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# A Comparative of Analysis of Image Restoration Using Mean and Median Filtering

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***Abstract:*** ***Image restoration is an important area to better the quality of an image, that attempts to recreate or remodel an image from noise. Image noise is a variation of brightness or unwanted signals and it used to destroy most of the part of image. Image destroyed by various type of noise such as Gaussion noise, Salt and Pepper noise, Poisson noise, etc., Several techniques are used to remove the noise and modifying or restore an image without resolution loss. In image restoration the operation implemented with filtering include smoothing, sharpening, edge detection. This paper is concentrated for analyzing the denoising of salt and pepper noise using filtering techniques.***
***Keywords: Median filter, Mean filter, Salt and Pepper Noise, Denoising.***

## I. INTRODUCTION

Digital images are prone to a variety of noise.Noise is the result of errors in the image restoration process that result in pixel values that do not reflect the true intensities of the real image. The image may destroyed due to camera misfocus motion blur etc., The most important noise in image processing is Gaussian noise, Salt and Pepper noise etc., This paper only concentrated denoising Salt and Pepper noise caused by sharp and sudden disturbance in the image. In appearance of the image is randomly scattered white or black pixel over the image. An image containing Salt and Pepper noise will have dark regions. A filter defined by a kernel, which is a small array defined to each pixel and its neighbors within image. The Salt and Pepper noise have some of the filtering technique been used such as mean filter median filter morphological filter.Thus filters are required for removing noised before processing. This paper compare the mean and median filter to remove the noise.Mean and median filtering for denoising extremely corrupted images by impulse noise,whenever an image is converted from one form to another,some degradation occurs at the output[1].Mean filtering fails to effectively remove heavily failed noise and median filters are edge preservation and efficient attenuation impulse noise..The mean filter is a simple sliding window spatial filter that replaces the centre value in the window with the average of all the pixel values in the window is usually square but can be any shape.

Distorted image

Enhanced Image

Image filtering is useful for many applications, including smoothing sharpening removing noise and edge detection. Finally the results of comparative analysis of mean and median algorithm with mean- median algorithm with mean, median filters for impulse noise removal show a high efficiency of this approach relatively to other once. In image processing filters are mainly suppress either high frequencies in image.Mean filter(MNF) is used to eliminate the noise from the image by taking the mean of the neighborhood pixels[2]. MNF is a linear low filter. It works on the concept of windowed filter. In this type of filter, center value window is replaced with the average value[3].



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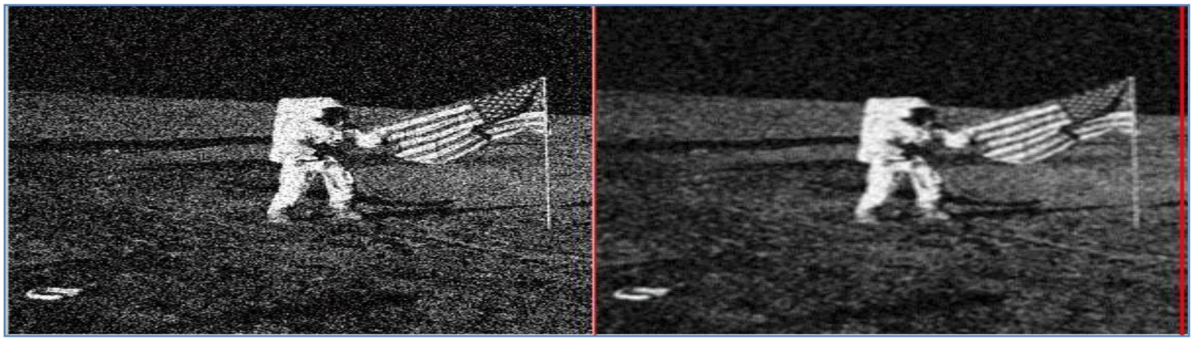
Unfiltered Value Mean Filtered Value

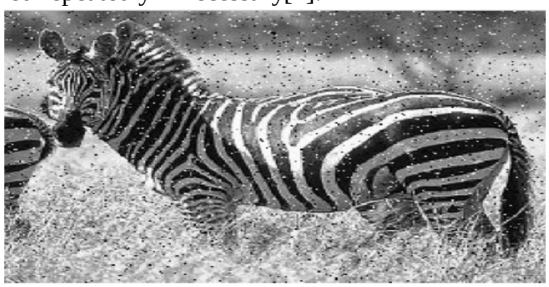
*A. Mean Filter with window size*

Mean filter is used to remove the salt and pepper noise both simultaneously from the image. We consider a sun image area of size m*n centered at (X,Y).We find out the mean value of that sub image area and replaces the mean value with the central value.The image details are not preserved in this operation , some details are lost. In this technique to provide simple to use and easy to implement opposite side any unwanted value of the pixel can strongly affected the mean value of all the neighborhood pixels[4].With the help of the scanning window corrupted image pixels are scanned in horizontal and verticaldirections. In each pixel scan after reappear by the mean value of the scanning window pixels.Median filters(MDNF) can do excellent job of rejecting certain types of noise,in particular,"shot" or impulse noise in which some individual pixels have extreme values. The SUMF is a sliding window spatial filters, but it replaces the centre value in the window with the median of all the pixel values in the window[5].



