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Hybridization of DBA-DWT Algorithm for Enhancement and Restoration of Impulse Noise Image

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ABSTRACT

Data is transmitted as image or video. Later communication, the image found is frequently degraded with noise. The corrupted values in extreme ranges are called as salt and pepper noise. The filtering is generally utilized for elimination of impulse noise or salt and pepper noise for noise free images and are fully recovered by minimum signal distortion and furthermore uncorrupted the images. Median filter is utilized to remove the salt and pepper noise from the image. Median works in low densities however not in higher densities in light of the fact that at higher densities the images are blurred and damages the image. To overcome this a novel Decision based Algorithm with Discrete wavelet transform method is proposed. It works well in higher density conditions then discrete wavelet transform has been useful to the result of the decision based algorithm processed by image enhancement technique. Firstly the restored Image has been converted to HSV color transformation that is Hue, Saturation and Value. Later, luminance intensity of low frequency component of value (V) component is enhanced. It is then followed by contrast enhancement technique, resulted in modified (V) component. The adapted (V) component is combined with Hue (H) and Saturation (S) and converted back into enhanced RGB image. Experimental results improve the Images which are captured at low-light and non-uniform lighting condition as in several standard Images as well as in real time Image.

Keywords: Median Filter, DBA, Impulse Noise, Salt and Pepper Noise, DWT, Noise Reduction.

I. INTRODUCTION

There is an immense Advancement in computers and digital imaging technologies because of this, the expenses of advanced cameras and PCs are bringing down every year, and hence these gears are getting to be noticeably reasonable nowadays. The utilization of digital images in our day by day life is turning normal. As the more data can be separated from advanced images, contrasted with one dimensional signal, many research areas, including material explores, are currently using computerized pictures, for example, microscopic pictures and X-ray pictures, as one of their assessment instruments. The images which are degraded by impulse or undesirable random differences in intensity values called noise. The images have been ruined by where the images are stored at default memory area in arrangement of equipment and the images are damaged by a noisy transmission channel. Digital images have been influenced by impulse noise where the camera sensors are defective.

Impulse noise can be expected as an additive noise [1], and the pixel is harmed randomly at random positions. [2].Normally, impulse noise will be showed up as highly contrasting spots on the picture [3]. Pixels are damaged by impulse noise has regularly either amazingly high or extremely low intensity values [4]. Generally, they have high differentiation towards their perfect, uncorrupted smooth encompassing zones [5]. Along these lines, impulse noise, even at a low level of degradation, will harm the presence of computerized picture significantly [6]. Much imperative data will be changed by this noise. As an outcome, the impulse noise likewise may make a completely programmed vision based framework to give mistaken outcome. In light of

this issue, numerous analysts around the world have put their serious efforts in seeking appropriate strategies that can diminish the level of corruption by the impulse noise. Such sort of digital image rebuilding strategy requires the analysts artificially add the impulse noise to set of test images so as to assess the execution of their proposed techniques.

The filtered image is contrasted by the assessments typically and the misleadingly degraded image. In any case, analysts have described impulse noise by numerous ways. The great number of scientific conditions has been recommended by analyst in written works to show impulse noise [7].Image enhancement is the area in which an image is processed so the outcome is more suitable than the original image for examination by people or machines [8]. Change of an image from one form to another reduces the quality of the image. The estimation of these corrupted images can be improved by utilizing enhancement methods. Image enhancement method increases the intensity of the image. So relying on the application distinctive enhancement strategies is adopted. Image enhancement sharpens features like edges, boundaries, contrast, etc.

The organization of this paper is as follows. Later this introduction section, Section II discusses previous Method. We will present our research approach in Section III. Experimental results on different images are presented in Section IV. Finally, Section V concludes the proposed algorithm.

II. RELATED WORKS

In this part, we cover the significant journalism of Impulse noise finding by Median filtering Method.

Median filter is regularly used to diminish noise in an image, to some degree like the mean filter. In any case, it regularly makes a better job with regards to than the mean filter of additive valuable component in the image. Similar the mean filter, the median filter reflects about every pixel in the image in turn and looks at its close-by neighbors to choose whether or not it is normal for its environment. Rather than essentially replacing the pixel value with the mean of close pixel values, it replaces it with the middle of those values. The median is designed by first strategy of all the pixel values from the nearby neighborhood into numerical order and after that replacing the pixel being measured with the center pixel value.

