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Hybrid Model for Preserving Brightness over the Digital Image Processing

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Abstract

Many researchers implement different types of organizations like image restoration, image enhancement, color image processing, image segmentation etc. Image enhancement technique is among the simplest and most appealing area of digital image processing. Enhancement techniques like brightness preservation, contrast enhancement highlight certain features means depend which part of the image want to be enhance some application some input image including noise, reduction or removal of noise is also form of image enhancement. Brightness preservation has enhanced visual quality of digital image so that the limitation contained in these images is used for various applications in a better way. A very popular technique for image enhancement is histogram equalization (HE). HE technique is commonly employed for image enhancement because of its simplicity and comparatively better performance on almost all types of images. This paper design a hybrid model through discrete cosine transformation, discrete wavelet transformation and combine output of both techniques with image fusion. Proposed algorithm enhanced features and removal noise by decomposition of image using DWT and discrete cosine transformation, adaptive histogram equalization is very important part in this algorithm for smooth image. The tested results of different images are comparing with previous method, generating result with different parameters; less mean square error and high PSNR for improve the quality of an image.

***Keywords**: Brightness Preservation; Hybrid Transformation; Image Fusion*

1.Introduction

The input images that are captured by these devices are sometimes not really in good brightness and contrast. Therefore, a process known as digital image enhancement is normally required to increase the quality of these low brightness images. The objective of image enhancement techniques is to improve a quality of an image such that enhanced image is better than the original image. Several image enhancement techniques have been proposed in both spatial and transform domains. In the spatial domain techniques, intensity values of images have been modified whereas in the transform domain techniques, transform domain coefficients are modified, typically, scaled .Image enhancement produces an output image that subjectively looks better than the original image by changing the pixel's intensity of the input image .The reason of image enhancement is to improve the interpretability or perception of information contained in the image for individual viewers, or to make available an improved input for other automated image processing systems. It plays an important role in the use of images in various applications like cancer and tumor detection, medical image processing, radar image processing etc.

In this paper proposed method included discrete cosine transformation and DWT with Haar transformation for enhance an image brightness or contrast and also remove noise. Result of proposed method is passed through image fusion technique then applies inverse DWT of reconstruct the image for better visual quality and reduces noise.

2. Hybrid Transformation

This paper processes a hybrid transformation technique ,where the identify of bright regions of image by Curvelet transformation and for image compression and reduced noise using discrete wavelets transformation .the advantages of this approach include the potential for improving the brightness and efficiency of image. A very popular technique for image enhancement is histogram equalization (HE). HE technique is commonly employed for image enhancement because of its simplicity and comparatively better performance on almost all types of images.

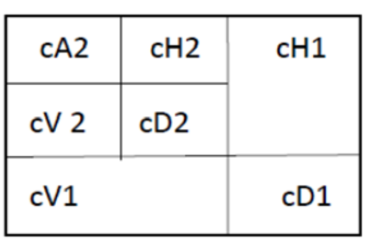
Hybrid transformation model, can be classified in to three parts:

- Discrete cosine transformation
- DWT using Haar transformation
- Image fusion

2.1 Discrete cosine transformation
Discrete cosine transformation, “DCT”, can linearly transform images from spatial domain to frequency domain, where the image can be represented by set of coefficients or separate the image into low and high sub-band with respect to the image visual quality.

2.2 Discrete Wavelet Transformation Using Haar Wavelet

In case of one-dimensional image, after a DWT transform using Haar basis functions, suppose input image given a one dimension image with the resolution of 256 pixels. The Haar wavelet transform divided image into four corners, upper left corner of the original image, lower left corner of the vertical details, upper right corner of the horizontal details, lower right corner of the component of the original image detail (high frequency), shown as in “Fig.1”.



“Fig1. Decomposition using DWT”

The Haar wavelet transformation decomposed an image by averaging the pixels together to get a new resolution image. To recover the original image pixels from the two averaged pixels and store some detail coefficients. Repeating this process on the averages gives the full decomposition. Imaging related operation with ties multi resolution analysis i.e. Haar transformation [2]. The Haar transform itself is both separable and symmetric and can be expressed in matrix form, for one dimensional Haar wavelet decomposition of each row of the original image pixel values and each column of the row transformed matrix. The Haar transformed performed in levels. At each level image is divided in two components with half of its length: an approximation and detail coefficients.

