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Sliding Window Based Blind Image Inpainting To Remove Impulse Noise from Image

Madhuri Derle, Gorakshanath Gagare

M.E. Student, Department of Computer Engineering, SVIT, Nashik, India

Assistant Professor, Department of Computer Engineering, SVIT, Nashik, India

ABSTRACT: In this paper an efficient algorithm has proposed for high-density salt and pepper noise removal from images. In the transmission of images over channels, due to faulty communications images are corrupted by salt and pepper noise. We will deal with the images corrupted by salt-and-pepper noise in which the noisy pixels can take only the maximum or minimum values. Several nonlinear filters have been proposed for restoration of images contaminated by salt and pepper noise. Among this proposed algorithm Median Filter is reliable method to remove the salt and pepper noise without damaging the edge details.

KEYWORDS*:* Image Restoration, Median Filter, Salt and pepper noise.

I. INTRODUCTION

In general, while transmission of images with due to the bit errors images may get corrupted by impulse noise or it may introduced by the signal acquisition stage. Impulse noise is classify mainly in two types, which is salt and pepper noise and random valued noise. There are many nonlinear filters which have been proposed for restoration of images which are corrupted by salt and pepper noise. In these methods standard median filter is established as improved method with which the salt and pepper noise can be removed without damaging the edge details. The drawback of standard Median Filter (MF) is that, this filter is effective only at low noise densities. If noise level is over 50% the edge details of the original image wouldn't be preserved by standard median filter. At high noise densities, trimmed median value cannot be obtained if the selected window contains all 0's or 255's or both. At very high noise density at 80% to 90% this algorithm does not give better results.

A. IMPULSE NOISE

Impulse Noise (IN) or Salt & pepper noise is a type of impulse noise which is typically observed in images. It represents itself as randomly occurring white and black pixels. An image containing this type of noise will have dark pixels in bright regions and bright pixels in dark regions. This type of noise can be caused by dead pixels, analog-to-digital converter errors, bit errors in transmission, etc. Following figure shows the image having impulse noise.

Fig. 1: Impulse noise images (salt and pepper)

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II. LITERATURE SURVEY

There are several algorithms which were proposed in recent years to remove impulse noise from images in search of good result generating algorithm.Which will help to improve image quality and also preserves the edges of the images that enhance the quality of digital image.

M. V. Afonso [2] proposed algorithm for solving the unconstrained optimization formulation of regularized image reconstruction/restoration. Different types of regularization (wavelet-based, total variation) can be used, this is based on a unique of variable splitting which gives an equivalent constrained problem. augmented Lagrangian method is used to address this constrained proble.

Celia A. Zorzo Barcelos [3] proposed a mathematical model for image restoration, with which missing parts of image can be recovered and corruption can be eliminated. The model presented was inspired on the BSCB model for inpainting and a balanced diffusion equation for denoising. The model has three equations, one to perform the transport of the data and two to perform the smoothing inside and outside of the inpainting domain D.

Amir Beck and Marc Teboulle [4] presented iterative shrinkage-thresholding algorithms (ISTA) to solve inverse linear problems of the image processing. This algorithm is the extension ofclassical gradient method, this technique is known sor its its simplicity and use to sovle large-scale problems with high density matrix data. A new fast iterative shrinkage-thresholding algorithm (FISTA) is presented in this paper which preserves the computational easeness of ISTA but practically FISTA is significantly more better as per the global rate of convergence.

An effort has been made to device and algorithm for high denity noise images. Modified Weighted Based (MWB) filter, which is based on the weighted differences between the noise pixel and the other neighbouring pixels which are aligned in four other directions.

III. EXISTING SYSTEMS FOR REMOVAL OF HIGH DENSITY SALT & PEPPER NOISE IN IMAGES

A. *STANDARD MEDIAN FILTER (MF):*

Standard median filter which has been established as improved method that can be used to remove the salt and pepper noise without damaging the edge details. It sets a limit on the number of good pixel with which median and mean value is calculated and will be substituted to impulse pixel by adding all of its mean value and median value which is divided by 2. After that it passes through Gaussian filter. The image with 90% of salt and pepper noise that can be removed with this method.

B. *ADAPTIVE MEDIAN FILTER (AMF):*

There are two types of models for images corrupted with impulse noise, two new algorithms for adaptive median filters are proposed. It has variable window size for removal of impulses while preserving sharpness. 1st is ranked-order based adaptive median filter (RAMF). The 2nd one is called as impulse size based adaptive median filter (SAMF) when the original image with its edge details will not be preserved by standard median filter if the noise level is above 50%.

