the spine, the entire body will be affected, and a high concentration of nerves will cause excruciating pain. In this study the data were obtained using a CT scan (Computed Tomography scan). In this study took 5 images of the spine from a CT scan and processed into 40 images. In this work, restoration is to restore an image that has degraded the quality of impulse and gausian noise. From the results of the implementation and analysis of the results of image processing restoration. Over time, a number of images spatially, it can be concluded that the image that has been restored with the average filter and the median filter performed on the spine Computed Tomography Scan image. In the test image restoration results showed the image of impulse noise filter median kernel 3x3 well and maximally shown with MSE 4.25383 and PSNR 41.877 while gausian noise image less can be restored with an average gausian filter 5 × 5 with MSE 7.36876 and PSNR 39.4909.

Keywords: Spine, Gausian, Impuls, CT-Scan, PSNR,MSE,Derau, Restoration

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INTRODUCTION

Image restoration is the objective process of refining an image for a specific purpose. Degradation can be caused by motion blur or noise. In the case of degradation caused by motion blur, it is possible to obtain a very good approximation of the actual blur and blurring functions to restore the original image. Conversely, if the image is damaged by noise, we can compensate for the resulting degradation as close as possible to the desired result . Image restoration refers to the removal or reduction of image degradation there is noise when taking data or image acquisition process. The degradation in question includes noise (error or Pixel Value Error). It is important to remove noise in the image before edge detection, image segmentation or object recognition procedures. The well-known median Filter and its derivatives are considered one of the effective ways to eliminate impulse interference. Image restoration is one of the most important aspects in this image processing technique because it removes unwanted noise . Image degradation can be known or unknown through the method. A technique involved in processing to recover the original image file from degraded form, the degradation function is often termed the Point Spread Function (PSF). Although there are many methods to remove noise from the image . Transmission effects or dim light environment during shooting, certain noise such as Gaussian noise and impulse appear in the image. In a nutshell, image restoration is the reverse process utilized to restore a distorted image back to its original Original Form .

In recent years, with the rapid development of generative models based on conditional velocity score estimation (CVSA) methods, Particle filtering (PF) uses Hidden Markov Models. The M-GCV can handle noisy images contaminated with blur, Gaussian noise, and pixels up to 70%. Contraharmonic mean filter method to reduce salt and pepper noise in panchromatic image has succeeded in removing salt and pepper noise but the image quality after reduction becomes blurry. Adaptive median/mean length algorithm to eliminate drip lines, strip lines, white bands, black bands, blots, and impulses with minimal opacity . Our research test images are given noise in the image in the form of salt & pepper impulses and adaptive Gaussian then analyzed its performance qualitatively by comparing the output filter image, noise image, and the original image.

RESEARCH METHODS

This study introduces the restoration approach by using impulse and gaussian noise in the median and average kernel filters 3x3 and 5x5 for image sharpening and image smoothing, then followed by finding the value of Mean Square Error (MSE), Root Mean Squared Error (RMSE), and Peak Signal-to-Noise Ratio (PSNR) . Noise gaussian can be significantly reduced by using a Gaussian filter shown with a high PSNR value of 23,548 dB for high noise levels (40%). known noise models in image restoration systems, including Gaussian noise, Impulse (salt and pepper) noise .
Figure 1 below shows the research framework used:

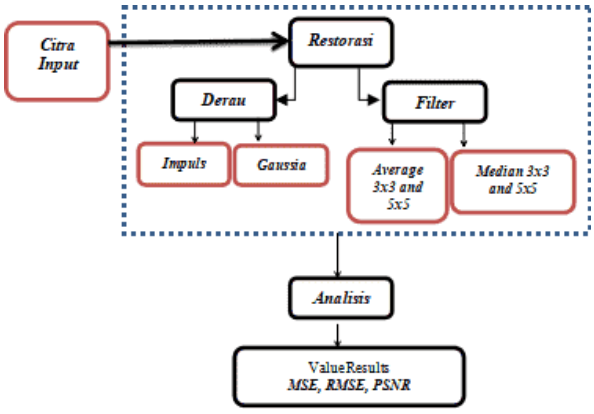


Figure 1. Framework

Image Insert

Insert image used is the image of the results of Computed Tomography Scan of the spine taken at the hospital M Djamil Padang.