Median filter [9] and its improvements mainly have the problems as followed:

(1) Although the filter with small filter window can maintain good image details and edges, it cannot filter all the noise. On the other hand, a bigger filter window would have a good effect on noise filtering, but it cannot preserve image details and edges, which would lead to fuzz and distortion in image.
(2) The selection of filter window size depends on the noise intensity, which needs a prior knowledge of the image.
(3) Median filter compliments at high densities and cannot be removed effectually.

III. PROPOSED SYSTEM

An overall architecture of the proposed method has been shown in Figure 1. We had first proposed the restoration algorithm for a re-establishment of a noisy image corrupted by noise. Create a noisy RGB image by increase of salt and pepper noise to unique shading picture. This takes salt and pepper independently on every R, G, and B shading channel so the noise might be hued. Each channel processed separately by the proposed algorithms to get the restored demised R, G, and B channel. Using this, reconstruction of RGB noise-free color image is obtained and then restored image is then deals with an enhancement technique.

In perspective of a 3×3 rectangular mask on the corrupted image and DBA helpful to it with the image intensity ranges from 0 to 255.here we need to recover the image by eliminating salt and pepper noise from the destroyed image. The DBA is isolated into two sections. To start with check the handling component is noise or noise free. In the previous stage, just the noisy component being prepared and noise free component left unchanged. If the component is noisy, then it will be processed by spatial filtering depending on the neighborhood of the handling element within a mask. Sort the mask elements in rising order and compute the median value of the mask. The median value is characterized by Y_{med} .Later depending on that median values the resulting sub-cases occur.

a) If Ymed is neither greatest (255) nor least (0) value, then replace the center processing element by median Ymed estimation of the elements inside a mask. As Ymed is of the comparable mask, consequently it has great relationship with its neighborhood component.

b) In other condition, where Ymed is a noisy component. It demonstrates that out of 9 segments, no under 5 parts are of a comparable sort both of salt or pepper noise, by then we substituted the center dealing with segment by its neighborhood processed component Y1 (I-1, j). Repeat this structure to cover the entire image and get the restored image in perspective of a decision based algorithm.

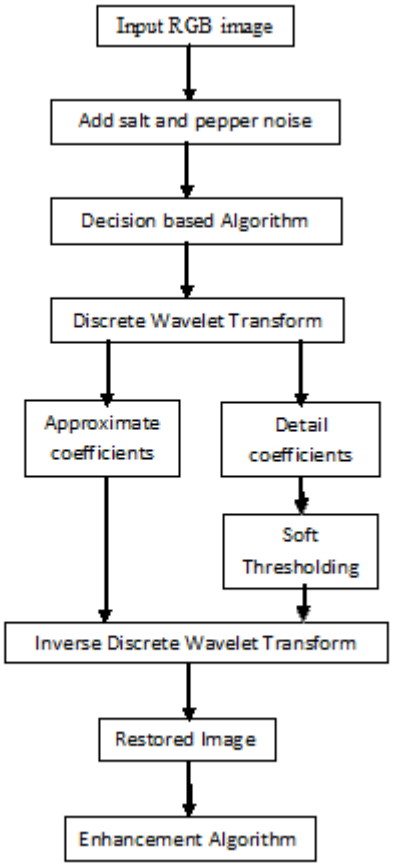


Figure 1. Flowchart of proposed algorithms for the removal of salt and pepper noise followed by Proposed Enhanced algorithm

DBA with DWT:

The result of decision based algorithm is changed over into four wavelet coefficient using 1 level Haar wavelet decomposition. For preventing the fine details and for eliminating the unwanted noise thresholding is applied on the coefficients. At the threshold of 100% maximum only the result can be estimated and using this threshold the detail coefficient can be modified. Applying inverse discrete wavelet transforms on approximated coefficient and detail coefficient to get the restored Image.

