IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Impact Factor: 6.252

Volume 2, Issue 7, June 2022

Contrast Enhancement of Gray Image Using Discrete Cosine Transform

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Abstract: *In this paper a new method for contrast enhancement based on the discrete cosine transform is discussed and implemented. The technique converts the image into DCT domain and the DCT coefficients are modified using proposed mask then the enhanced image is reconstructed using inverse DCT. The discrete cosine transform outperforms with better image quality and with highest PSNR value.*

Keywords: Contrast, PSNR, Discrete Cosine Transform, etc.

I. INTRODUCTION

Image Contrast Enhancement process enhances images quality in which features are hardly detectable by eye. It improves the visualization of features of image. Basically, contrast is developed due to luminance reflected by two surfaces. In satellite, medical field the contrast enhancement techniques are used to enhance the images brightness and contrast. Histogram equalization is one the most well-known method for contrast enhancement. This approach generally useful for images with poor intensity distribution. By enhancing edges in image enhances the contrast. Multi scale edge enhancement approach, takes all resolution levels into account MSR softens the strongest edges and keeps the faint edges almost untouched. The strategies are different, but methods allow the user to see details which were hardly distinguishable in the original image, by reducing the ratio of strong features to faint features.

The wavelet approach consists of first transforming the image using the dyadic wavelet transform. Then the two wavelet coefficients relative to the horizontal and vertical wavelet bands are modified by multiplying by constant at scale and at pixel position. Finally, the enhanced image is obtained by the inverse wavelet transform from the modified wavelet coefficients. Wavelet bases present some limitations, because they are not well adapted to the detection of highly anisotropic elements, such as alignments in an image, or sheets in a cube. In DCT approach by modifying DCT coefficients of sub images can enhance the image properly.

II. OVERVIEW DCT

In this paper, discrete cosine transforms for enhancing the grey image has been proposed. The DCT helps to separate the image into parts with respect to the image's visual quality. As shown in Fig. The popular block-based DCT transform segments an image non overlapping block and applies DCT to each block. It gives result in three frequency sub-bands: low frequency sub-band, mid-frequency sub-band and high frequency sub-band.

DCT based enhancement is based on two facts.

The first fact is that much of the signal energy lies at low-frequencies sub-band which contains the most important visual parts of the image. The second fact is that high frequency components of the image and it is noise.

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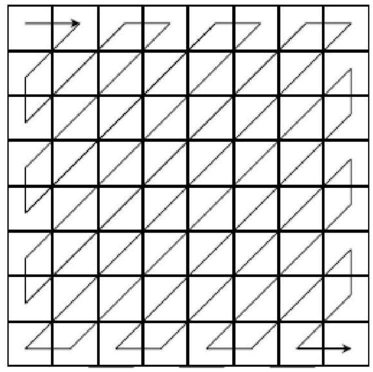

Figure 1: Zigzag Ordering of DCT Coefficients

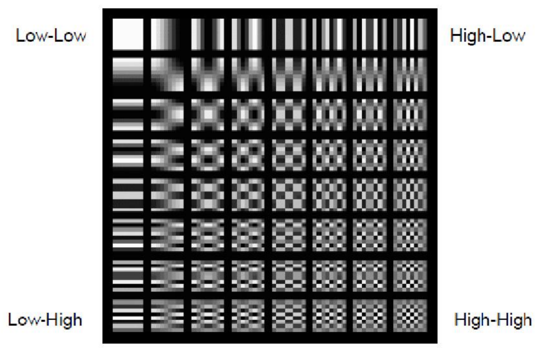

Figure 2:DCT Coefficients

M	m	m	m	m	m	m	m
M	m	m	m	m	m	m	n
M	m	m	m	m	m	n	n
M	m	m	m	m	n	n	n
M	m	m	m	n	n	n	n
M	m	m	n	n	n	n	0
M	m	n	n	n	n	0	0
M	n	n	n	n	0	0	0

Figure 3: ProposedDCT8*8 Scaling Mask

III. PROPOSED METHODOLOGY

In this paper, a technique based on discrete cosine transform has been proposed for enhancing the contrast of grey images. Discrete cosine transform is applied to extract the features of an image. The DCT converts the spatial domain into frequency domain represented by its DCT coefficients. DCT separates higher and lower frequency components in two parts.

The important information is present in low frequencyDCT coefficients. Hence separating low and high frequency coefficients and modifying DCT coefficients by multiplying proper scaling factor, a new enhanced grey image is obtained. For obtaining enhanced image from modified coefficients inverse DCT is used.Assume A is a grey image, $\bar{A}$is an enhanced image.

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The following are the steps for proposed technique.

Step1: Read a grey image A.

Step2: Divide the input image into 8*8 non-overlapping sub blocks.

Step3: Apply DCT to each sub block.

Step4: Using designed mask each sub block DCT coefficients are modified.

Step5: By applying inverse DCT reconstruct the enhanced image $\bar{A}$ from modified DCT coefficients.

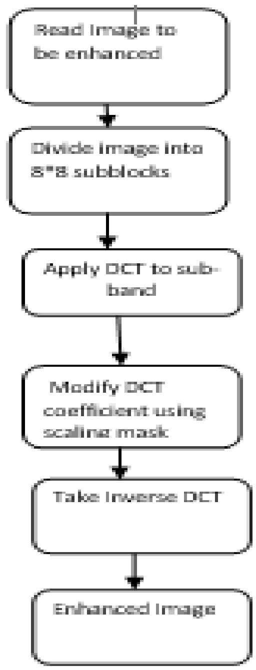

Figure 1: Flowchart

IV. RESULT

For obtaining better result different scaling factors are analyzed and best scaling factors are used to enhance the image.

Output for test image without noise

Figure 2:a) input image b) enhanced image

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Output for test image with noisy image

Figure 3:a) input noisy image b) enhanced image

Table 1: DCT Scaling factor analysis

Lena.jpg	Scaling Factor		For noiseless image		For noisy image	
Sr.no.	m	n	PSNR	Contrast	PSNR	Contrast
1	0.7000	0.8040	24.1805	0.1660	24.3919	0.7229
2	0.8000	0.8080	24.5534	0.2025	24.7919	0.8022
3	0.9000	0.8120	26.2177	0.2406	26.5022	0.8911
4	1.0000	0.8160	51.6302	0.2937	33.6584	1.0030
5	1.1000	0.8200	75.4320	0.3304	42.0890	1.1002
6	1.2000	0.8240	93.2853	0.3595	47.9023	1.1794
7	1.3000	0.8280	Inf	0.3829	51.9566	1.2449

Above table shows the PSNR and contrast values for various values of m and n scaling factor and DCT outperforms for m=1.2 and n= 0.8240.

V. CONCLUSION

From above result we conclude that for enhancement of grey image without noise discrete cosine transform outperforms but for enhancement of noisy image DCT enhances noise also so DCT can be used to enhance the noiseless images only. For noiseless image enhancement using discrete cosine transform gives highest PSNR value i.e. 96 dB.

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