Gaussian Noise

Gaussian noise is a noise model that follows a normal distribution with a mean of 0 and a standard deviation of 1. When the image is exposed to gaussian noise, the image will appear colored dots whose number is equal to the percentage of noise. This is because in the image there is Gaussian noise, in the image there is a random variable with a value between 0 and 1. The traditional method of recovering color images contaminated with Gaussian noise is based on the average local method . Median filtering is the most well-known order-statistics filter. The workings of this filter are formulated in the following equation:

F (x,y) = median(S,t)€sxy {g (s,t)} (1)

By calculating the peak signal-to-noise ratio (PSNR) of the recovered image. PSNR for image x is determined by :

$$\mathrm{PSNR}(x) = 10\log_{10}\frac{255^2}{n\|x - x_{\mathrm{true}}\|_2^2}, \quad (2)$$

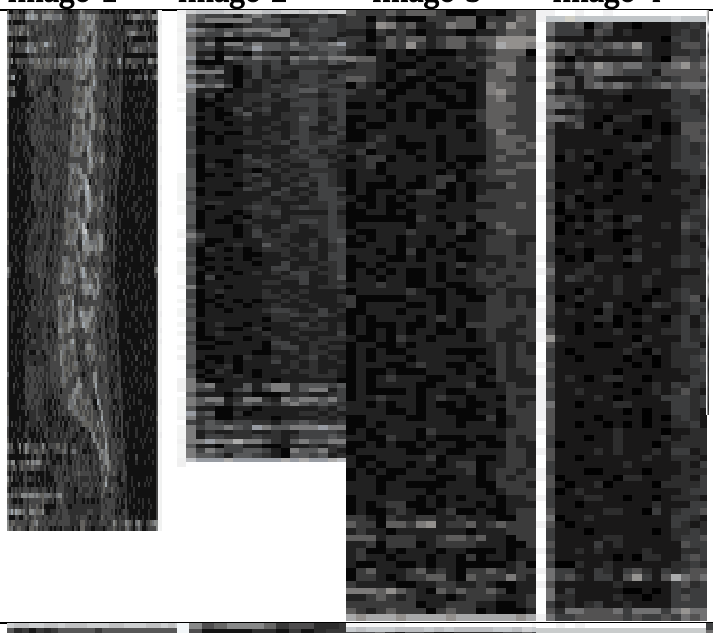
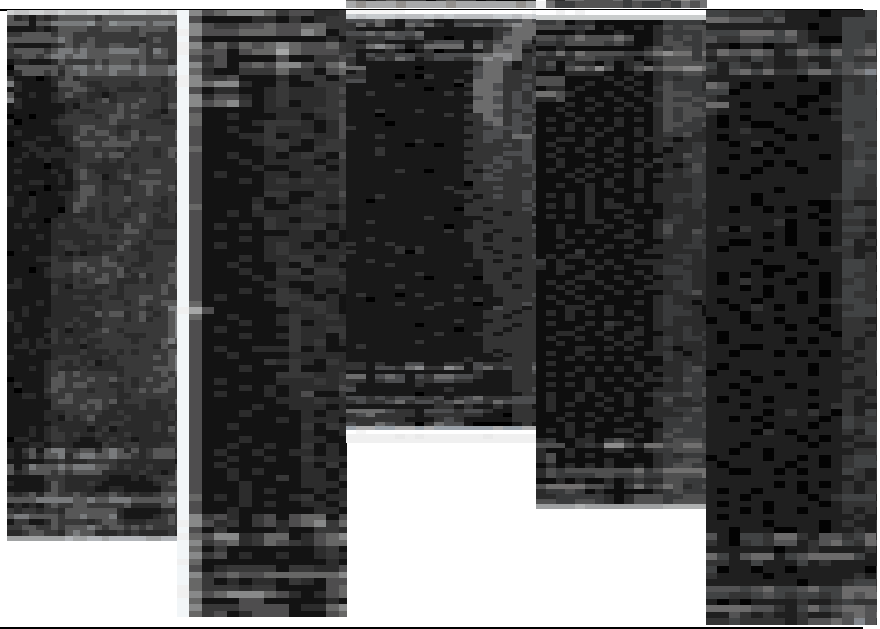
The Mean Filter replaces the value of the pixels at the position (x, y) with the average value of the neighboring pixels. The number of neighboring pixels, such as 2x2, 3x3, 4x4, and so on. Then will be done mean filter for image M by using kernel Matrix (3x3).