Salt and Pepper noise Denoising Mean filter

An improved median filtering algorithms for image noise reduction the algorithm used the correlation of the image to process the features of the filtering mask over the image[6].In median filter first 3*3 sliding window is taken, and checked whether the $5^{th}$ pixel of the corresponding window is noisy then the respective pixel value is replaces by median value of the current sliding window.MDNF is in a sense a more robust,"average "than the mean as it is not affected by outliers. Since the outpixel value is one of the neighboring values, new "realistic values are not created near edges. Since edges are minimally degraded, median filters can be applied repeatedly if necessary[7].



Salt and pepper noise Denoisingmedian filter

The SUMF is an example of a non-linear filter and, if properly designed, is very good at preserving image detail. To run a SUMF Consider each pixel in the image
Sort the neighboring pixels into order based upon the intensities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Replace the original value of the pixel with the median value from the list[8].

## II. LITERATURE REVIEW

In this paper, the comparative analysis of mean and median filtering algorithms is analyzed based on the performance of denoising and distorted image.

S.Lal et all.,[9](SUMF) is proposed to denoising high density Salt and Pepper noise from natural digital images. The proposed filtering algorithm performances in two stages, the noisy pixels are found in the first stage and each noisy pixel is replaced by the mean value of noise free pixel of 2×2 matrix in the second stage. First one is detection of noise and second one is the replacement of the noisy pixel value with estimated median value. In this filter the values of the noisy pixels are replaced with the mean value of noise free pixel in selected window. In addition, the proposed filter (SUMF) uses simple fixed length window of size 2X2 which results in easy implementation. The proposed SUMF filter has provided better presentation as compared to other many existing denoising filters and algorithms even at 95% noise density levels. Both visual and quantifiable results have been determined. The proposed SUMF filter has effective for impulse noise (salt and pepper) removal from images at high noise densities.

P.Thakur et all.,[10]The proposed (ADCG) method forms the tainted pictures by first distinguishing the Salt and Pepper contamination. The very first step is the checking of the input processing pixel that whether it is noisy or not. To certify that whether the input processing pixel is noisy or not we have to check that if it comes between the lower limit or maximum limit of gray scale level and of it lies in between then it should be left unaltered or intact. In the event if the handling pixel takes the most extreme or least gray level then it is a corrupted pixel. Even at the high noise levels of 80-90% the method gives efficient and promising results and thereby can be said that the method is very effective for high density salt & pepper noise removal.

A.Meligy et all.,[11] In this paper, an efficient adaptive switching mean filtering algorithm for salt and pepper noise removal is proposed. Switching mean filter framework is used in this algorithm in order to speed up the process and allow local details in the image to be preserved because only the noise pixels are filtered.Thus, it takes a decision whether the pixel under test is corrupted or not before applying the filtering which applied only to the detected “noise pixels “in the input image. This method adaptively changes the size of the filter based on the number of the “noise-free pixels” in the neighborhood. For the filtering, only “noise-free pixels” are considered for the finding of the average value of noisy pixel. This algorithm utilizes previously processed neighboring pixel values to get better image quality. The experimental results demonstrate that the proposed technique is effective for removing noise and preserving fine details than other existing denoising methods.

Abhishek.R et all.,[12] Proposed weighted median filter (WMF) method is proposed to allows the remove sequences of outlying and it preserve the discontinuities (shifts) in underlying regression function (the signal) it is in the presence of local linear trends and it is suitable for reduces the bias of arising from nonlinearities where the weighting of the observations according to their distances in the design space. It allows refiningthe efficiency of (un-weighted) repeated median filters which using the high bandwidths, for preserving the properties for wellknown between long-term shifts and sequences. To determine the noise points of images are provides an important basis for the classification of image pixels, the first step ofweighted algorithm filtering is the important step. There are many different ways to determine the noisy points. A 3x3 window size of discrete is used for determine the noise by calculating its difference between the average gray scale value of all pixels. The comparison between the difference of given threshold is within the central pixel and given window.Where the noise point is examined as greater than threshold value in pixels and non-noise point is considered as lower than threshold value in pixel. After determining the size and noise of filtering window, the image is divided into non-noise points and noise points. The new weighted median filter remove the noise points, but he gray values are reserved and kept from filtering for non-noise points. According to the weighted median filter method, the gray value of pixels of filtering window to that of central pixel, then the higher the weighted value and then result are obtained.It removes the noise before filtering to avoid the negative impact of noise on calculating the filtering value and get the best filtering result.When compare to existing algorithms the weighted median filter (WMF) gives better results even at high noise density levels. The proposed weighted median filter algorithm is effective for impulses noise removal in images at high noise densities.

