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Removal Of Salt & Pepper Noise In Image Through Weighted Median Filter

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ABSTRACT: When sending images through channels, there are some corrupted images by salt and pepper noise, due to unknown communication. Impulse noise is also referring as salt and pepper noise. The noise free images are fully recovered with minimum signal distortion when objective of filtering is to remove the salt and pepper noise. The nonlinear digital filters are best to remove impulse noise. Adaptive Median filter identifies the noisy pixels and make them to arrange as original pixels without noisy pixels. It is also known as "switching" and "decision based system". It detects the images at higher density also, but its takes more time to operate the process. Median filter algorithms are well defined for removal of salt and pepper noise in images without changing the preserved edges. At low and medium noise densities, the existing nonlinear filter like Standard Median Filter, Adaptive Median Filter, Decision Based Algorithm & Robust Estimation Algorithm shows better results and their performance is poor at high noise densities. By using modified sheer sorting method we can remove high-density salt and pepper noise. A new algorithm is Weighted Median Filter is proposed.

KEYWORDS:-Image, Noise Filtering, MSE, PSNR, SMF, AMF, MDBUTMF.

I. INTRODUCTION

During acquisition and transmission Images are corrupted by impulse noises. The noise can be classified as the easier-to-restore salt-and pepper noise based on the noise values and the more difficult random valued impulse noise. The median filter is used widely because of its high computational efficiency & effective noise suppression capability from all the methods of removal of impulse noise. Digital filters are Non-linear. Digital filters are based on order statistics are median filters. We have known that the capabilities of median filters are remove impulse noise without the damaging of edge. Standard median filter is effective only for low noise densities. It is the main drawback of a standard median filter (SMF). SMFs often exhibit insufficient noise suppression & blurring for large window sizes for small window sizes at high noise densities.

The median filters operate uniformly across the image & both noise and noise-free pixels are modified. Consequently, the effective removal of impulse often leads to images with distorted features & blurred. Ideally, while the leaving uncorrupted pixels, the filtering should be applied only to corrupted pixels. Unconditionally the median filter is applied to across the entire image. The entire image as practiced in the conventional schemes would inevitably alter the remove the signal details of uncorrupted pixels & intensities. Therefore, a noise-detection process to discriminate between corrupted pixels & the uncorrupted pixels, applying nonlinear filtering is highly desirable.

Adaptive Median is a "switching" or "decision-based" filter. While leaving all other pixels unchanged it identifies possible noisy pixels & then replaces them using the median filter or its variants. At a high noise level this filter is good at detecting noise & most of the impulse noises are detected. At high noise level it is provided that the window size is large enough. At lower noise density levels the performance of AMF is good, because the median values are replaced in the place of fewer corrupted pixels. The number of replacements of corrupted pixel increases at higher noise densities, increasing window size will provide better performance of noise removal. However, the replaced median pixel values & corrupted pixel values are less correlated. The corrupted image by first detecting the impulse noise in the DBA processes. By checking the value of a processed pixel element only it can detecting of noisy and noise-free pixels. It is decided whether the value of a processed pixel element lies between the maximum and minimum values that occur inside the selected window. In the dynamic range (0, 255) the impulse noise pixels can take the maximum and minimum values. At higher noise densities due to replacement with the neighborhood pixel values only streaking occurs. This is the main drawback of DBA. Especially when the noise level is high the details and edges are not recovered satisfactorily.

II. PREVIOUS METHODS

STANDARD MEDIAN FILTER

The median filter is used to remove the noise & it is a nonlinear digital filtering technique. Such noise reduction is a typical pre-processing step to (for example, edge detection on an image) improve the results of later processing. Under certain conditions, it preserves edges while removing noise. This filtering is very widely used in DIP. Replacing each entry with the median of neighbouring entries only the median filter is run. The main idea of the median filter is to run through the signal entry by entry. Over the entire signal the pattern of neighbours is called the "window", which slides, entry by entry. For higher-dimensional or 2D signals such as images, more complex window (such as "box" or "cross" patterns) patterns are possible, whereas for 1D signal, the most obvious window is just the first few preceding and following entries. Note that the median is simple to define when the window has an odd number of entries & the middle value is sorted numerically after all the entries in the window.