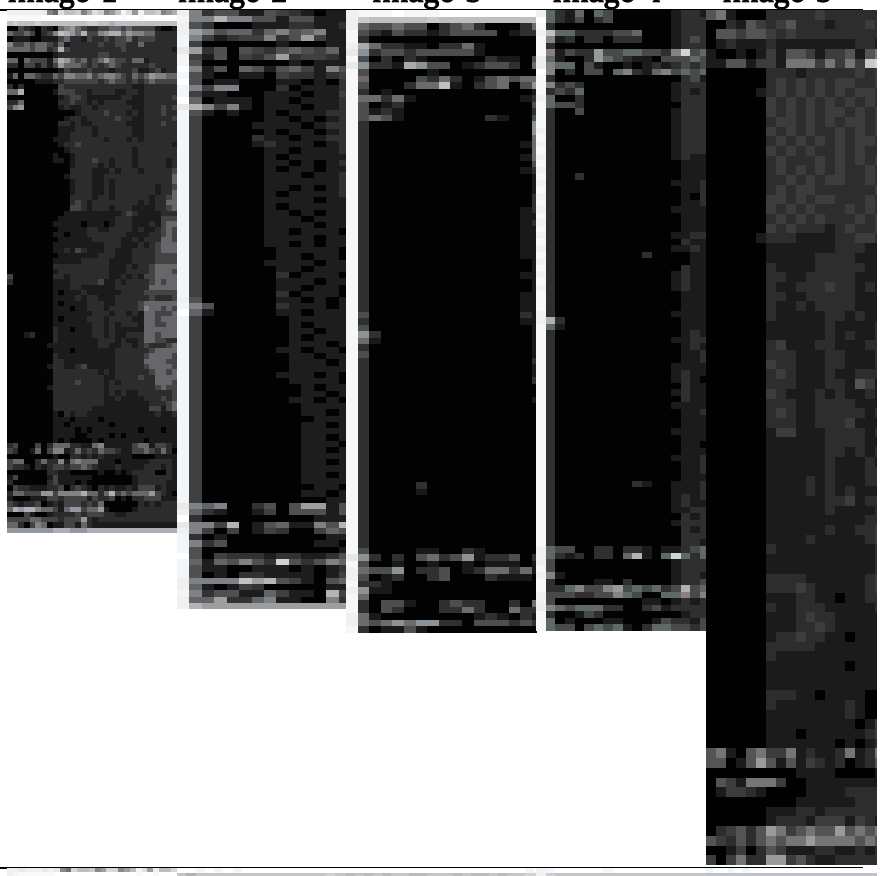
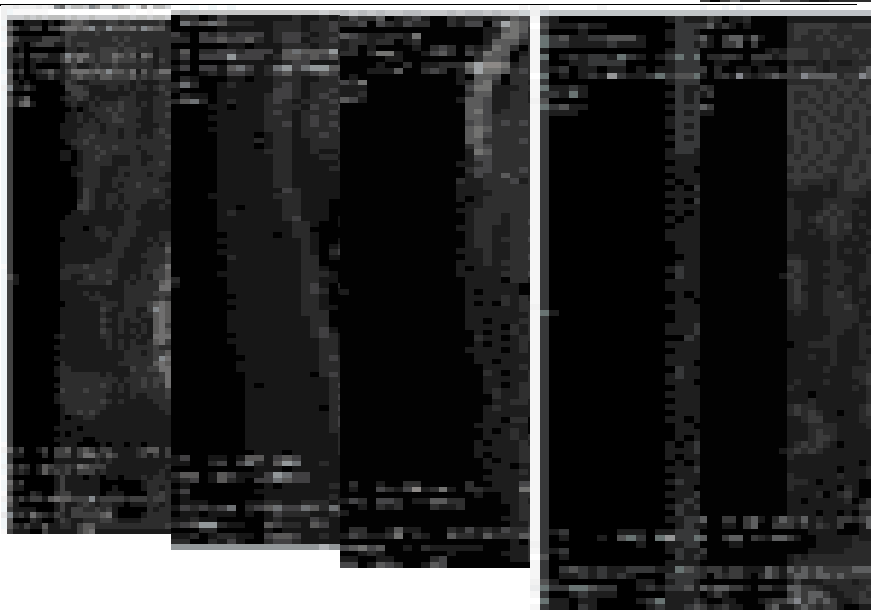
RESULT AND DISCUSSION

