

# Analysis and Comparison of Image Enhancement Techniques for Improving PSNR of Liver Images by Median Filtering over Mask Filtering

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## Abstract

**Aim:** The goal of this research is to employ median filters and mask filters to reduce noise in liver images so that they can be improved. In addition, the Peak Signal to Noise Ratio of both filters' outputs was examined (PSNR). **Materials and Methods:** The afflicted and normal liver photos were obtained from the Kaggle website for this investigation. Then, using Matlab software, the mask filtering and median filtering algorithms were run. Clinclac.com was used to compute sample size, and SPSS software was used to conduct the comparative analysis. This study has two groups, each with a sample size of 20 people with an average G power of 80%. The innovative median filter's performance is assessed, and the PSNR performance metric is compared to that of the mask filter. **Results:** The PSNR of innovative median filters is 64.0310, while mask filters have a PSNR of 78.0095, according to Matlab simulation data. The significant value of PSNR (Peak Signal to Noise Ratio) (0.409) and  $p > 0.05$  was found in the statistical analysis. **Conclusion:** The innovative median filter delivers greater PSNR than the mask filter for medical image enhancement on ultrasound liver pictures, according to this study.

## Keywords

Filtering, Smoothing, Mask Filter, Median Filter, Image Processing, Speckle noise, Image filters.

## Imprint

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## Introduction:

Median filtering is a nonlinear method for reducing impulsive noise, sometimes known as salt-and-pepper noise. A mask is a type of clean out that performs multiple operations at the same time on a photo (Niemeijer et al. 2010). Clear out masks, also known as convolution masks, are an innovative image enhancing technique for boosting PSNR of liver images (Bagus 2015; Annisa, Latifah, and Rusyadi 2021; Arce, Bacca, and Paredes 2005; Viero and Neuvo 1993; Sovilj-Nikic 2009; Vertan et al., n.d.; Cappellini 1980; Karvelis and Fotiadis 2007; "Color Image Filtering and Enhancement," n.d.; Jackson and Sovakis 2005; Yang 2013; Yuwono 2015; Yang 2012; Hansen and Higgins, n.d.)). The investigations are a comparison of various types of filters to determine which is the best way for unquestionably seen photos (Shyu and Leou 1998). In today's society, we can recognise a photograph without a doubt thanks to the use of studies ((Bagus 2015; Annisa, Latifah, and Rusyadi 2021; Arce, Bacca, and Paredes 2005; Viero and Neuvo 1993; Sovilj-Nikic 2009; Vertan et al., n.d.; Cappellini 1980; Karvelis and Fotiadis 2007; "Color Image Filtering and Enhancement," n.d.; Jackson and Sovakis 2005; Yang 2013; Yuwono 2015; Yang 2012; Hansen and Higgins, n.d.)). The median clean out is a non-linear virtual filtering technique that is commonly used to remove noise from a photo or signal (Ng et al. 2014). Noise reduction is a common pre-processing procedure to improve image quality.

About 20 google pupil and 10 technology direct articles have been visible associated with this work, done with inside the beyond five years reporting the advanced PSNR ratio of median clear out over masks filtering selection algorithms to predict (Santosh et al. 2019). The standard mentioned articles from google pupil, IEEE, technology direct, and we observed the maximum critical component is to lessen picture noise and frequency ((Bagus 2015; Annisa, Latifah, and Rusyadi 2021; Arce, Bacca, and Paredes 2005; Viero and Neuvo 1993; Sovilj-Nikic 2009; Vertan et al., n.d.; Cappellini 1980; Karvelis and Fotiadis 2007; "Color Image Filtering and Enhancement," n.d.; Jackson and Sovakis 2005; Yang 2013; Yuwono 2015; Yang 2012; Hansen and Higgins, n.d.)) . In my opinion the general studies we observe approximately need to enhance the picture greatly and decrease the noise of the picture to provide a really per-

fect picture as output (Oliva and Hinojosa 2020; Iyer, Ghosh, and Balas 2021; Najarian and Splinter 2016).