ADAPTIVE MEDIAN FILTER

Comparing with Standard median filtering the Adaptive median filtering is an advanced method. Which pixels in an image have been affected by impulse noise can be determined by using spatial processing.

AMF performs in the image by comparing each pixel with its surrounding neighbour pixels to classify pixels as noise. The neighbourhood pixel of the size is adjustable, as well as for the comparison the threshold is adjustable. A pixel is not structurally aligned with those pixels to which it is similar, as well as pixel that is different from a majority of its neighbours can be treated as impulse noise. The median pixel value of the pixels in the neighbourhood can be replaced in the place of noise pixels that have passed the noise labelling test.

Level A:

IF Zminimum < Zmedium < Zmaximum, then

Zmedium is not an impulse

go to level B to test if Zxy is an impulse

ELSE

Zmedium is an impulse

The size of the window is increased and

Level A is repeated until

Zmedium is not an impulse and go to level B or

Smaximum reached: output is Zxy

Level B: IF Zminimum < Zxy < Zmaximum, then

Zxy is not an impulse

output is Zxy (distortion reduced)

ELSE

either Zxy = Zminimum or Zxy = Zmaximum

Output is Zmedium (standard median filter)

Zmedium is not an impulse (from level A)

MDBUT MEDIAN FILTER

MDBUT Median Filter can be called as Modified Decision Based Un-symmetric Trimmed.

It processes the corrupted images by first detecting the impulse noise. Whether it is noisy or noisy free can be checked by using the processing pixel. It can say it is noise free pixel if the processing pixel lies between maximum and minimum gray level values otherwise it can say that it is noisy pixel.

The steps of the MDBUTMF are elucidated as follows.

Step 1: Assume that the pixel being processed is & Select 2-D window of size 3x3.

Step 2: If then is an uncorrupted pixel and its value is left unchanged. This is illustrated in Case iii) of Section IV.

Step 3: If or then is a corrupted pixel then two cases are possible as given in Case i) and ii).

Case i): If the selected window contains all the elements as 0's and 255's. Then replace with the mean of the element of window.

Case ii): If the selected window contains not all elements as 0's and 255's. Then eliminate 255's and 0's and find the median value of the remaining elements. Replace with the median value.

Step 4: Repeat steps 1 to 3 until all the pixels in the entire image are processed.

Case(i): If the selected window contains salt/pepper noise as processing pixel (i.e., 255/0 pixel value) and neighboring pixel values contains all pixels that adds salt and pepper noise to the image:

Where 255 is processing pixel P(i,j)

0	255	0
0	255	255
255	0	255

Since all the elements surrounding are 255's & 0's. It will be either 0 or 255 which is again noisy, if one takes the median value.

To solve this problem, the processing pixel is replaced by the mean value & the mean of the selected window is found. Here the mean value is 170. Replace the processing pixel by 170.

Case(ii): If the selected window contains salt or pepper noise as processing pixel (i.e., 255/0 pixel value) and neighboring pixel values contains some pixels that adds salt (i.e., 255 pixel value) and pepper noise to the image:

Where 0 is processing pixel P(i,j)

78	90	0
120		255
97	255	73

Now eliminate the salt and pepper noise from the selected window. That is, elimination of 0's and 255's. The 1-D array of the above matrix is [78 90 0 120 0 255 97 255 73]. After elimination of 0's and 255's the pixel values in the selected window will be [78 90 120 97 73]. Here the median value is 90. Hence replace the processing pixel by 90.

Case (iii): If the selected window contains a noise free pixel as a processing pixel, it does not require further processing. For example, if the processing pixel is 90 then it is noise free pixel: Since "90" is a noise free pixel it does not require further processing.

90	95	90
45	65	21
32	90	101

Each and every pixel of the image is checked for the presence of salt and pepper noise. Different cases are illustrated in this Section.

