Image Processing Discrete Wave Transform Using Non Linear Filters

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ABSTRACT:- Noise compression from images is one of the most important concerns in image processing. There are different type of noise are present in Image processing like Impulse noise,Salt nd pepper Noise,Gaussian Noise etc. For removing these noise different type of filter are used. For this, we proposed method for 5x5 matrix window are used.

In proposed algorithm for the restoration of gray images that are highly corrupted by impulse noise We use the matrix of 5 *5 for detection and correction of noise pixel. There are many method for removing noise pixel for that we used to phases for detecting and correcting the noise pixel. First phase detects whether the processing pixel is corrupted or not,and in Second phase correct the corrupted pixel.After removing noise in image be calculate the peak signal to noise ratio(PSNR) and comper the result with different technique.

Keywords: decision based unsymmetrical median, median filter, mid-point filter, and salt and pepper noise.

I. INTRODUCTION

It is basically the process of removing noise from a signal. Majorly the recording devices, are in the analog and even the digital, contain some features which render them more prone to noise. To put across noise usually occurs either as the random and even the white noise and the presence of coherence, and the coherent noise brought about by the device's technique and also the manufacturing algorithms [1].

Majorly in applying the electronic sound recording devices, the basic type of noise is usually the hiss which comes as a result of continuous random electrons that affects the system and it is stimulated by the heat and the causation from the most restrictive area and the way it follows. The most commonly affected aspect is majorly the voltage which usually results to the recognition of the noise which is available and the voltage is usually associated with the output signal. normally in some cases like in the photographic film and even in the magnetic tape, it is usually detected that the basic noise is as a result of the appearance of the grains within the medium and the structure is very important in the in the realization of the noise which is introduced.

Various mechanisms are applied to ensure that the yield is highly in traduced and this is achieved in the presence of the photographic film, where it is detected that the size of the medium grain present in the voltage grains within the in the film .it is usually recorded that when the grain size appears to be large then the it yield more sensitivity and this makes it to be very important in the reduction of noise [1]. In some occasion like in magnetic tape, it is usually very different in that as the size of the grains present in the magnetic particles becomes larger then it is detected that the medium will posses more of the noise and this is the pollution of the noise. This has become a problem on its own and to counter this problem the application of the increased areas of film and even the magnetic tape are to be applied majorly to ensure that the noise is greatly reduced to the capacity that the human can adapt with.

Many mechanisms have actually been applied by various people to reduce this problem of the noise pollution .this activities have to be carried out so that the risks brought about by the noise is reduced. according to research the first commonly applied mechanism was applied by Ray Dolby in 1966.it was basically designed for very crucial application that is the Dolby Type A which was a decode and even the encode system where the amplitude present in the frequencies of approximately four bands became higher due to the recording activity in that during the encoding it was denoted that the increase as compared to during the decoding where various problems were incurred in that there was a very great decrease availed.

The second mechanism was the Dolby B system which was very important and it was basically made for the consumer consumption products and during its action it was recorded that it only applied a single band system which was highly preferred over very many others .normally while carrying out the work of encoding it is very necessary that the aspects which are very crucial are not left behind as this will give more noise. while putting down the specific parts of the audio signal [2],it is very important that the frequencies which is more than 1 kHz should automatically be improved through other mechanisms .to achieve this I is necessary that the signal is to be increased to a given proportion relative to the volume of the audio system. this will automatically result to a very low sound which has got no effect to human and this comes as a result of the decoder which is connected.

It is denoted that the Dolby B system, is less effective relative to the Dolby A, this is because the type B is very active when it comes to the issue remaining in a stereo sound as one keeps listening on the radio or any sound device but type A cannot maintain this as it lacks the decoder and this makes it not to be very effective as the type B. the invention of the Dabs was the major competing analog mechanism of noise reduction system by the David E. Blackmore, the first person to come up with dbx laboratories. majorly he applied the root-mean-squared encode and for the decode algorithm which were associated with the noise-prone increased frequencies activated and made to be very great while a specific ratio has to be given out and it is usually given by the signal fed by specific 2:1 commanders.