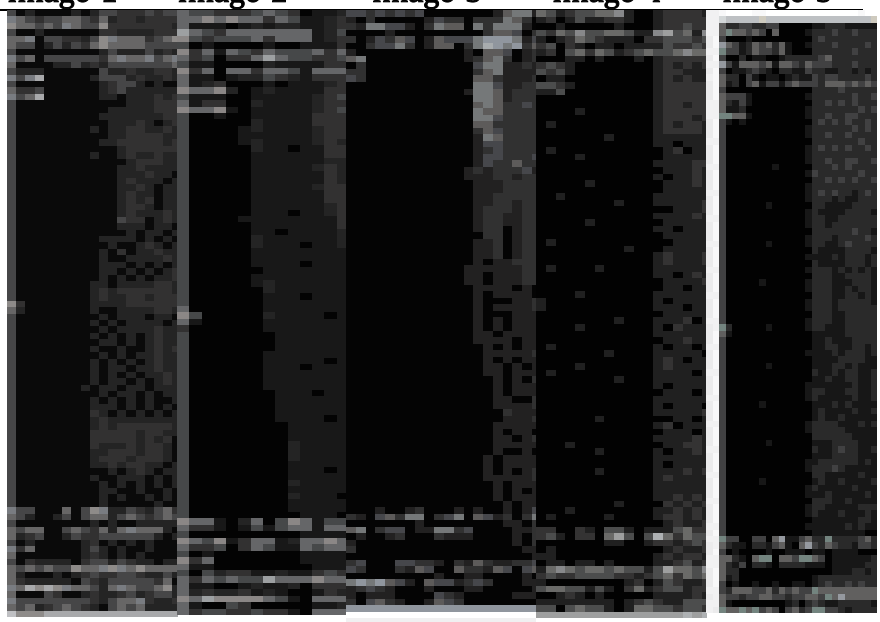
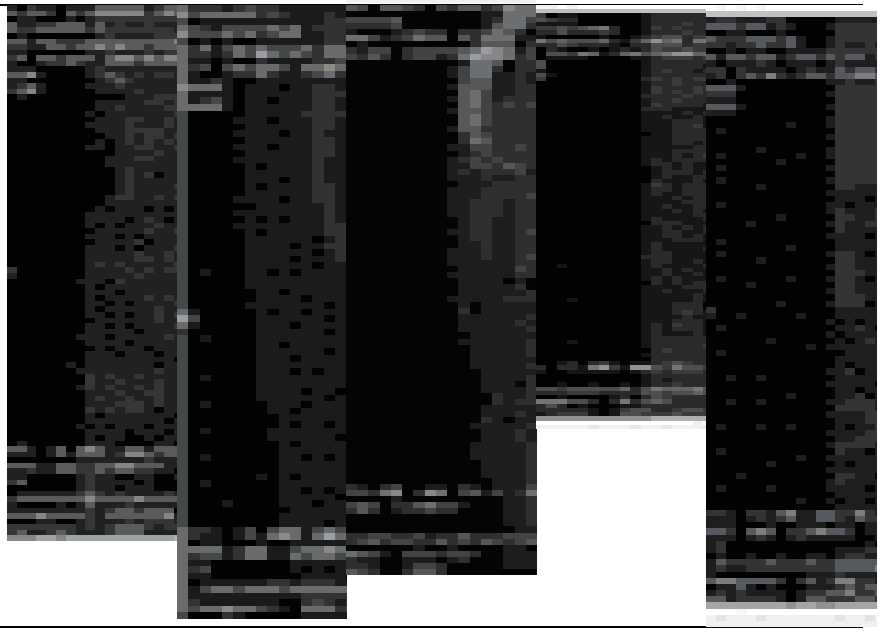
This study was conducted to determine the effectiveness of the implementation of noise restoration. The Data used as a result of the acquisition of the spine will be given 2 noise impulse noise and gausian noise.by using Matlab r2018a programming application with noise 0.2. Common types of noise found in image processing, namely: gaussian noise, impulse noise applied to the same grayscale image using Matlab. The image results of impulse and gausian noise in the original image of the spine can be seen in Table 1 . Followed by comparing the results of noise on impulse and gausian by using an average of 3x3, average 5x5, median kernel 3x3 and median kernel 5x5 which can be seen in Table 2 and the calculation results by looking at the value of MSE, RMSE and PSNR in Table 3