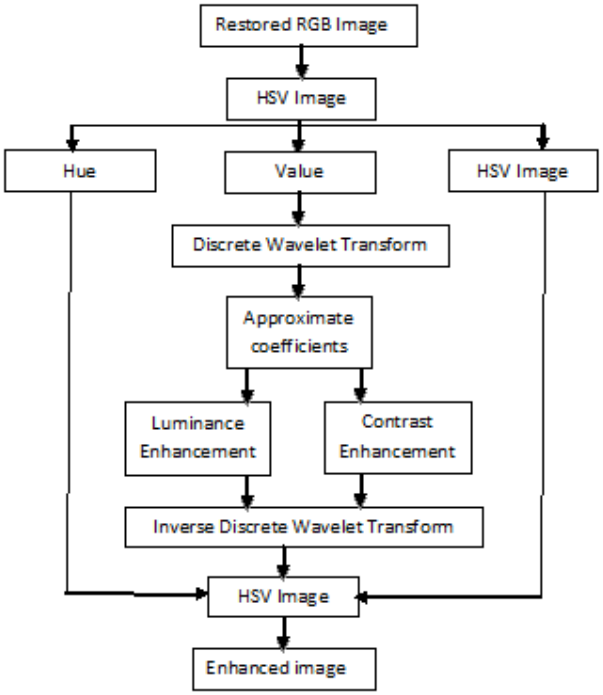


Figure 2. Flowchart of Proposed Algorithm for enhancement of the restored Image

RGB to HSV Conversion:

Convert the restored RGB color image into an HSV color image. It transforms colors from RGB space (red/green/blue) into HSV space (hue/ saturation/ value). HSV separates the image intensity or luma from the color information or Chroma.

HSV defines:

Value - (brightness) gives the amount of light in the color.

Hue -describes the dominant wavelength.

Saturation - is the amount of Hue mixed into the color.

Discrete Wavelet Transform:

After RGB to HSV conversion, all three components H, S and V are separated. The enhancement technique is applied to V component only and left H and S component unchanged. In this algorithm we have used haar discrete wavelet transform for decomposing the V component of HSV into its approximate (A) and detail (D) coefficients.

Luminance Enhancement:

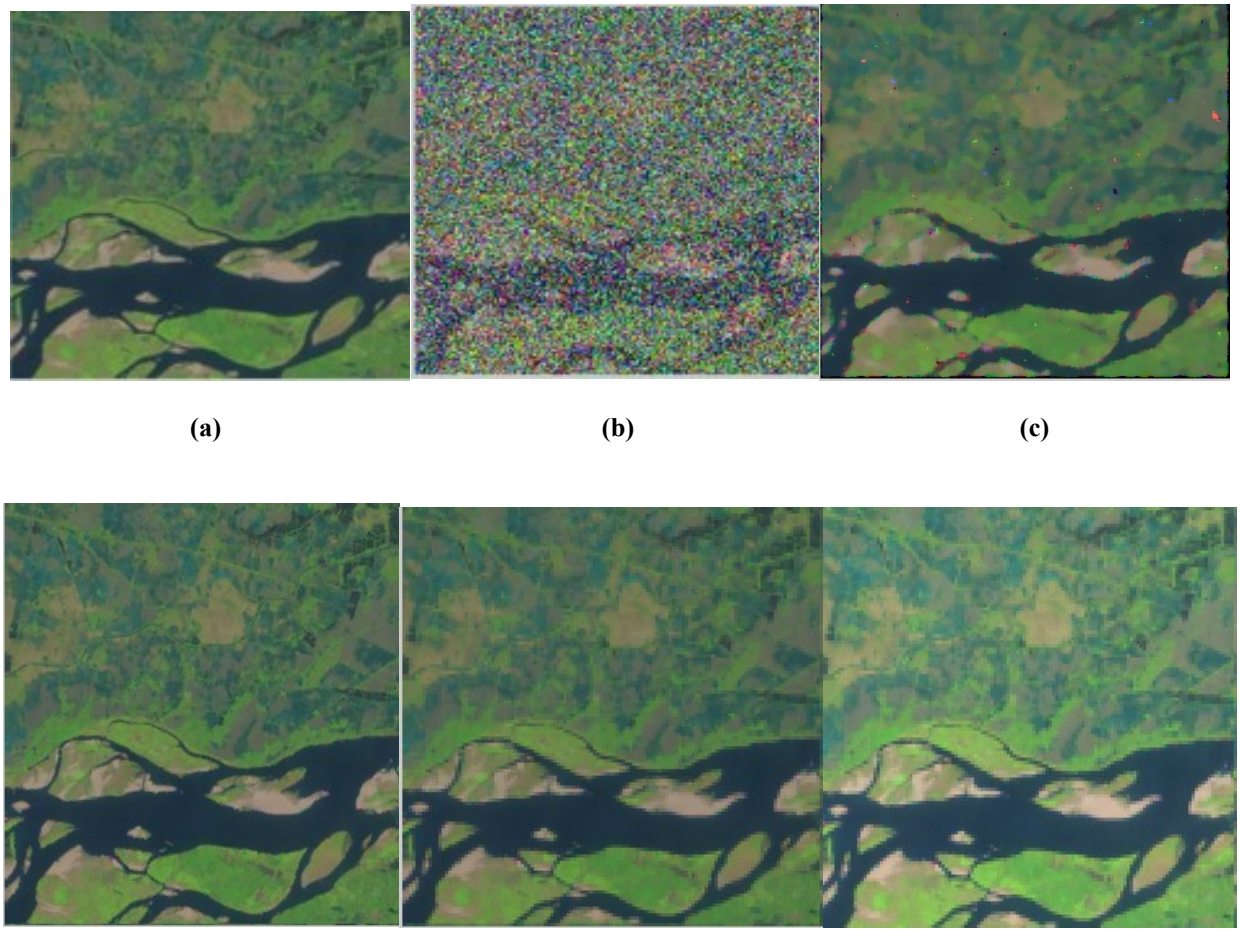
Luminance enhancement technique is applied to the approximate coefficient of the 'V' component this process also called as dynamic range compression. This technique is widely used for the brightness enhancement of the Image. Luminance enhancement increases the luminance of bright elements and decreases the luminance of dark elements.