The other very important aspect in the dbx operated used in the whole audible bandwidth but this is the opposite in the Dolby B which was not as common as this and it could not be applied in the very open ended system. This was not the limiting factor in the attainment of the reduction in the noise but it could do this perfectly only under proper application. it is usually record that in the Analog video recordings the application of the frequency modulation for the basic luminance part very crucial in the tape at maximum level of saturation it will be denoted that the audio style noise decrease is not very important and it has got no effect therefore it should not be introduced.

II. PROBLEM STATEMENT

In a trimmed filter a 3 x3 window is selected and the corrupted pixels are rejected. Alpha Trimmed Mean Filtering (ATMF) is a symmetrical filter where the trimming is done symmetrically at both ends. Trimming of uncorrupted pixels takes place in this method and so loss of image detail and image blurring will occur. An Un symmetric Trimmed Median Filter (UTMF) is proposed to overcome the above mentioned drawback. In this UTMF, a 3x 3 window is selected and the elements are arranged in either ascending or descending order. From this the noisy pixel elements Os and 255s are eliminated, which are responsible for salt and pepper noise and the median value of the remaining pixels were taken. The corrupted pixel is replaced by this median value. Since the pixel values Os and 255s are eliminated from the selected window it is called as trimmed median filter. This method is better than ATMF, because it identifies the noise and is removed [9].

The pixel value is processed to check whether it is corrupted or not. If the gray level value lies in-between 0 and 255 it is not corrupted and is left unchanged. Else it is a corrupted pixel and is processed by the proposed filter. The steps of the algorithm are as follows.

ALGORITHM

Step 1: Select 2-D window of size 3 x 3. Let P (i,j) be the processing pixel .

Step 2: Check whether processing pixel P (i,j) is corrupted or not.

Step 3: If P (i,j) is an uncorrupted pixel then its value is left unchanged. This is illustrated in Case iii) of Section IV.

Step 4: If P (i,j) 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 O's and 255's. Then replace with the mean of the preprocessed neighborhood pixels by means of a midpoint filter.

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

Step 5: Repeat steps 1 to 4 until all the pixels in the entire image are processed.

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 O's or 255's is illustrated in Ca se 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). Case i): If the selected window contains salt and 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: An example is illustrated

0	255	0
0	255	255
255	0	255

Fig 1: 3x3 widow m the process matrix

Where "255" is processing pixel, i.e., P (i,j). Since all the elements surrounding are O's and 255's. If one takes the median value it will be either 0 or 255 which is again noisy. To solve this problem, the mean of the previously processed neighborhood pixels from the selected window is found and the processing pixel is replaced by the mean value. And for finding this mean value we go for a midpoint filter. Let P is the processing matrix and P' is the processed matrix. Consider a 3x3 window in the processing matrix as shown below.

P' (i-1,j-1)	**P' (i-1,j)**	**P'(i-1,j+1)**
P' (i,j-1)	< P (i,j) >	P (i,j+1)
P (i+1,j-1)	P (i+1,j)	P (i+1,j+1)

Fig 2: 3x3 widow m the process matrix

In cases where the processing pixel is corrupted and all the surrounding pixels are noisy, we replace that processing pixel by finding the mean of the previously processed neighborhood pixels. Here we find the mean of [P' (i-l,j-l) , P' (i-l,j), P '(i-l,j+l), P' (i,j-l)], previously processed neighborhood elements, with the help of a midpoint filter and will replace the processing pixel by that value.

III. PROPOSED METHODOLOGY

Peak signal-to-noise ratio, often abbreviated PSNR, is an engineering term for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. Because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibel scale.

