A REALTIME NOISE REMOVAL IN CAPTURING WILDLIFE PHOTOGRAPHY USING MEDIAN FILTER COMPARED OVER GAUSSIAN FILTER WITH IMPROVED ACCURACY

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Abstract

Aim : The research aims at performing noise removal in capturing wildlife photography by applying Median Filter with improved accuracy compared to Novel Gaussian Filter technique.
Materials and Methods: There are about a total of 104 samples out of which N= 52 samples are from the 1st group which is Median Filter and the remaining N= 52 are from the 2nd group which is the Gaussian Filter algorithm with G power as 80% for noise removal over images.
Results: The performance has been improved in terms of accuracy for the Median Filter algorithm with 88.5% while the Novel Gaussian filter algorithm has shown an accuracy of 85.4% The mean value is 88.5, mean accuracy detection is ±1SD and the significant value is 0.534 ($p>0.05$) from an independent sample T test.
Conclusion: The final outcome of the Median Filter (88.5%) algorithm is found to be significantly more accurate than the Gaussian Filter algorithm (85.4%).

Keywords: Novel Salt and Pepper Noise, Gaussian Filter**,** Image Processing**,** Median Filter, Non-linear Filter, Noise Removal.

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1. Introduction

Image Processing is a procedure for performing operations on (Reljin et al. 2020) a image for providing enhancement over images and gathering data in Novel Salt and pepper noise related to implementation of scientific operations in non-linear filter medical scan technology, space research, (Taylor 2016) weather monitoring, surveillance security systems , artificial intelligence and so on. Image compression, Restoring Images , Image enhancement , (Qi, Guo, and Hu 2022) encoding comes under Novel Image Processing. Image restoration, Linear filtering ,Component Analysis, Generation of image, (Rozovsky and Lototsky 2018) Matching of templates, Pixelation are some techniques followed for implementing Noval Image Processing systems. In the field various filters have been used in NovelNonlinear Filter and applications such as Novel Image Processing for enhancing Images transforming brightness, resolutions, denoising etc have been used.

There are about 1550 articles from various sources such as Google Scholar, IEEE Xplore and Springer. Some kinds of noise affects image quality while capture (Zhang et al. 2022) or transmission such as sparse light , dark disturbances, (Sanford et al. 2021) Novel gaussian noise where the original image was affected due to sufficient light, speckle noise etc. Some filters failed to remove noise affecting edges of images Novel Salt and Pepper Noise (Ranade and Gharpure 2019) , blurring the source image , and poor quality distribution. Novel Image Processing Here we apply two filters, the Novel Gaussian Filter and the Novel Median filter, for performing denoise images (Reljin et al. 2020) without affecting the quality of source. Our team has extensive knowledge and research experience that has translated into high quality publications(K. Mohan et al. 2022; Vivek et al. 2022; Sathish et al. 2022; Kotteeswaran et al. 2022; Yaashikaa, Keerthana Devi, and Senthil Kumar 2022; Yaashikaa, Senthil Kumar, and Karishma 2022; Saravanan et al. 2022; Jayabal et al. 2022; Krishnan et al. 2022; Jayakodi et al. 2022; H. Mohan et al. 2022)

A median filter is a non-linear filter designed (Ranade and Gharpure 2019) for preserving image detail. Design of novel median filter concentrates on novel image processing every pixel present within the image and sorts out nearby pixels in (Tamminga et al. 2020) order based on their Novel Salt and Pepper Noise intensity and replaces real value of the pixel with (Russ and Brent Neal 2018) median value obtained from the operations carried out over image. Novel Gaussian filtering denoise images (Asokan and Anitha 2020) preserving its detail. Novel Gaussian filter is a linear filter that effectively makes images smooth , supports blurring and reduces the size of image for Novel Image Processing transmission by applying a low-pass filter. Not effective for denoising images with Novel salt and pepper noise. The aim of this research is to remove noise in real time by capturing wildlife photography using Median Filter with Novel Gaussian Filter technique to improve accuracy.

2. Materials and Methods

This research paper was carried out in the Department of Artificial Intelligence Laboratory of Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences. The dataset used for both the algorithms is cars dataset which consists of 5000 images which is downloaded from www.kaggle.com (Devi, Malini Devi, and G. Narayanamma Institute of Technology Science for Women 2020). This paper includes 2 groups and the 1st group is Median Filter algorithm with 91% while the 2nd group is Novel Gaussian filter algorithm which has accuracy of 88%. There are about 104 samples in which 52 belong to the first group and the remaining 52 belong to the second group with g power as 80% along with confidence interval as 95% and enrollment ratio is set to be 1.

The dataset is cleaned by removing unwanted images. In order to install the necessary software a minimum of 50GB hard disk space is needed and to download all the required files for installation. And 4GB RAM is required to run the software smoothly without any interruption along with the i3 processor to make sure that all the processes are running parallely. A minimum of 2GB graphics card will generate the faster results for object recognition. Kaggle online development environment is used to run the framework specified.