If the processing pixel is noisy and all other pixel values are either 0's or 255's is illustrated in Case (i).

If the processing pixel is noisy pixel that is 0 or 255 is illustrated in Case (ii).

If the processing pixel is not noisy pixel and its value lies between 0 and 255 is illustrated in Case (iii).

III. PROPOSED METHOD

WEIGHTED MEDIUMIAN FILTER

In general the robust signal is extraction from time series in particular. The outlying sequences are to preserve discontinuities (shifts) in the underlying regression function (the signal) in the presence of local linear trends is an proposed methods to remove suitable weighting of the observations according to their distances in the design space reduces the non-linear and it also allows improving the efficiency of (un-weighted) repeated median filters using larger bandwidths, keeping their properties for distinguishing between outlier sequences and long-term shifts.

Which provides an important basis for the classification of image pixels is the first step of filtering algorithm and also is the crucial step and it determining of the noise points of the images. For calculating the difference between the average gray value of all the pixels within the window and the central pixel, and making a comparison between the difference and a given threshold and there are many methods for determining the noise points. A 3 3× discrete window is used to determine the noise. Where the pixel is greater difference than the threshold value is considered as noise point, otherwise non-noise point. A KXK sliding window over the image is used to find out the maximum and minimum gray level. The gray value of central pixel of the window is equal to the maximum or minimum value, it is considered as the noise point, otherwise the non-noise point. The drawback of this method is that it takes the maximum and minimum gray value of the local window as the noise criterion. Although it is self adaptive to some extent, the noise points will be mistaken for non-noise points if the maximum and minimum noises are not the true noise points. The two methods above are integrated and combined with block uniformity. When the block uniformity of the window is equal to that of the whole image, the pixel is considered as noise point, otherwise non noise point. The problem of this method is that it does not rule out the noise points having been determined when calculating the block uniformity of the sliding window. And thus it is easy to mistake the edge frequency signal points as noise points, especially when the noise density is high.

IV. EXPERIMENTAL RESULTS

Finally the improved results shown in below Figure1 & Table 1

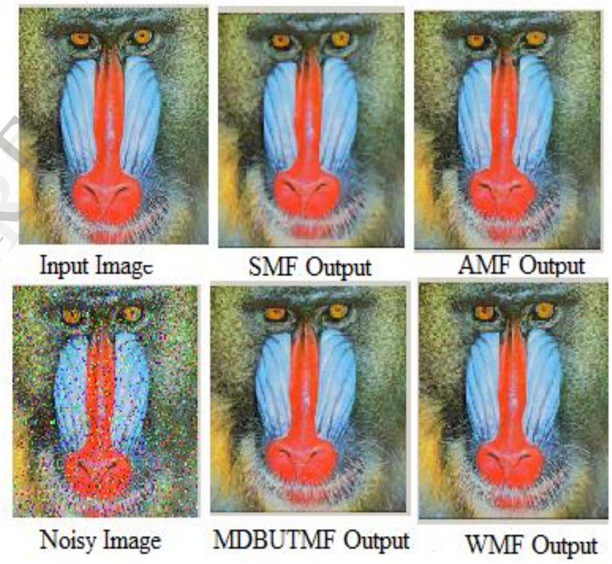

Figure 1: Noise Corrupted & Result Images

METHOD NAME	PSNR	MSE
SMF	29.7013	69.6932
AMF	33.596	28.4187
MDBUTMF	34.2678	24.3524
WMF	38.3879	9.43628

Table 1: Comparing of All Filter Results

V. CONCLUSION

In our project, a new algorithm Weighted Median Filter is proposed which gives better performance in comparison with previous methods and other existing noise removal algorithms in terms of MSE and PSNR. Even at high noise density levels the WMF gives better results in comparison with other existing algorithms. Both visual and quantitative results are demonstrated. The performance of the algorithm has been tested at low and high medium noise densities on both color images gray-scale images. The proposed algorithm is effective for impulse noise in images at high noise densities.

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