PSNR is most commonly used to measure the quality of reconstruction of lossy compression codecs (e.g., for image compression). The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codecs, PSNR is an approximation to human perception of reconstruction quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality, in some cases it may not. One has to be extremely careful with the range of validity of this metric; it is only conclusively valid when it is used to compare results from the same codec (or codec type) and same content.

$$\text{PSNR in dB} = 10\ \log_{10} \frac{255^2}{MSE} \quad (1)$$

$$\text{MSE} = \frac{\sum_i \sum_j (Y(i,j) - \hat{Y}(i,j))^2}{M \times N} \quad (2)$$

We propose the 5*5 matrix by replace the 3*3 matrix. Matrix replacement give the paper and salt noise in large number of pixels .

ALGORITHM

Step 1: Select 2-D window of size 5*5. Let B (i,j) be the processing pixel .

Step 2: Check whether processing pixel B (i,j) is corrupted or not.

Step 3: If B (i,j) is an uncorrupted pixel then its value is left unchanged.

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Step 4: If the selected window contains not all elements as O's and 255's. Then eliminate 255's and O's and find the median value of the remaining elements. Replace with the median value.

Step 5: Repeat steps 1 to 4 until all the pixels in the entire image are processed.

```
for i=3:a-2
    for j=3:b-2
        if B(i,j)==255 || B(i,j)==0
            X = [B(i-2,j-2),B(i-2,j-1),B(i-2,j),B(i-2,j+1),B(i-2,j+2),...
                B(i-1,j-2),B(i-1,j-1),B(i-1,j),B(i-1,j+1),B(i-1,j+2),...
                B(i,j-2),B(i,j-1),B(i,j+1),B(i,j+2),...
                B(i+1,j-2),B(i+1,j-1),B(i+1,j),B(i+1,j+1),B(i+1,j+2)...
                B(i+2,j-2),B(i+2,j-1),B(i+2,j),B(i+2,j+1),B(i+2,j+2)];
            B(i,j) = mean(X);
        end
        MSE2(i,j)=(B(i,j)-I(i,j))^2;
```

As the above design code is describing ,if B(i,j) = 255 or 0 then store the all the nearby pixels in X. Then find the mean of all the store pixels values which is storing B(i,j).

MSE22(k) = sum(sum(MSE2))/(a*b);

For calculate the MSE for the proposed methodology ,use the equation 2 .

PSNR22(k) = 10*log10(double(max(max(B))^2/MSE22(k)));

For calculate the PSNR , use the equation 1.

IV. RESULTS

The sample image are shown in figure 3 . Introducing the impulse noise in fig 3 . Set the level of the impulse noise at 0, 0.001, 0.02, 0.05, 0.1, 0.2, 0.5, 0.8, 0.9,1 . The value of MSE and PSNR are checking at below given values .

Figure 3 :- Sample Image

```
ND = [0,0.001,0.02,0.05,0.1,0.2,0.5,0.8,0.9,1];  %
```