Igor Djurovi’e[13]In this paper, we perform postprocessing (post-filtering) of the salt-and-pepper denoising filters.For postprocessing, we have used the block matching and 3D filtering (BM3D). It is the filter that is looking for local neighborhoods of similar shapes. Shapes are feed into 3D matrix.Filtering is performed in transform domain employing appropriate threshold. Hence we are able to achieve two goals for the salt and pepper noise environment. Firstly, for low-density noise, this scheme is able to reduce unused noise caused by changes in the local neighborhood (as an output of the filter, we are selecting one of the pixels in the local neighborhood). For a high-density impulse noise, an output of the decision-based/adaptive median filters is corrupted by



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artifacts and edges are disturbed. The BM3D We process blocks within the image in a sliding manner and utilize the block-matching concept by searching for blocks which are similar to the currently processed one. The proposed technique can also be considered as an extension of the BM3D algorithm that is able to work with images corrupted by the salt-and-pepper noise. This is a powerful demonstration of how legacy of existing well-developed filtering technique can be applied for improving results in digital image filtering even to problems previously not considered. This is an attempt in direction where huge legacy of developed digital image processing methods can be used for a different purpose with respect to the original one.

Raymond H.Chan et all.,[14]In this paper, we propose a powerful two-stage scheme which combines the variational method proposed with the adaptive median filter [5]. More precisely, the noise candidates are first identified by the adaptive median filter, and then these noise candidates are selectively restored using an objective function with an data-fidelity term and an edge-preserving regularization term. Since the edges are preserved for the noise candidates, and no changes are made to the other pixels, the performance of our combined approach is much better than that of either one of the methods. Salt-and-pepper noise with noise ratio as high as 90% can be cleaned quite efficiently.

MadhuS.Nair et all.,[15]An improved decision-based algorithm for the restoration of gray-scale and color images that are highly corrupted by Salt-and-Pepper noise, is proposed in this paper which efficiently removes the salt and pepper noise while preserving the details. The algorithm utilizes previously processed neighboring pixel values to get better image quality than the one utilizing only the just previously processed pixel value. The proposed algorithm is faster and also produces better result than a Standard Median Filter (SMF), Adaptive Median Filters (AMF), Cascade and Recursive non-linear filters. The advantage of the proposed algorithm (PA) lies in removing only the noisy pixel either by the median value or by the mean of the previously processed neighboring pixel values. Different grayscale and color images have been tested by using the proposed algorithm and found to produce better PSNR and SSIM values. AMF performs well at low noisedensities since the corrupted pixels which are replaced by themedian values are very few. At higher noise densities, window size has to be increased to get better noise removal which will lead to less correlation between corrupted pixel values and replaced median pixel values. The major drawback of this method is that defining a robust decision measure is difficult. Also these filters will not take into account the local features as a result of which details and edges may not be recovered satisfactorily, especially when the noise level is high.

Table 1.1 Comparative analysis of Mean and Median filter for image denoising

Table 1.1 shows various views of authors regarding difference between mean and median filter. The median filter is normally used to reduce noise in an image, somewhat like the mean filter. However, it often does a better job than the mean filter of preserving useful detail in the image.

| Paper Name | Filtering Technique | Advantage | Disadvantage |
|---|---|---|---|
| SUMF | Mean Filter | The proposed SUMF filter has effective for impulse noise (salt and pepper) removal from images at high noise densities. | The maindrawback of this that it also modifies nonnoisy pixels thus removing some fine details of the image.<br>2.It is only suitable for very low level noise density. |
| ADCG | Mean Filter | Method is very effective for high density salt & pepper noise removal. | 1.Details and edges are not recovered satisfactorily, especially when the noise level is high. |
| [11] | Mean Filter | This algorithm utilizes previously processed neighboring pixel values to get better image quality. | 1.It is effective only for low noise densities and at high noise densities.<br>2.It often exhibits blurring for large window sizes and insufficient noise suppression for small window sizes |
| WMF | Median Filter | It removes the noise before filtering to avoid the negative impact of noise on calculating the filtering value and get the best filtering result. | 1.Noisy pixels are replaced without taking into account local features such as the presence of edges and the noise level.<br>2.Hence details of the images and edges are not recovered satisfactorily, especially when the noise level is high. |