C. *DECISION BASED ALGORITHM (DBA):*

DBA algorithm is implemented with two steps in which the first step is to detect all possible corrupted pixels from the degraded image and then second step is used to replace the degraded image with either the median of all the noise free pixels in the selected window and if the selected window contains noisy pixels only than trimmed global mean filter is used. Decision Based Algorithm (DBA) is proposed; to overcome the drawbacks of above filter At high noise density the median value will be noisy which is 0 or 255.

IV. PROPOSED SYSTEM

A. *ARCHITECTURE*

Adaptive Median is a “decision-based” filter that first detect all possible corrupted pixels from the degraded image and then second step is used to replace the degraded image with either the median of all the noise free pixels in the image or its variables, while all remaining pixels are kept unchanged.This filter is good for detecting noise even at a high noise level. For designing system, the basic idea of the osed scheme is illustrated in Fig.2.

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In this paper we are going to use input noisy image which is affected by salt and pepper noise. Those input pixels are under gone into pre-processing in which we are going to convert the image RGB bands in to gray image and then creating a text file which is containing pixel values of the noisy image. Now by considering 3*3 mask, in which the center pixel value is going to observe and then compare using some threshold value. Depending upon the threshold value we will classify the image pixels. Then by using median filter that of size 3*3 mask is going to apply on the image. The pixels which are affected by noise are replaced by the median value of the neighbour pixel values. To eliminate the noise, this process is applied for all the noisy affected pixels. The noise free image we can get at the output end.

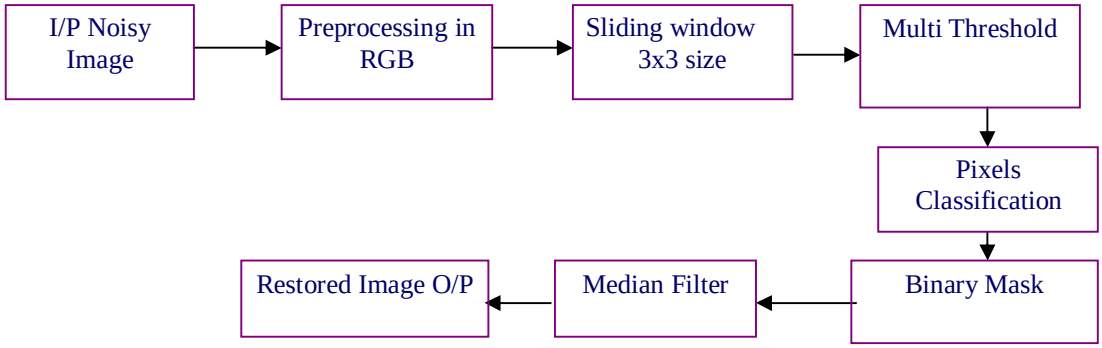

Fig.2: Block Diagram of proposed method

D. *MATHEMATICAL MODEL*

- Problem Description

Let S be the technique for removal of noise for effective data transmission and further processing.
Such That S= {I, F, O} Where,

I represent the set of inputs
I= {D, W}
D= original image
W= image converted to header file (named h i.e. pixels)

F is set of Functions
F= {ES, SW, MF, RED}

ES: edge selection
SW: sliding window to detect noise pixel
MF: median filtering of neighbourhood pixels
RED: Final noise free image pixels

O is set of output
O= {C, MSE, PSNR}

C: Final output image without impulse noise.
MSE: mean square error (difference between output and input image)
PSNR: peak to signal noise ratio.

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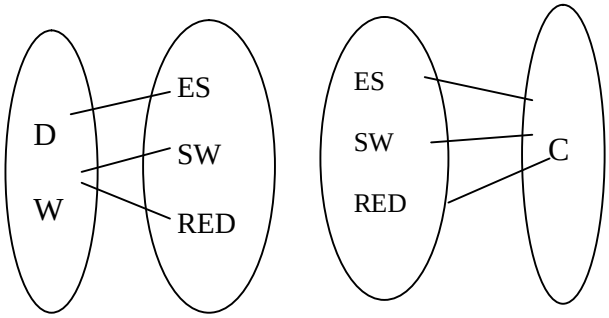

Fig.3: Functional Dependency

C. *ALGORITHM :*

The proposed method deals with the images which contains noisy pixels. This method detects the salt and pepper noise first then the processing pixel is checked for noise presence in images. That is, the pixels which are noise free those will remain unchanged if the processing pixel values are in between maximum and minimum gray level values .if the processing pixel value holds maximum or minimum gray level then the processing pixel value is noisy and noisy pixels will be processed by this method.