Image-1	Image-2	Image-3	Image-4	Image-5
				

Table 2 Image Results on Impulse Noise and Gausian Noise

Derau	Filter	Image-1	Image-2	Image-3	Image-4	Image-5
Impuls	average (3x3)					
	average (5x5)					

Derau	Filter	Image-1	Image-2	Image-3	Image-4	Image-5
	Median (3x3)					
	Median (5x5)					

Derau	Filter	Image-1	Image-2	Image-3	Image-4	Image-5
Gausian	average (3x3)					
	average (5x5)					

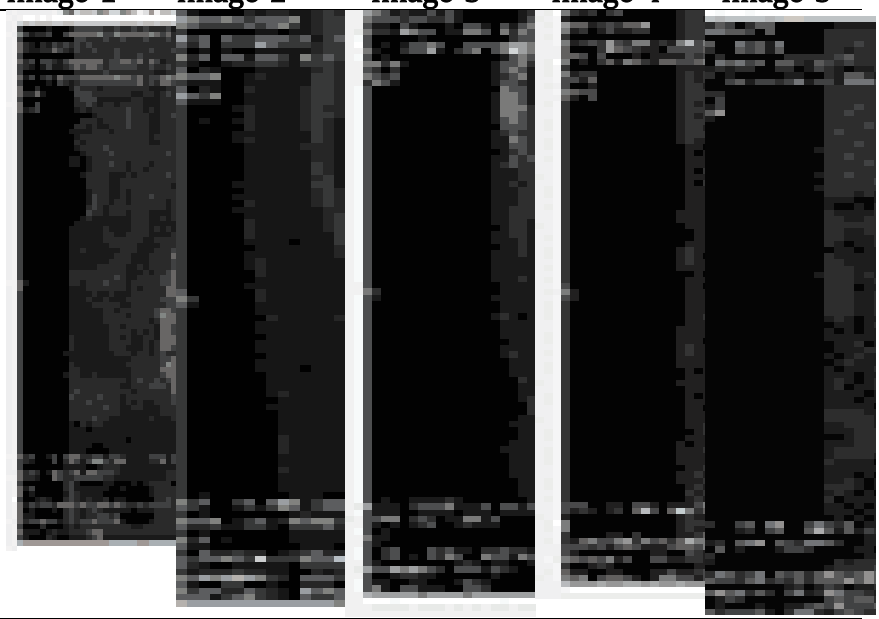
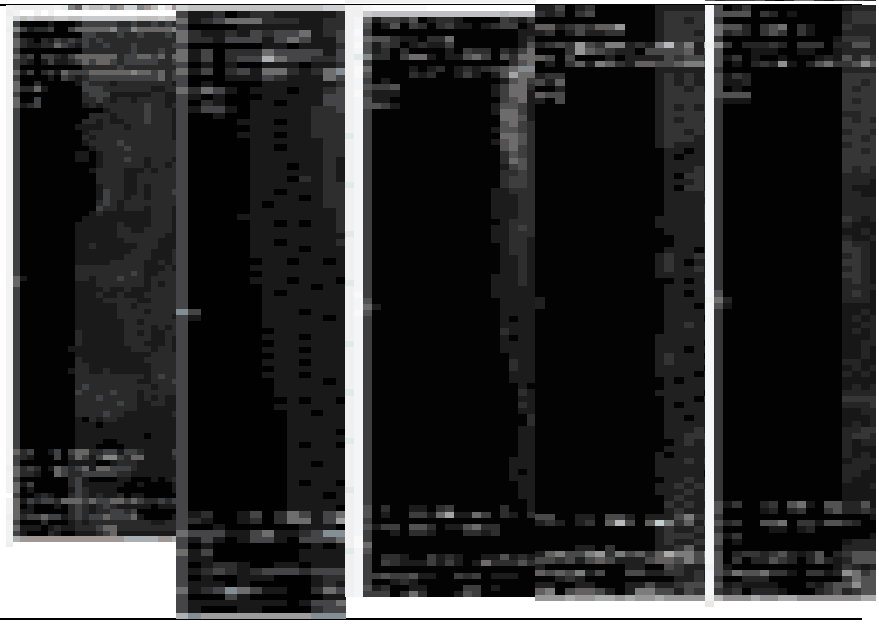
Derau	Filter	Image-1	Image-2	Image-3	Image-4	Image-5
	Median (3x3)					
	Median (5x5)					