2.3. Image Fusion
Image fusion is a process of combining the relevant information form a set of images, into a single image where in the resultant image fused image .the primitive fusion scheme perform the fusion right on the source images. This would include operation like averaging, addition, subtraction or summation of the pixels intensities of the input image to be fused. Image fusion can be divided into three levels: pixel-level fusion, feature-level fusion and decision-level. Pixel-level fusion is lowest processing level, in this level physical parameter like size, edge, noise etc. of image are merging and its application is very wide. At this level it has the details on the information which other levels do not have. The data level fusion is also called pixel level fusion, which means the direct process of data taken from any source. The merit of this fusion method is keeping the living original data as much as possible, which provides the details those other level fusion methods, cannot supply.

3. Proposed Methodology

This paper shows the proposed methodology with proposed architecture and algorithm as shown below:

3.1 Architecture Of Hybrid Transformation Model
Hybrid transformation model as in “Fig 2”.this model is consist of six components-
1. Load Input Image
2. DWT Using Haar Wavelet
3. Discrete Cosine Transformation
4. Image Fusion

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5. Inverse DWT
6. Output Image

1) Load Input Image

a) take an image like 'lena.jpeg'.

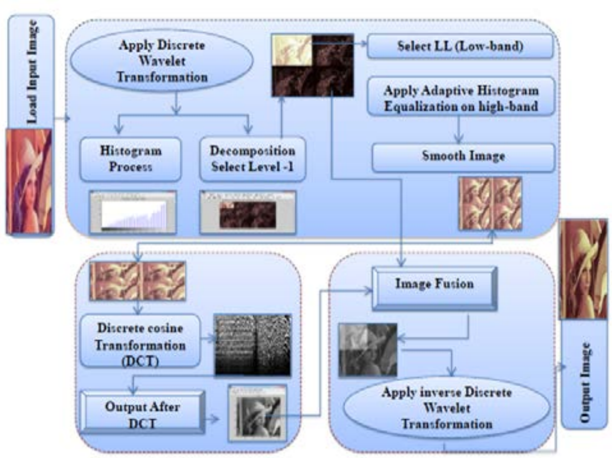
b) load image into two coordinates (I,MAP) where, I is intensity value of load input image and MAP is probability of color image map range is 256×3.

2) DWT Using Haar Wavelet

a) Find the histogram of input image. This histogram shows the distribution of pixel value above color bar of the color map. The color map, must be at least as long as the largest index in I. After, find histogram image I create array returns the size of matrix I in variable row and column.

b) Now, apply DWT, first select level=1 For decomposition of image. According to level, image is divide in to four parts cA approximation coefficients, and cH,cV, cD,detail coefficients.

c) Now select cA coefficient part and create a matrix of cA pixel values, find total no of pixel in coefficient part by multiplication of row and column. then repeat this process for next level. In this level decomposition of only cA part not detail coefficient part because this process is identified only low-band in image.



"Fig 2. Architecture of hybrid transformation model"

After decomposition of image for enhance the brightness of the image by transforming the value using adaptive histogram equalization operation on small regions in the image called tiles image ,rather than the entire image brightness, especially in homogeneous areas,

d) noise presented in the image for detecting noise on this area is limited.

e) Two element vector of positive integer specifing the no of tiles by row and column [M,N]. Both M,N must be at least 2,the total no of tiles is equal to M×N, by default value of M by N is 8×8.After apply of adaptive histogram equalization image will be smooth image.

3) Discrete Cosine Transformation Technique

a) Smooth image passed through DCT.DCT is used for contrast enhancement, it perfomed input image as 8×8 sub block in array of integer, this array contains each pixels gray scale level.

b) For gray scale images, pixels of this type images lies at low frequencies; these appear in the upper left corner of the DCT. For enhancement since the low frequencies values represent higher frequencies, and are very low frequencies values presented in the image to be neglected with low vision distortion. This is used for better contrast and noise free input image.

4) Image Fusion

a) Image fusion is process of combining the relevant information from a set of image, into a single image.

b) In this model used pixel level image fusion means image is fused by intensity of pixel in low band and high band.

c) In this architecture select low band image by dwt and contrast enhance image by DCT are fused by image fusion technique Maintaining the Integrity of the Specifications.

