An Accession for Image Denoising by Multiple Filter and Correlative Examination for Random Impulse Noise

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Abstract: Denoising an image is a significant problem in the processing of digital images. Any impulse noise damages the image and the aim of denoising is to remove noise and restore the high-quality image as much as possible. This paper aims to develop a method to discriminate between corrupted and uncorrupted pixels and develop a novel filter to denoise the image. It is also necessary to consider images with different levels of noise of various applications to develop an optimal system to remove the noise for further processing. In this paper, different filtering techniques, such as Median-Filter (MF), Weighted-Median-Filter (WMF), Centre-Weighted Median Filter (CWMF), and adaptive centre weighted median filter (ACWMF) are used for denoising, also a novel filter Asymmetric Trimmed Median Filter (ATMF) is designed, which outperforms compared to the filters designed earlier. Experimentation is carried by considering the dataset size of 700 noisy images. The average PSNR value of proposed system is 28.12%(DB).

Keywords: MF, CWMF, ACWMF, WMF, ATMF, impulse noise.

I. INTRODUCTION

Digital image processing technology enables us to computer to manipulate digital images, as there are deficiencies in raw information from imaging sensors from different platforms. Different steps to be taken to overcome these deficiencies and achieve the originality of the data. The three common steps that all type of data must go through when using digital images are processing, enhancement and display, and information extraction. Defective element of the camera sensors, memory location errors and impulsive noise due to synchronization errors. Denoising the image is essential for subsequent activities in most applications, some of those edge discovery, picture division, object acknowledgment, and so on. Decision tree based method [1] is used to remove random impulse noise. The decision tree based quantifiable evaluation tells that performance of system is good. Algorithm for the removal of the corrupted input image of salt and pepper noise [5,7] using adaptive median filter. This method uses the best performance of the edge in pixel label and removes the impulse noise. Due to the higher efficiency the user will be reliable in the real-time environment also in order to address these issues.

II. PROPOSED SYSTEM

In this paper a powerful image restoring technique for highly corrupted images, namely Asymmetric centering filter for highly corrupted images with impulsive noise of random values is proposed. In study articles, the proposed impulse detection filtering method followed by ATM filter can generate high-quality pictures and avoids blurred pictures compared to other noise reduction techniques[8,11]. In order to obtain better performance, different kinds of weighted nonlinear filtering methods have been explored over the years[4,6]. By and large, the exchanging middle channel comprise of two steps: 1) Impulse detection[1,2,3] and 2) Noise separating.

Remaining part of the paper details about the proposed ATMF and comparative analysis of ATMF over other filter.
Fig.1 System design of multiple filter analysis

Fig.2 Database Collection

Image denoising nothing but Pre-processing technique. After pre-processing the image can be used for the various purposes. The results are stored in temporary database where PSNR and MSE values are stored. Based on these values the percentage of denoise can be concluded.

2.1 MEAN SQUARE ERROR (MSE)

PSNR is best defined as mean squared error (MSE) and provides a strong approximation to the noisy image m*n I.

\[
MSE = \frac{1}{m \times n} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i,j) - f(i,j)]^2
\]

2.2 PEAK SIGNAL TO NOISE RATIO (PSNR)

The two error measurements used to compare image compression quality are the mean square error (MSE) and maximum signal to noise ratio (PSNR). MSE is the cumulative square error between the compressed picture and the initial picture, and PSNR is the maximum error metric. Typical PSNR values are between 25 and 40 dB for lost pictures if the depth of the chip is 8 bits. Calculated by PSNR as,

\[
PSNR = 10 \log_{10} \left( \frac{MAX^2}{MSE} \right)
\]

Where MAX is the largest pixel value in the image. For all filtering techniques, PSNR and MSE values are calculated using equation 1 and equation 2 is calculated. In data users to find the files from cloud they need to enter multi-keywords to search the similar data or files from the cloud. For authentication secret key is sent to data users for giving permission to access the data. Then data users able to copy the files. In cloud server it will return the top-k results of files.

III. IMPLEMENTATION AND MULTIPLE FILTER ANALYSIS

The proposed system is implemented on MATLAB 2010a version. In this paper multiple filters can be analysis based on their technique. They are Median Filter, Center Weighted Median Filter, Weighted Median Filter, Adaptive Centre Weighted Median Filter a Asymmetric Trimmed Median Filter. Comparative analysis can be performed based on their PSNR values.

3.1 MEDIAN FILTER (MF)

The order-statistics filter which will use the median value of the pixel is the median filter, it replaces value of one pixel with the equaling median value of the same pixel value in the grayscale scale with respect to the neighborhood of pixel represented by the following.

\[
f(x,y) = \text{median}\{g(s,t)\}
\]

It has the higher efficiency in case of the low level noise the image pixel is low. But causes the blurring of the image when the threshold value is increase linearly.