Table 1. Original image of the spine

Table above shows the results of image restoration in spinal samples using impulse noise and gausian noise with a ratio of 0.2 in each filter average 3x3, average 5x5, median 3x3 and median 5x5 in each of the noise used.

Input image	Derau	Filter	MSE	RMSE	PSNR
Image 1	**Impuls**	average (3x3)	20.9571	4.57789	34.9515
		average (5x5)	12.8781	3.58861	37.0663
		Median (3x3)	9.27948	3.04622	38.4896
		Median (5x5)	15.2843	3.90952	36.3223
	Gausian	average (3x3)	13.0959	3.61883	36.9934
		average (5x5)	15.7491	3.96851	36.1923
		Median (3x3)	13.3856	3.65863	36.884
		Median (5x5)	16.5937	4.07354	35.9654
Image 2	**Impuls**	average (3x3)	19.8355	4.4537	35.1904

Input image	Derau	Filter	MSE	RMSE	PSNR
		average (5x5)	13.2189	3.63577	36.9529
		Median (3x3)	12.2633	3.50189	37.2787
		Median (5x5)	18.5658	4.3088	35.4777
	Gausian	average (3x3)	16.4632	4.05748	35.9997
		average (5x5)	19.18115	4.45101	35.1956
		Median (3x3)	16.5314	4.06589	35.9817
		Median(5x5)	19.8626	4.45675	35.1844
Image 3	Impuls	average (3x3)	19.5345	4.41978	35.2568
		average (5x5)	13.06	3.61386	37.0054
		Median (3x3)	10.1499	3.18589	38.1002
		Median(5x5)	16.7761	4.09586	35.9179
	Gausian	average (3x3)	13.6074	3.68882	36.8271
		average (5x5)	17.1852	4.1455	35.8133
		Median (3x3)	13.0388	3.61093	37.0124
		Median (5x5)	17.3936	4.17056	35.7609
Image 4	Impuls	average (3x3)	17.6526	4.20149	35.6967
		average (5x5)	11.188	3.34485	37.6773
		Median (3x3)	8.2057	2.86456	39.0236
		Median(5x5)	13.7945	3.7141	36.7677
	Gausian	average (3x3)	11.7036	3.42105	37.4816
		average (5x5)	11.2777	3.35823	37.6426
		Median (3x3)	11.2887	3.35987	37.6384
		Median(5x5)	14.6267	3.82449	36.5133
Image 5	Impuls	average (3x3)	17.8213	4.22153	35.6554
		average (5x5)	10.5236	3.24401	37.9432
		Median (3x3)	4.25383	2.06248	41.877
		Median(5x5)	6.42413	2.53459	40.0867
	Gausian	average (3x3)	8.20432	2.86423	39.0244
		average (5x5)	7.36876	2.71455	39.4909
		Median (3x3)	8.55754	2.92533	38.8413
		Median(5x5)	8.07822	2.84222	39.0916

Table 2. MSE,RMSE and PSNR values on the spine

The results of the image obtained will be evidenced by looking at the value of MSE, RMSE and PSNR on impulse noise and gausian noise can be seen in Table 3 which uses the filter average 3x3, average 5x5, median 3x3 and median 5x5 for each image will be processed restoration in removing or reducing degradation of the image that there is noise when data retrieval or image acquisition process used.