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| BM3D | Mean Filter | The edges are preserved for the noise candidates, and no changes are made to the other pixels | 1. The original noisy pixel is kept unchanged when failing to find the median value in the maximum window size; 2. The noisy pixels are considered in the calculation of median operation. |
| | Median Filter | When the noise density is low then the outcome of the above said filter is very good | Some details and edges are also removed particularly in case of high noise density. |
| SMF,AMF | Median Filter | This is suitable for elimination of high density impulse noise ranging from 60% to 95%. | 1.The major drawback of this method is that defining a robust decision measure is difficult. Also these filters will not take into account the local features as a result of which details and edges may not be recovered satisfactorily, especially when the noise level is high. 2.Another major issue with median filter is that when noise density increases then this filter is not able to preserve the edge details of the image This algorithm does not give better results athigh noise density ranging from 70% to 95%. |

## III. CONCLUSION

In this paper,of the mean and median filtering for image denoising algorithms are analysed.The algorithm are compared based on the performance of MSE and PSNR values of before and after denoising. The comparative studies show that the mean and median filtering algorithms are suitable for certain environment.But if doesn't applicable for the entire environment still here have a problem to recover all the noise from the image.

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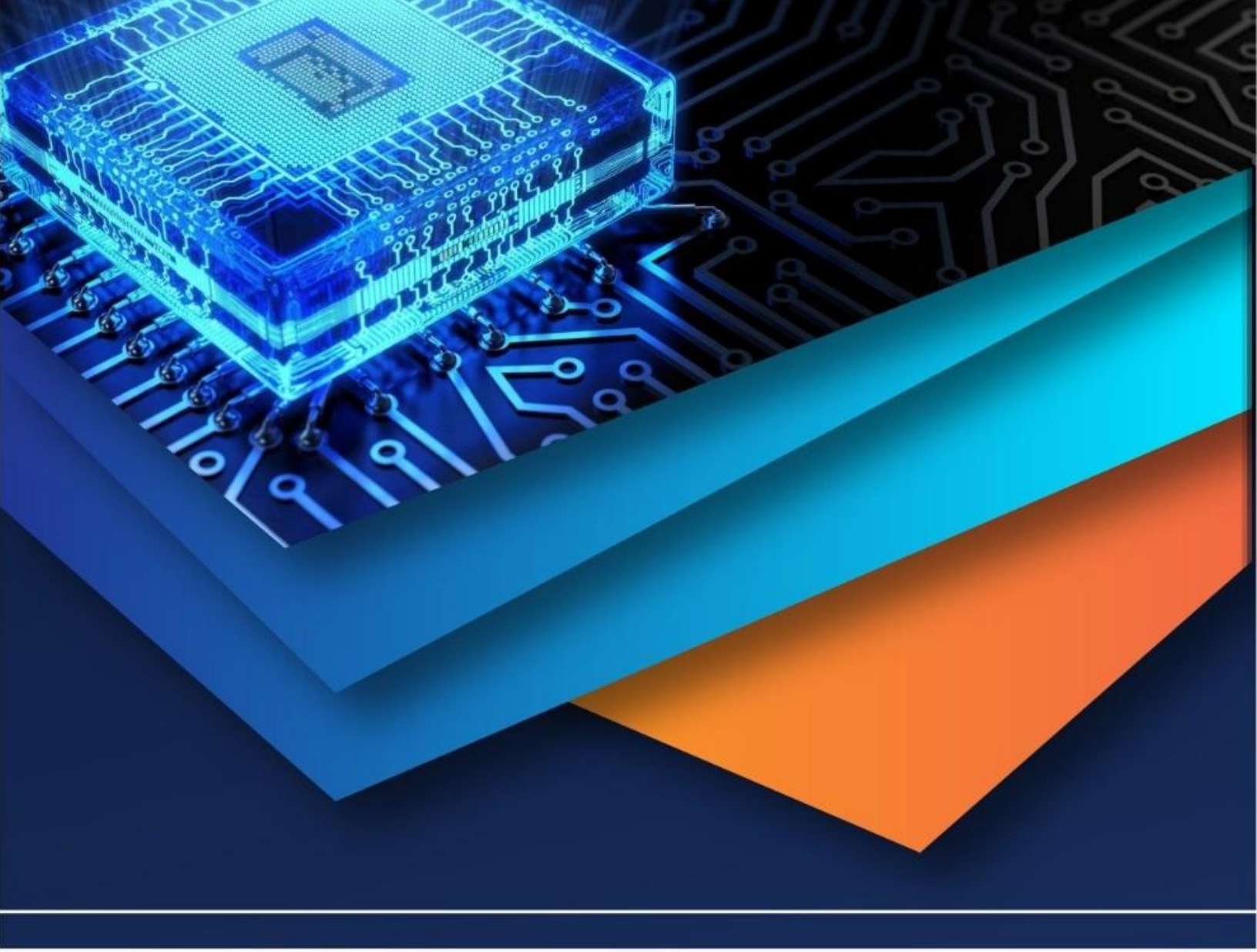

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