Contrast Enhancement:

Contrast enhancement is a technique which is used to adjust the intensity values of the image. Here the contrast enhancement done on the Image using the Gaussian function After applying the Luminance Enhancement and Contrast Enhancement then the image can be modified using inverse discrete wavelet transform to get enhanced value (V) component. The enhanced value (V) component combined with H and S components in HSV space. Finally the HSV are converted back to RGB image. The RGB enhanced image is used for enhancing image capture at low-light and non-uniform lighting condition.

IV. EXPERIMENTAL RESULTS

The performance of the proposed algorithms is tested on several color images. The algorithm has been implemented and verified using Mat lab. The performance parameters [10] such as Mean Absolute Error, Mean Square Error, and Peak Signal to Noise Ratio and Signal to Noise Ratio are calculated for the restoration of noisy image.



(a) **(b)** **(c)**

(d) **(e)** **(f)**

Figure 3. (a) Original satellite image. **(b)** Noisy image **(c)** Restored output of noisy image using Median Filter. **(d)** Restored output of noisy image using proposed algorithm DBA. **(e)** Output of DBA with DWT **(f)** Enhanced output.

(a) (b) (c)

(d) (e) (f)

Figure 4. (a) Original Flower image. **(b)** Noisy image **(c)** Restored output of noisy image using Median Filter. **(d)** Restored output of noisy image using proposed algorithm DBA. **(e)** Output of DBA with DWT **(f)** Enhanced output.

Mean Square Error:
It measures the normal of the total square error between the first and the recreated image. The MSE is registered as

MSE =sum ((sum (f(i,j) - $f^{|}$(i, j)). ^2)/ (m*n))

Peak Signal to Noise Ratio:

It measures the nature of reconstructed image contrasted and the first image and a standard approach to quantify image fidelity.
PSNR =10*log10 (255*255/MSE)

Signal-to-noise Ratio:
It is defined as the ratio of the power of a signal and the power of background noise

SNR =10*log10 (P_{signa}l/P_{noise})

Mean Absolute Error:
It is a measure of difference between two continuous variables.

MAE =$\frac{\sum_{i=1}^{n} |y_i - x_i|}{n}$

Table 1. PERFORMANCE PARAMETER OF DIFFERENT METHODS ON SATELLITE IMAGE

Algorithm/Parameters	MAE	MSE	PSNR	SNR
Median Filter	18.42381	142.76415	26.61861	0.03112
DBA With DWT	4.98817	27.16421	33.82483	30.88137

V. CONCLUSION

This paper proposed algorithms for the restoration of the noisy color images, which are destroyed by impulse noise. We have also proposed a method for color image enhancement in HSV space using luminance and contrast enhancement concept. The reconstructed image is enhanced to increase the visibility of the image so that it is more suitable for display and even for further image analysis. The proposed approach works well for low illumination and low contrast images. The algorithm provides more edge information, more important to better edge preservation as well as better Human & visual perception and shows reliable and stable performance.

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