5) Inverse DWT

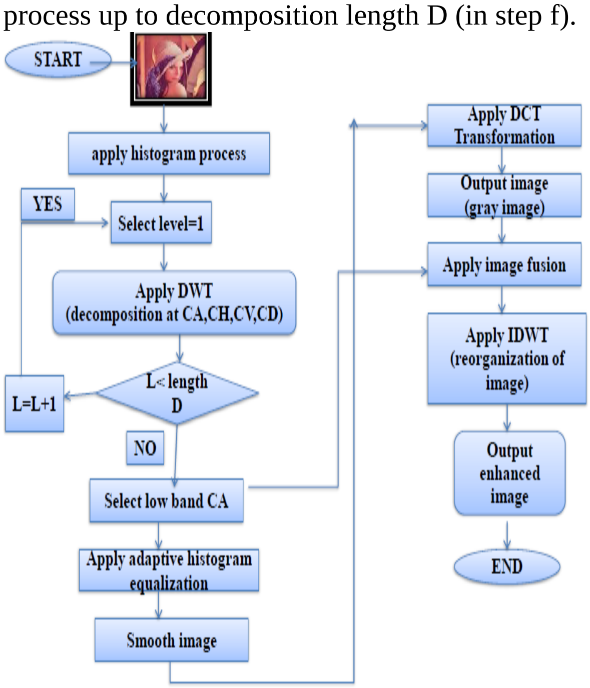
After image fusion result apply inverse dwt on fused image, after inverse DWT intensity level of pixels are recognized or restored image domain.

6) Output Image

After the process of hybrid transformation image is enhanced by contrast, preserving brightness and noise free image will generate.

3.2Algorithm of hybrid transformation

Steps in the hybrid transformation algorithm show, as in “Fig. 3”.
a) Start
b) Load input image for example I=‘lena.jpeg’. Create MAP for stored in M×N matrix form with range 256×3.after MAP image is stored in [M, N] = (I, MAP).
c) Apply histogram process for find intensity level of pixel in input image. After find histogram of image ‘I’ create an array and return the size of matrix ‘I’ in variable row and column.
d) Select level = 1 then apply DWT, image is decomposed in to four part, Approximation coefficient storage cA, Horizontal detail coefficient cH, storage. Vertical detail coefficient cV storage, Diagonal detail coefficient cD storage. Repeat the process up to decomposition length D (in step f).



“Fig.3 algorithm of hybrid transformation model”

e)Select cA part and create matrix of cA, find total no of pixels (M×N).
f) Select epsilon = 0.4.Decompose the Coefficient part of image for find length of decomposition level by
D= (log(x (m, n)) +epsilon/total no of pixel
g) Select low band cA; apply adaptive histogram equalization for smooth tiled image.
h) Smooth image passed through discrete cosine transformation output image is contrast enhanced in gray scale.
i) Apply pixel level image fusion on cA part gray image after DCT process.
j) Apply inverse DWT for reorganization of approximate and detailed coefficient part of image .after restoration of image .output image is preserving brightness and noise free with better visual quality then input image.
k) Exit.

4. Experimental Result Analysis

The performance of the method is measured in terms of the following significant parameters -PSNR (peak signal to noise ratio), MSE (mean square error), NAE (normalized absolute error), and NCC (Normalized Cross-correlation).

PSNR is used to quantitatively asses the contrast enhancement. Assuming that M*Nis the total no of pixel in the input or output image.

PSNR is calculated using the following equation –

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

Where, MAX is the maximum possible pixel value of the image.
NAE is used for Image quality measures are calculated for a distorted image with reference to an original image. The greater PSNR is better the output image quality.
MSE is the error metrics used to compare image compression quality. The MSE represents the cumulative squared error between the compressed and the original image. The lower value of MSE, output image is free from error like noise.
NAE is used for find error between original image and distorted image