No	Filter	MSE	RMSE	PSNR
1	Image 5 Impuls Median Kernel (3x3)	4.25383	2.06248	41.877
2	Image 5 Impuls Median Kernel (5x5)	6.42413	2.53459	40.0867
3	Image 5 Gausian Rata-rata (5x5)	7.36876	2.71455	39.4909
4	Image 5 Gausian Median Kernel (5x5)	8.07822	2.84222	39.0916
5	Image 5 Gausian Rata-rata (3x3)	8.20432	2.86423	39.0244
6	Image 4 Impuls Median Kernel (3x3)	8.2057	2.86456	39.0236
7	Image 5 Gausian Median Kernel (3x3)	8.55754	2.92533	38.8413
8	Image 1 Impuls Median Kernel (3x3)	9.27948	3.04622	38.4896
9	Image 3 Impuls Median Kernel (3x3)	10.1499	3.18589	38.1002
10	Image 5 Impuls Rata-rata (5x5)	10.5236	3.24401	37.9432

No	Filter	MSE	RMSE	PSNR
11	Image 4 Impuls Rata-rata (5x5)	11.188	3.34485	37.6773
12	Image 4 Gausian Rata-rata (5x5)	11.2777	3.35823	37.6426
13	Image 4 Gausian Median Kernel (3x3)	11.2887	3.35987	37.6384
14	Image 4 Gausian Rata-rata (3x3)	11.7036	3.42105	37.4816
15	Image 2 Impuls Median Kernel (3x3)	12.2633	3.50189	37.2787
16	Image 1 Impuls Rata-rata (5x5)	12.8781	3.58861	37.0663
17	Image 3Gausian Median Kernel (3x3)	13.0388	3.61093	37.0124
18	Image 3 Impuls Rata-rata (5x5)	13.06	3.61386	37.0054
19	Image 1 Gausian Rata-rata (3x3)	13.0959	3.61883	36.9934
20	Image 2 Impuls Rata-rata (5x5)	13.2189	3.63577	36.9529
21	Image 1 Gausian Median Kernel (3x3)	13.3856	3.65863	36.884
22	Image 3 Gausian Rata-rata (3x3)	13.6074	3.68882	36.8271
23	Image 4 Impuls Median Kernel (5x5)	13.7945	3.7141	36.7677
24	Image 4 Gausian Median Kernel (5x5)	14.6267	3.82449	36.5133
25	Image 1 Impuls Median Kernel (5x5)	15.2843	3.90952	36.3223
26	Image 1 Gausian Rata-rata (5x5)	15.7491	3.96851	36.1923
27	Image 2 Gausian Rata-rata (3x3)	16.4632	4.05748	35.9997
28	Image 2 Gausian Median Kernel (3x3)	16.5314	4.06589	35.9817
29	Image 1 Gausian Median Kernel (5x5)	16.5937	4.07354	35.9654
30	Image 3 Impuls Median Kernel (5x5)	16.7761	4.09586	35.9179
31	Image 3 Gausian Rata-rata (5x5)	17.1852	4.1455	35.8133
32	Image 3 Gausian Median Kernel (5x5)	17.3936	4.17056	35.7609
33	Image 4 Impuls Rata-rata (3x3)	17.6526	4.20149	35.6967
34	Image 5 Impuls Rata-rata (3x3)	17.8213	4.22153	35.6554
35	Image 2 Impuls Median Kernel (5x5)	18.5658	4.3088	35.4777
37	Image 2 Gausian Rata-rata (5x5)	19.18115	4.45101	35.1956
36	Image 3 Impuls Rata-rata (3x3)	19.5345	4.41978	35.2568
38	Image 2 Impuls Rata-rata (3x3)	19.8355	4.4537	35.1904
39	Image 2 Gausian Median Kernel (5x5)	19.8626	4.45675	35.1844
40	Image 1 Impuls Rata-rata (3x3)	20.9571	4.57789	34.9515

Table 3. MSE,RMSE and PSNR results

Based on table above, it can be seen that the lowest error value is generated on the noise of the kernel median impulse image 3x3, the noise of the average gausian image 5x5. The result of the lower error will result in the value PSNR the higher and prove that the resulting image is getting better.

CONCLUSION

Image analysis is an important part in the process pre-ah techniques have evolved to recover degraded images.In this work,the noise used is impulse and gausian. From the results of the implementation and analysis of the results of image processing restoration. Over time, a number of images spatially, it can be concluded that the image that has been restored with the average filter and the median filter performed on the spine Computed Tomography Scan image. In the test image restoration results showed the image of impulse noise filter median kernel 3x3 well and maximally shown with MSE 4.25383 and PSNR 41.877 while gausian noise image less can be restored with an average gausian filter 5 × 5 with MSE 7.36876 and PSNR 39.4909.

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