Gaussian Filter Algorithm

Gaussian filter designed to perform blur images, remove noises and maintain detail of image source. It applies a gaussian function dependent on standard deviation for providing strong smooth images. We need to obtain a discrete approximation for the gaussian function. It is a non-uniform low pass filter that allows fast computation

Step 1 : Pass the Image as input with noises.

Step 2: Compute the values of pixels present in the image source.

Step 3: Define a point spread function based on pixels of image source.

Step 4: Implement Gaussian function using standard deviation procedures.

Step 5: Mean values are obtained from standard deviation values calculated using Gaussian Step 6: Based on mean value Update the pixel values of noisy images by fixing limitations.

Step 7: IF mean value is out of range . Stop operation. ELSE
Step 8 : DO STEP 2 to STEP 6
Step 9: Pass the final image altered with values obtained from distribution of mean values produced from Gaussian function.

Median Filter Algorithm
It adapts non linear filter technique to perform comparison on neighbor pixels within the image source. Obtains a median value from sorting procedure and places the center pixel value with high intensity to provide sharp images from gaussian blur , Novel salt and pepper noise , and other noise effects too.
Step 1 : Read the image for performing Denoise.
Step 2: Pass the values of row and column (x,y) obtained from the image source.
Step 3: Read the pixel values present in the entire image source.
Step 4 : Calculate the Median value of pixels found in the image source.
Step 5: REPLACE the center Pixel value with Median Value obtained.
Step 6: CHECK the range of pixels is between the limit of row element and column element .
Case 1: if it is within the given range , Perform sorting of pixel values.
Case 2: If range is out of the limit , stop comparison.
Step 7 : Pass the image with new values sorted out and Pass the median values sorted.
Step 8 : DO from STEP 2 to STEP 7 till image is free of noise

Statistical Analysis
The analysis had been carried out using IBM SPSS version 21, a statistical software tool for data analysis. Group statistics comparison for mean, standard deviation and standard error were calculated for the Novel Median Filter algorithm. (Pai et al. 2022) over the existing Gaussian Filter algorithm. Independent variables are accuracy, Standard deviation and standard mean error and dependent variable is the visual behaviour set. The analysis of research work done using Independent T-Test had been performed to find mean, standard deviation which is used to compare Novel Median Filter algorithms and Gaussian filter algorithm, thereby denoising image from without disturbing quality was assured.

3. Results

The comparative analysis of the existing and the proposed algorithms is carried out by taking the accuracy rate of detection for both the algorithms. The proposed algorithm effectively maintains brightness of image whereas the gaussian filter algorithm fails to maintain sharpness and brightness of images after noise removal. The proposed algorithm is said to be more accurate than the existing algorithm, and the accuracy rate of the proposed algorithm is found to be 91%.
Table 1 shows the comparison of the accuracies of Novel Gaussian Filter Algorithm and Median Filter for a sample size of N=10.
Table 2 depicts the group statistics which shows the mean accuracy percentage is 88.5% and the standard deviation is 2.11870 for the sample size N=52 whereas the mean accuracy percentage is 85.4% with standard deviation as 2.50555 for sample size N=52.
Table 3 is an independent sample T-test with confidence level 95% which compares the Novel Gaussian Filter Algorithm and Median Filter algorithm.
Table 4 shows the bivariate correlation of the accuracies of the both Novel Gaussian Filter Algorithm and Median Filter where it has a correlation as 0.45.
Figure 1 which is a graph shows the comparison of the mean accuracy of both Gaussian Filter Algorithm as well as Median Filter algorithm along with their error bars taking groups on X-axis and accuracy on Y-axis. The accuracy of the Gaussian Filter Algorithm is 85.4% while the accuracy of the Median Filter algorithm is 88.5%.

4. Discussion

Based on the result, Median Filter (88.5%) appears to be better than the Gaussian Filter Algorithm (85.4%). The values of the Mean filter are analyzed statistically and the difference is found out by plotting the graph against the algorithms.
Similar findings related to Median Filter(Li et al. 2016) algorithm is significantly efficient in removing Novel Salt and pepper noise , smoothing of image (Duan et al. 2021) without affecting source data compared to the existing algorithm, (Edwards 2018) The dataset containing a large number of images using Non-linear Filter is given as input into both the algorithms, and the accuracy rate of (Kimsey 2009) prediction is obtained for the existing and the proposed algorithms. These values obtained are used for analysis and comparison for efficiency.
After performing Gaussian Filter procedure images produced lack sharpness,(Dziarski, Hulewicz, and Dombek 2021) brightness in Non-Linear Filter compared to denoise effects of Median filter. Median filters are of more cost and utilizes more time for quality (Léna 2020). In the future, the Median filter technique will have its wide application in the field of Medical analysis, Space Research, Military organizations and so on.The factors that affect this system is that more cost for sorting out data sources.

5. Conclusion

The research study found that the proposed Median Filter algorithm is significantly efficient and accurate compared to the Mean Filter algorithm. The accuracy of the prediction of the proposed algorithm is found to be 88.5%, and hence using the proposed algorithm gives better results compared to the existing algorithm that has accuracy of 85.4%.