Algorithm to remove salt and pepper noise from the corrupted images.

Step 1: A two dimensional window of size 3x3 is selected which is centered arround the processed pixel p(x, y) in the corrupted image.
Step 2: Sort the pixels from selected window in ascending order and store it into vector V_0. Then find,
Median pixel value (P_{med}),
Maximum pixel value (P_{max}),
Minimum pixel value (P_{min}) of sorted vector V_0.

Now the first and last elements of the vector V_0 is the P_{min} and P_{max} respectively and the middle element of the vector is the P_{med}.
Step 3: If the processed pixel is within the range $P_{min} < P(x, y) < P_{max}$, $P_{min} > 0$ and $P_{max} < 255$,it is classified as uncorrupted pixel and it is left unchanged. Otherwise p(x, y)is classified as corrupted pixel.
Step 4: If p(x, y) is corrupted pixel, then we have the following two cases:

Case 1: If $P_{min} < P_{med} < P_{max}$ and $0 < P_{med} < 255$,
Replace the corrupted pixel p(x, y) with P_{med}

Case 2: If the condition in case 1 is not satisfied then P_{med} is a noisy pixel. In this case compute the difference between each pair of adjacent pixel across the sorted vector V_0 and obtain the difference vector V_D .Then find the maximum difference in the V_D and mark its corresponding pixel in the V_0 to the processed pixel.

Step 5: Step 1 to step 4 are repeated until the processing is completed for the entire image

V. IMPLEMENTATION STRATEGY

A. IMPULSE NOISE MODEL

The Impulse noise is also known as salt & pepper noise which has minimum 0 as gray level value or max 255 as gray value (for 8-bit monochrome image) and these pixel values may vary in range of 0 to 255. In impulse noise

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image pixel values are may get corrupted by either min value 0 or max value 255 and this created with equal probability.

Consider an image I and an observation image X of same size

$$I_{ij} = \{N_{i,j} \text{ with probability } p\}$$
$$X_{ij} = \{N_{i,j} \text{ with probability } p\}$$

Where *i=1,2,*and…..*j=1,2,s1* and…..*0<p<1.* I*ij* and N*ij* gives the pixel values which is located at *(i,j)* of the original image and the noisy image, respectively and *Nij* gives noisy value which is not dependet on I*ij*. When the image is noisy image with impulse noise , for gray images which are 8 bits per pixel then the Nij corrupted pixel value may be either 0 or 255 and each with equal probability i.e. (p/2) .

In this paper, the image which is affected by impulse noise is input image. Those pixels which are corrupted will go through preprocessing in which first RGB image will be converted into gray scale image and then we will form text file i.e. header file. This text file will contain pixel values of the noisy image.

Now, 3*3 mask image we are going to consider in which the center pixel value is noisy pixel which will be observed and compared with some fixed value. By comparing noise pixel value and fixed value the noisy image pixel values will be classified.

Then median filter with size of 3*3 mask is going to apply on the noisy image. Then the median of all the neighbour pixels will be calculated and this median value will be used to repalce noisy pixel's value. This processes will be done repeatedly to remove all the noisy pixels value from the corrupted image.

Then finally we will have noise free image at the output end.

VI. RESULT AND DISUSSION

The proposed algorithm is used for testing noisy images with 512*512, 8- bits/pixel. The different images with different noise densities i.e images which are corrupted with various levels of impulse noise densities the performance of developed method is tested and compared with standard filters namely adaptive median filter (AMF), standard median filter (SMF) and decision based algorithm (DBA). Each time the test image is corrupted by salt and pepper noise of different density ranging from and after selecting 3x3 pixels sorting is the most important operation used to find the median of a window. There are various sorting algorithms such as bubble sort, binary sort, quick sort, merge sort etc. Next work for this concept with more precision is going on. GUI and the output we are going to observe. We are going to check Mean square error and PSNR values.

Add PSNR at different noise density for flower image.

The Peak signal to noise ratio (PSNR) is used to compare the relative filtering performance of various filters. The PSNR between the filtered output image C and the original image D.

The snapshots for the current system are as follow,

As shown in fig 5. It gives the idea about the GUI of the current system which will be used to remove impulse(salt & pepper) noise from image by using sliding window based algorithm. There will be browse option on GUI with which user can browse any noisy image. Once image is browsed it will be displayed on GUI below the browse option. After this,before removing noise from image it should be converted to gray scale image. So to converet image to gray scale, there is Gray option on GUI . when this button is pressed the image will be converted into gray scale image.