Processing ultrasound photos in diagnosing the presence of liver in most cancers there are 4 stages; preprocessing data, picture segmentation, extraction functions, and classification. The preprocessing level is the primary and maximum vital step with inside the picture processing due to the fact the procedure of reconstructing a picture without doing away with vital functions need to be accomplished so that it will be used on the segmentation level (2009) (Oliva and Hinojosa 2020; Iyer, Ghosh, and Balas 2021; Najarian and Splinter 2016). We evaluated and in comparison algorithms via means of calculating quantitative parameters like PSNR, MSE, MSSIM and indicated the pleasant clear out that fits for our utility via means of decreasing multiplicative noise in the meantime stopping edges and functions ((Bagus 2015; Annisa, Lati-fah, and Rusyadi 2021; Arce, Bacca, and Paredes 2005; Viero and Neuvo 1993; Sovilj-Nikic 2009; Vertan et al., n.d.; Cappellini 1980; Karvelis and Fotiadis 2007; “Col-or Image Filtering and Enhancement,” n.d.; Jackson and Sovakis 2005; Yang 2013; Yuwono 2015; Yang 2012; Hansen and Higgins, n.d.)). The time period gray stage is used frequently to consult the depth of monochrome photos. Color photos are fashioned by means of an ag-gregate of man or woman 2-D photos (2011). For ex-ample: The RGB color system, a color picture includes 3 (red, inexperienced and blue) man or woman element photos ((Oliva and Hinojosa 2020; Iyer, Ghosh, and Balas 2021; Najarian and Splinter 2016) Our team has extensive knowledge and research experience that has translate into high quality publications (Chellapa et al. 2020; Lavanya, Kannan, and Arivalagan 2021; Raj R, D, and S 2020; Shilpa-Jain et al. 2021; S, R, and P 2021; Ramadoss, Padmanaban, and Subramanian 2022; Wu et al. 2020; Kalidoss, Umapathy, and Rani Thirunavuk-karasu 2021; Kaja et al. 2020; Antink et al. 2020; Paul et al. 2020; Malaikolundhan et al. 2020) (Chellapa et al. 2020; Lavanya, Kannan, and Arivalagan 2021; Raj R, D, and S 2020; Shilpa-Jain et al. 2021; S, R, and P 2021; Ramadoss, Padmanaban, and Subramanian 2022; Wu et al. 2020; Kalidoss, Umapathy, and Rani Thirunavuk-karasu 2021; Kaja et al. 2020; Antink et al. 2020; Paul et al. 2020; Malaikolundhan et al. 2020)

## Materials And Methods

The data for this study was gathered via the Kaggle website. According to clinical.com, samples having a

PSNR ratio of 20 and a G power of 80 percent were designated size 20. The benefit of pixel sensible func-tion fusion is described in the 2D method. The follow-ing phase delves into each set of rules in detail.

For Group 1, there are ten liver image samples obtained from CT scans, X-ray scans, and MRI scan images. The mask filtering approach is used to en-hance PSNR-based liver pictures utilizing the image samples. For Group 2 sample processing, X-ray, MRI, and CT scan images were used to create 10 liver im-ages. The testing environment is set up using Matlab R2018a software. Following preparation, Matlab code was used to apply median filtering and mask filter-ing techniques. The PSNR value in liver images was utilized to evaluate both algorithms' performance. To determine the method's efficacy, this parameter was calculated and examined, and the results of both ap-proaches were compared to see which algorithm per-formed better.

## Statistical Analysis

The statistical analysis was carried out using the SPSS tool. The significance is calculated using Inde-pendent t-test. It was performed for the two depen-dent variables such as packet drop ratio and residu-al energy. The independent variables are number of nodes, battery power and battery size. Using the SPSS software the standard deviation, standard error of mean were also calculated.

## Results

Table 1 shows the PSNR (dB) values of 20 liver images produced using the mask and median filters. The mean PSNR (dB) of the mask filter is 78.0095, while the median filter is 64.0310dB. In this study, we discovered that by minimizing the noise and fre-quency range of the image in matlab programming, the PSNR ratio of filtering strategies produced supe-rior results.

Table 2 compares the mask filter used by picture enhancement algorithms with a median filter based on PSNR values. The mask filter has a high PSNR (78.0095dB) while the median filter has a low PSNR (64.0310dB). The mask filter has a low standard deviation (1.34682), while the median filter has a high standard deviation (9.84517).

Table 3 shows an independent sample test of PSNR-based image improvement using the Wie-ner and mask filter approaches. With two tails,

Table 1

Tabulation explains the PSNR value of median filter and mask filter algorithms. These were obtained by simulating the ultrasound liver images in Matlab software. These 20 samples were taken from the dataset and is used for comparing both the algorithms

S.NO	PSNR of Median filter	PSNR of Mask filter
1	42.74	43.65
2	57.54	55.75
3	54.86	56.78
4	59.75	62.31
5	64.24	64.53
6	66.34	69.76
7	69.67	70.24
8	73.33	70.19
9	75.34	72.16
10	77.10	74.34
11	77.18	75.16
12	77.22	75.64
13	77.27	76.65
14	78.43	76.48
15	78.44	77.65
16	78.87	77.42
17	79.38	78.53
18	79.76	78.59
19	79.38	79.26
20	79.54	79.34

Table 2

The table shows mean value of PSNR for the 20 samples, standard deviation and standard deviation mean error obtained using SPSS software for both median filter and mask filter.

	Group	N	Mean	Std. Deviation	Std. Error Mean
PSNR	Median Filtering	20	64.0310	9.84517	2.20145
	Mask Filtering	20	78.0095	1.34682	.30116

Table 3

The table shows the mean difference, standard error difference and significance obtained from SPSS and these were used to find which algorithm gives significant results.

		Leven's test for equality of variance		T-test for equality of variance					95% of confidence interval of difference	
		f	sig	t	df	Sig (2-tailed)	Mean difference	Std.error diff	lower	upper
PSNR	Equal variances assumed	28.531	.002	-6.291	38	.0003	-13.97850	2.22195	-18.47661	-9.48039
	Equal variances not assumed			-6.291	19.711	.0003	-13.97850	2.22195	-18.61777	-9.33923

the significance p-value is 0.0003. With a standard mean difference of -13.97850 and a standard error difference of 2.22195, PSNR is significant at 0.0003. (-18.47661) is the lowest result in the test confidence interval, while (-9.48039) is the highest (-9.48039). In an independent sample T test, the mask filter-based picture enhancement method outperformed the wiener filtering method with a 95 percent confidence interval.