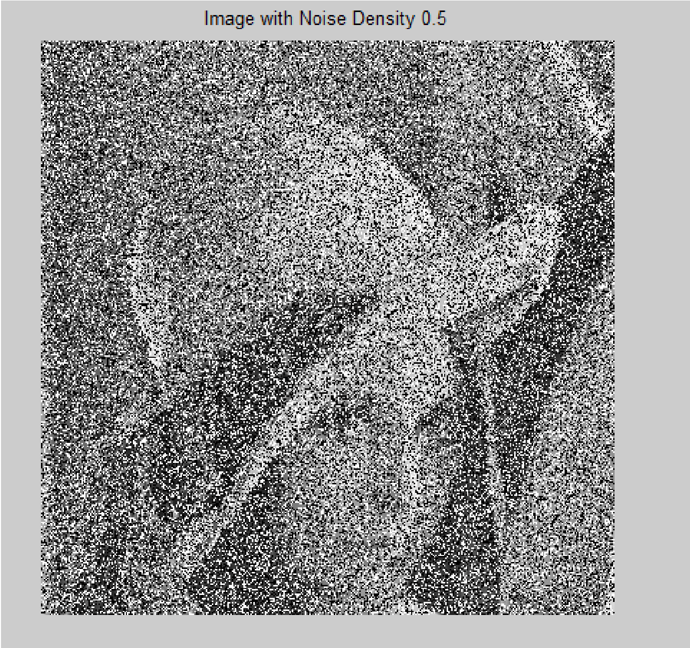

Figure 4:- Noisy Image

Figure 5:- After remove the noise

Noise Level	Proposed Algorithm		Base Paper Algorithm	
	MSE	PSNR	MSE	PSNR
0	0	24.0654	0	24.0654
0.001	0.0261	24.0654	0.0205	24.0654
0.02	0.5467	24.0654	0.4090	24.0654
0.05	1.6406	21.9033	1.5050	22.2789

0.1	4.0887	17.9239	4.3460	17.7085
0.2	11.2209	13.6173	12.9976	13.0103
0.5	43.1076	7.7815	47.8327	6.9897
0.8	82.1463	4.7712	87.2308	4.7712
0.9	96.0008	4.7712	101.5913	4.7712
1	109.8962	3.0103	115.5774	3.0103

Table 1 :- Comparison table

Comparison table is showing the results of the MSE and PSNR in between proposed and Base paper .

1. MSE Comparison

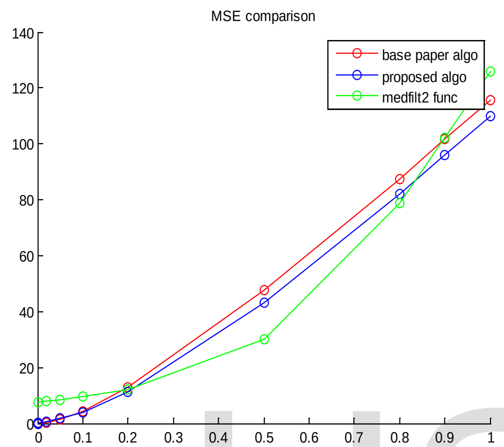

Fig 4:- Comparison of MSE for Proposed and base paper values

As the MSE graph is showing the value of proposed algo is low from the base paper .

2. PSNR Comparison

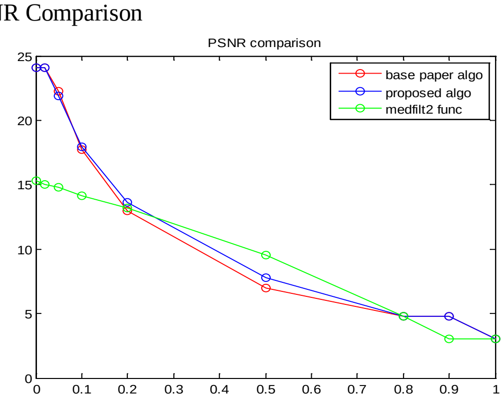

Fig 5 :- Comparison of PSNR for Proposed and base paper values

As the PSNR graph is showing the value of proposed algo is high from the base paper PSNR values .

V.CONCLUSION

The proposed algorithm presents a new approach to improve PSNR of highly corrupted images. This method gives an acceptable and recognizable restoration of image corrupted with noise as high as 90%. Unlike some filtering mechanisms which require iterations, and thus consumed lengthy processing time, the proposed filter only need to be applied once and is very efficient with its computational time. According to the experimental results, the proposed method is superior to the conventional methods in perceptual image\ quality, and it can provide quite a stable performance over a wide variety of images with various noise densities. One of the advantages of this method is that this method does not need the threshold parameter. Simulation results shows that this method always produces good output, even when tested with high level of noise. Thus, the proposed filter is able to suppress low to high density of salt and pepper noise, at the same time preserving fine image details, edges and textures weil. In criminology, the chances of occurring salt and pepper noise in digital images are so high. The images captured through CCTV camera may get blurred. In such cases we can use the proposed method in the preprocessing stage of captured image. After preprocessing the blurring is removed and thus the perceptional quality of image increases.

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