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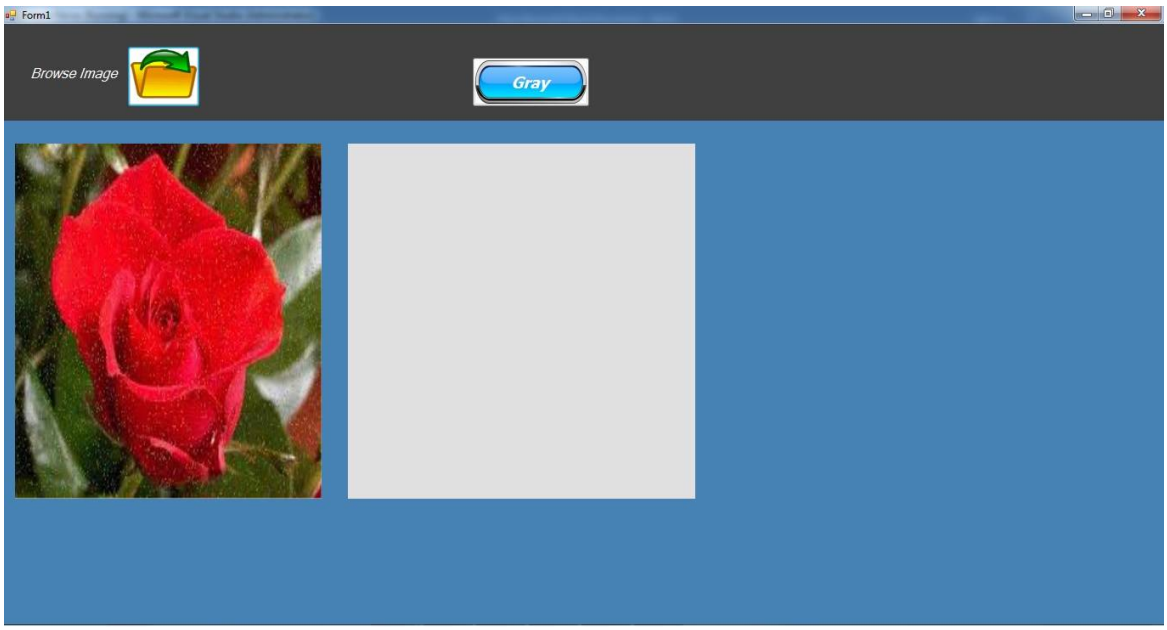

Fig.4: Image With Noise

When Gray button is clicked the image will get converted into gray scale image and this image will be displayed on GUI below the Gray option as shown in fig 5.

If the browsed input noisy image is colored image then it will get converted into gray scale image first and then that gray image will go undr further process to remove noise .