## Discussion

Many researchers have proposed a model based on ensemble techniques using a mask filter for enhancing images, with the purpose of assessing the model's PSNR. With a precision of 98 percent and an accuracy of 54 percent, and the PSNR values 87% the findings were accomplished (Eliza and K. 2019). Another investigation developed a computer-aided identification approach based on the filters. Different filters (Hassanien and Oliva 2017a) used feature selection and a Principal Component Analysis model to correctly enhance medical images with a PSNR of 90%. Actual (Class 1) and Actual (Class 2) selections can be reduced using filters (Patgiri and Ganguly 2021). (Thakore and Bhatt, n.d.) carried out a comparison study (Hassanien and Oliva 2017b). The experimental outcomes revealed that SVM-PCA had the highest PSNR of 98.9 percent over the clinical guided filter data set, out of numerous filters.

## Conclusion

The results show that the proposed bilateral filtering technique outperforms guided filtering in terms of PSNR. The proposed bilateral filter proved with better PSNR (75.85dB) when compared with guided filter. The enhanced images have more visual clarity than that of original images.

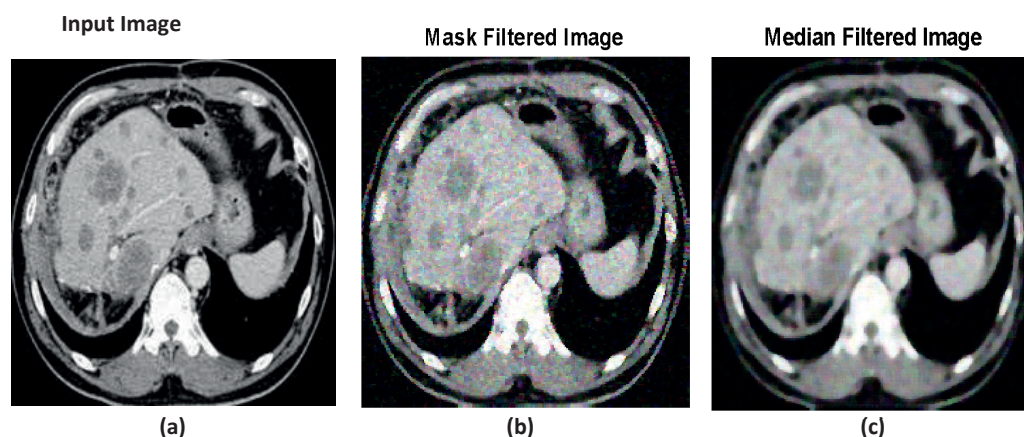


Fig 1. Matlab simulation results of median filter and mask filter (a) Input image (liver image) (b) Enhanced result of median filter (c) Enhanced result of mask filter.

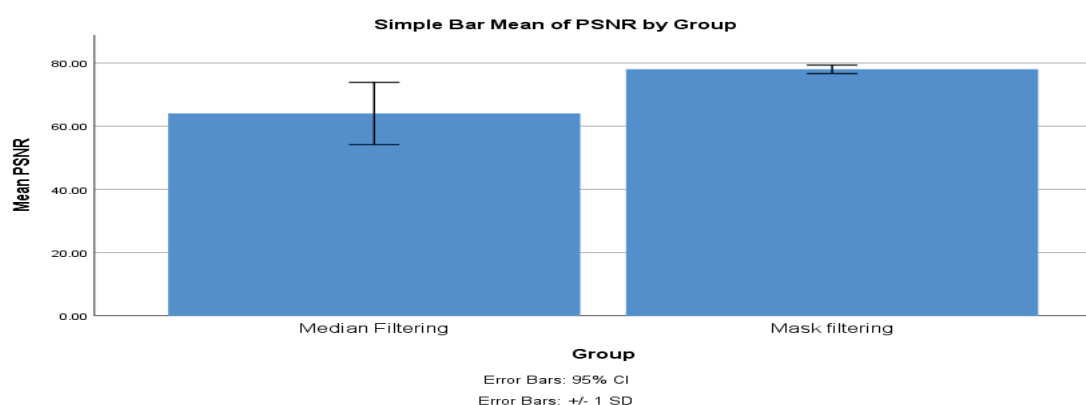


Fig 2. Graph obtained using SPSS that compares PSNR of Median filter and Mask filter. From the graph it was observed that Median filter has better PSNR compared with Mask filter on liver image. In the graph, Group (Median filter and Mask filter) are represented as X-axis and PSNR represented as y-axis with  $\pm 1$  SD.

## DECLARATION

### Conflict of Interests

In this manuscript, there are no conflict of interests

### Authors Contributions

KDP was involved in data collection, data analysis and manuscript writing. Author RR was involved in conceptualization, data validation and critical review of manuscript.

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