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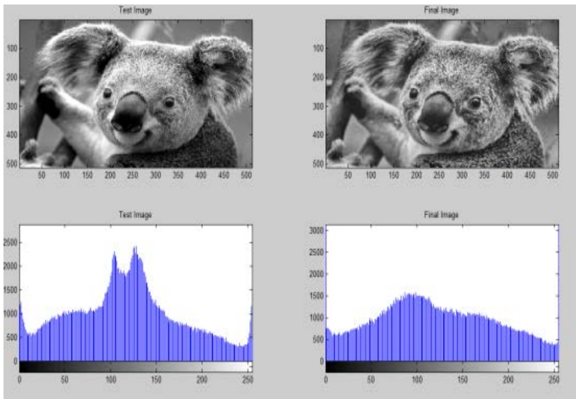
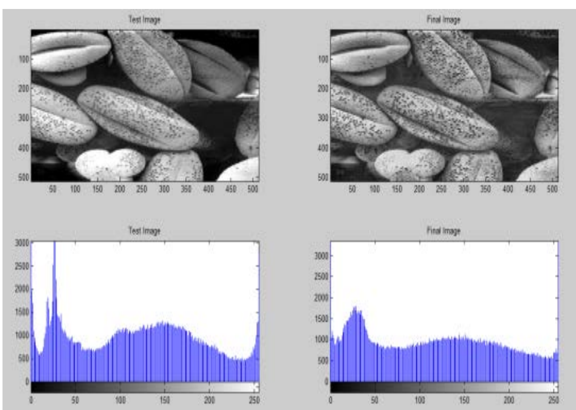
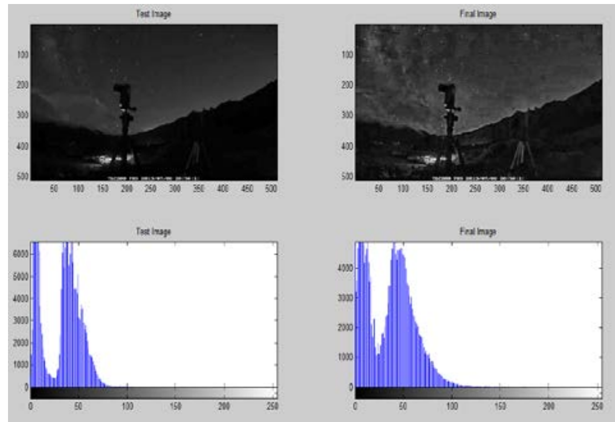
$$\mathrm{NAE} = \frac{\sum abs(error)}{\sum (orignal\ image)}$$

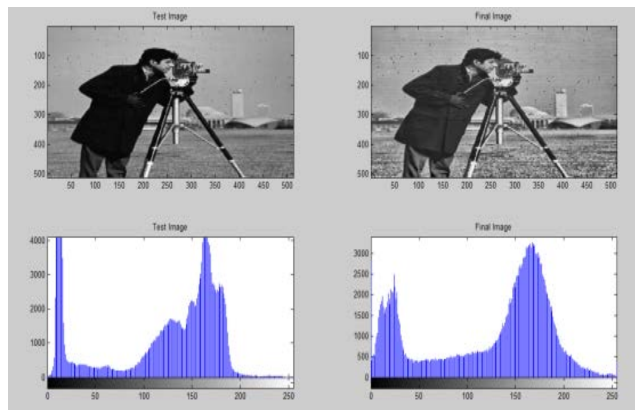
Where, Error = original image – distorted image





"fig4.Input image and output image and their histograms"





IMAGES	PSNR	MSE	NAE
Koala	29.0333	81.2364	0.0588
Nature	41.2036	4.8132	3.8147e-006
Seed	29.7710	68.5464	0.0553
Photography	32.1299	39.8193	0.0131

"Table 1. Comparison table"

5.Conclusion

This presents a new hybrid transformation model based on DCT, DWT and image fusion. For preserving brightness, contrast enhancement and reducing noise for high brightness and low contrast images. Performance of this technique has been compared with IDBPHE. The result show that the proposed method gives better performance in terms of brightness and contrast of the enhanced image. Thus this model can be consider, suitable for preserving brightness and reducing noise for low contrast and high brightness images. In future this approach can be used in improving the satellite images and medical science.

We concluded that,in histogram of output image the intensity of peak values are equalized as compared to the histogram of input image. .So,the brightness of the image is preserved.Also it has good performance on enhancing contrast and visibilility for a majority of images.

6.References

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