3.2 WEIGHTED MEDIAN FILTER (WMF)

The proposed median filter extension is a weighted median (WM) filter. Add weighting to pixel values in the same window. If you put the input and output values in X and Y, then the intermediate filter,

\[
Y = \text{median}\{X(i-s,j-t)|W(s,t)\}
\]

3.3 CENTER WEIGHTED MEDIAN FILTER (CWMF)

This filter allows the higher weight of the pixel in the center based value of the same pixel. Hence it is easy compared to the WMF.

\[
Y = \text{median}\{X(i-s,j-t)|W(s,t)\}
\]

3.4 ADAPTIVE CENTER-WEIGHTED MEDIAN FILTER (ACWM)

Estimates based on the total difference between the image-based current pixel and the pixel output were filtered to a central center weight filtered using multiple center weights. The switching method is based on a full pulse detection system.

\[
I(i,j) = \text{median}\{C(X)|i-x,y-t|\}|W(s,t)\}
\]

The ACWMF used the varied weights of the pixel in the window of the varied center weights in the way of the more general operator; it will be realizing impulse detection by the total differences which has been made to define the different weight between outputs of the CWM filters. In the respect to the current pixel will be in the concern.

3.5 Asymmetric trimmed median filtering Technique (Proposed)

Asymmetric Trimmed Median Filtering for the image denoising has been subsequently used to eliminate stunning noises. It also keeps the edges
and details of the pixels in the digital image. The steps of the proposed methodology are as follows:

**Step 1:** 2-dimensional square analyzing filtering in the weight of the window of the size 3 x 3 will be initially slid over on input image X(i , j). It went up and down through raster scan mode.

$$W(i,j) = (X-n(i,j),X0(i,j),X1(i,j),...,Xn(i,j))$$

Where

$$X0(i,j)$$ - original central vector-valued pixel

**Step 2:** In the given input image, the central valued pixel inside the used 3x3 window will be verified too see whether it is corrupted. If central valued pixel is uncorrupted, it will be left unaltered. A 3 x 3 weight window $$w(i,j)$$ will be centred around the

$$X0(i,j)$$ which is than considered to filter can be shown as;

$$W(i,j) = X_{4(i,j)},...,X_{(i,j)},X_{0(i,j)},X_{1(i,j)},...,X_{4(i,j)}$$

**Step 3:** If central pixel is corrupted, 383 using the filtering selected in the weight window. The median value of the pixel is found among uncorrupted pixels. It is later replaced with the median value.

**Step 4:** Finally weight moved, and it is formed a new set of the pixel reconstructed values $$X0(i,j)$$, by using the neighbor pixel which has been processed at the center of the weight 3*3 window as shown in the Fig 3. This process is carried out for each of the pixel.

Impulse noise detection and noise filtering are performed under the following conditions:

If $$X0NL$$>$$X0(i,j)$$>$$X0HL$$

{$$X0(i,j)$$ it is noiseless pixel }

$$X0(i,j) = X0NL$$

Else

{$$X0(i,j)$$ noisy values;}

Determine the median value}

$$X0(i,j)=X_{med}$$

end

**Fig. 4 Results for restoration and improvement 20% damaged image “baby”**

**Table 1: PSNR value of various filters**

| Filters        | Lena  | Penguin | Peppers | Baby | Cameraman |
|----------------|-------|---------|---------|------|-----------|
| Noisy          | 17.08 | 17.84   | 17.22   | 17.20| 21.78     |
| Median Filter  | 17.92 | 18.04   | 18.08   | 18.08| 22.29     |
| Weighted MF    | 18.02 | 22.91   | 22.32   | 21.38| 23.52     |
| Center WFM     | 10.12 | 19.21   | 19.05   | 19.27| 22.63     |
| Adaptive CWMF  | 10.68 | 22.11   | 25.07   | 25.05| 28.65     |
| Asymmetric Trimmed median Filter | 28.16 | 28.64 | 27.68 | 28.49 | 26.54 |

**Fig. 5 PSNR value of various filters**

Fig. 4 shows that filters that are applied on image baby. And Table 1 is various filters applied on different kind of images such as Lena, Penguin, Peppers, Baby and Cameraman. Results analyzed in Fig. 5 PSNR values in ATMF is more than the other filters hence we can conclude that ATMF is good among these.

**Table 2: Average PSNR values for input image database of size 700**

| Filtering Method | PSNR value |
|------------------|------------|
| Noisy image      | 18.06      |
| MF               | 20.34      |
| WMF              | 21.16      |
| CWMF             | 19.92      |
| ACWMF            | 27.42      |
| ATMF             | 28.12      |

**Fig. 6 PSNR values for image database**

The overall performance is shown in Fig.6. The denoised percentage result asymmetric Trimmed Median Filter (Proposed filter). This is better when compared to researched filter.
IV. CONCLUSION AND FUTURE WORK

In this paper we suggested that the novel accession by applying the multiple filers and proposed the comparative study based on the PSNR, MSE, values of the input image. Image denoising can be done using the different techniques in the existing system. The image will be initially performed de noising of random impulse noise by using the multiple level noise of 10, 20, to 50%. And multiple techniques can give the various results based on the features of images which are applied to them. So in the suggested novel algorithm scheme to overcome some issues of the current scheme. Adaptive methods assist enhance the quality of images that have been rebuilt. The method's quantitative analysis has been assessed. The findings of MATLAB demonstrate that the image quality is significantly enhanced.

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