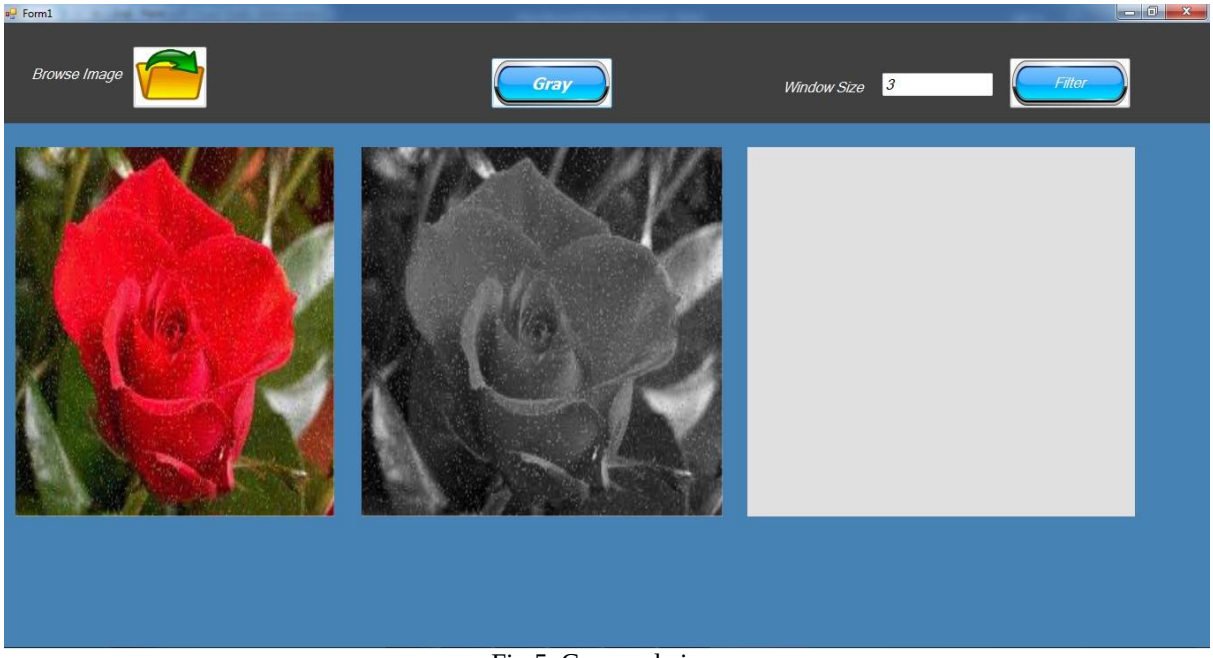

Fig 5. Gray scale image.

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Once the given browsed image is converted into gray scale image then next step is to remove noise from image. So for this process to happen the sliding window algorithm is used to remove salt & pepper noise from image. In this algorithm user has to select the window size and base on the user requiremqnts algorithm will be applied to remove noise.

In fig 6 , there will be list from which user has to select the window size and then further process will be carried out to remove noise from image. Once window size is selected then click on filter option which is there on GUI. When filter button is clicked you will get noise free image as your output image without noise. That image will be displayed on GUI below the Filter Button.

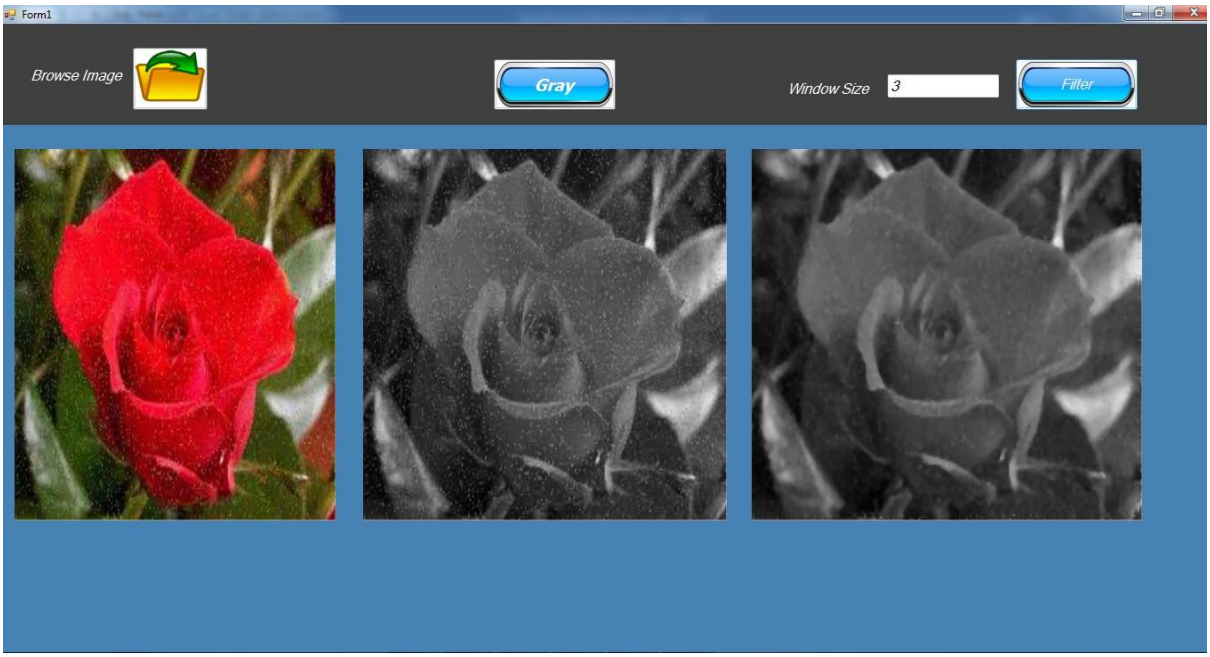

Fig 6. With Noise free image

VII.CONCLUSION

The proposed method is used to remove salt and pepper noise from highly noised images. The performance of the algorithm will be tested at low, medium and high noise densities on gray-scale images. The algorithm implementation can be carried out with de-noising technique and edge preserved with median filtering and then sorting technique helps to improve performance in terms quantitative evaluation and visual quality. This technique will reduce percentage of impulse noise and complexity.

We can further modify proposed algorithm of gray scale images to colour images for filtering a impulse noise.

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