Declarations

Conflict of Interest

No conflict of interest in this manuscript

Author Contribution

Author GVH is involved in data collection, data analysis and manuscript writing**.** Author VK was involved in conceptualization, data validation and critical review of the manuscript.

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TABLES AND FIGURES

Table 1. Comparative study between the Median Filter algorithm (88.4%) and the Gaussian Filter algorithm (85.5%).

S.No	**MEDIAN FILTER**	**GAUSSIAN FILTER**
1.	88	83
2.	88	83
3.	91	85
4.	91	86
5.	85	83
6.	91	88
7.	89	88
8.	85	84
9.	86	86
10.	91	88

Table 2. Group statistics T-Test for existing algorithm Gaussian Filter (85.4%) and Median Filter Algorithm (88.5%) with the sample size 10. There is a statistically slight difference in the SD accuracy of the two algorithms. The Median Filter algorithm had the highest accuracy compared with Gaussian Filter .

Pair 1	**N**	**Mean**	**Std.Deviation**	**Std.Mean Error**
Gaussian Filter	10	85.4000	2.11870	.79232
Median Filter	10	88.5000	2.50555	.66999

Table 3. Independent sample T-test with confidence level 95% and which shows the difference between two groups. The accuracy for equal variance assumed and equal variance will be compared.

ACCURACY	**Levene's test for equality of variances.**		**T- test for equality of means**						
	F	**Sig.**	t	**df**	**Sig.(2-tailed)**	**Mean difference**	**Std. error difference**	**95% confidence interval of the difference**	
								Lower	**Upper**
Equal variance assumed	.397	.537	2.988	18	.008	3.10000	1.03763	.92003	5.27997
Equal variances			2.988	17.156	.008	3.10000	1.03763	.91571	5.28429

Table 4. The correlation of the existing and the proposed algorithm with p-value where N=20 and significance value of .537 from the statistical analysis tool.

Pair 1	**N**	**Correlation**	**Significance Value**
Gaussian Filter	20	.607	.537
Median Filter Algorithm	20	.854	.537

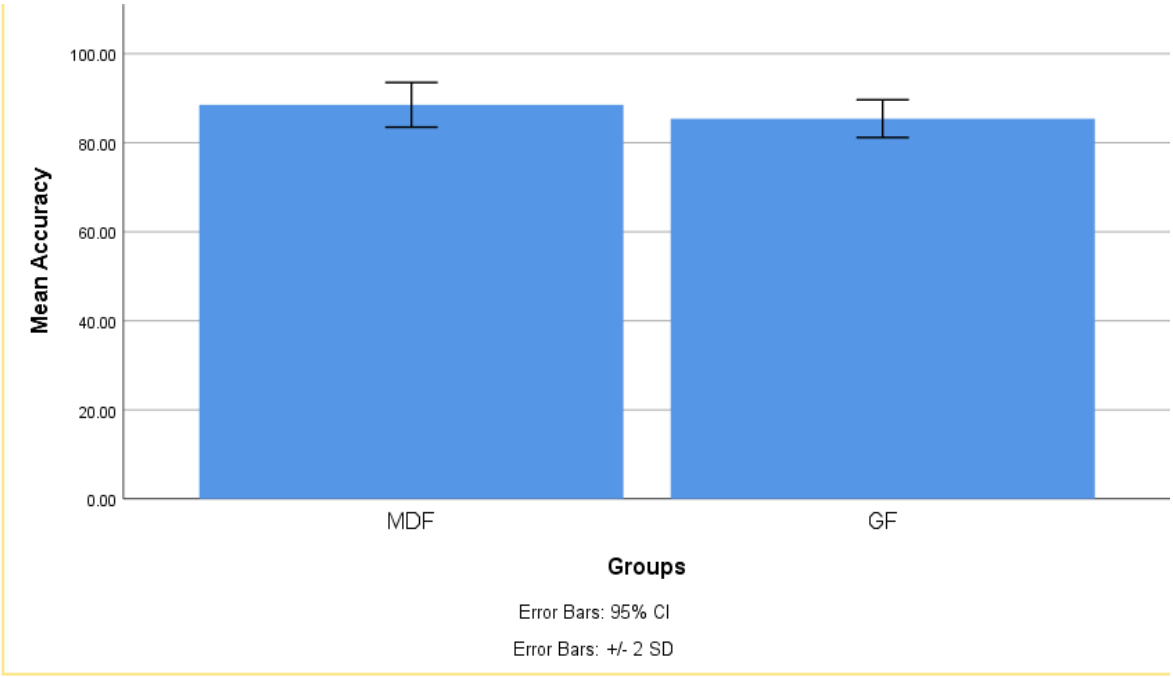

Fig. 1. Bar chart representation of the comparison of mean accuracy of the proposed and the existing algorithm. The accuracy of the prediction of the proposed algorithm is found to be 88.5%, and hence using the proposed algorithm gives better results compared to the existing algorithm that has accuracy of 85.4% the mean accuracy detection is ±2 SD..