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Applying the discrete cosine transform to improve the contrast of grayscale images

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ABSTRACT:

This study introduces and applies the novel discrete cosine transform-based approach for contrast enhancement. The process converts the original image into the DCT domain, adjusts the coefficients of the DCT using a proposed mask, and then reconstructs the improved image using inverse DCT. When the PSNR values are higher and the image quality is better, the discrete cosine transform performs better. This method is contrasted with the improvement method based on the discrete wavelet transform.

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

OVERVIEW OF DWT AND DCT

In this paper, discrete cosine transform for enhancing the gay image has been proposed and compared with discrete wavelet transform

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DISCRETE WAVELET TRANSFORM:

The wavelet approach consists of first transforming the image 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. The discrete wavelet transform is based on sub band coding and easy to implement. After transforming, an image is separated into approximations and detail coefficients. Approximate coefficients are high scale, low frequency components of an image. The

Fig. No.1. Decomposition of image

Fig.No.2 DWT scaling factor mask

After decomposition approximate and detail coefficients are modified using properly designed
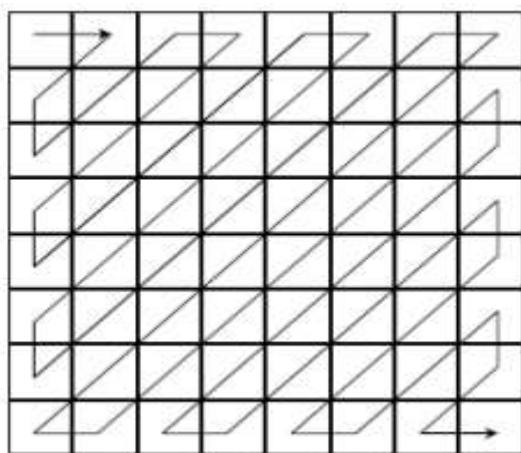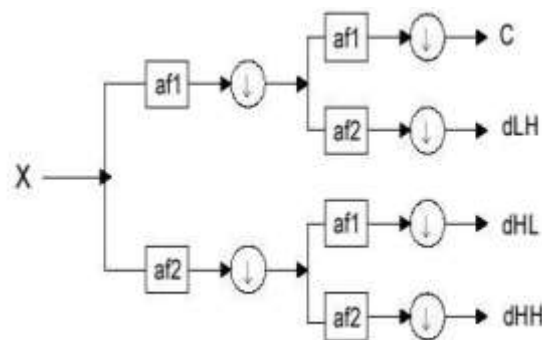

Fig.No.3. zigzag ordering of DCT coefficients

detail coefficients are low scale, high frequency components. Two-dimensional DWT leads to a decomposition of approximation coefficients at level j in four components: the approximation at

scaling factor. Then using inverse transform enhanced image is reconstructed.

DISCRETE COSINE TRANSFORM:

The DCT helps to separate the image into parts (or spectral sub-bands) of differing importance (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 subband, 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.

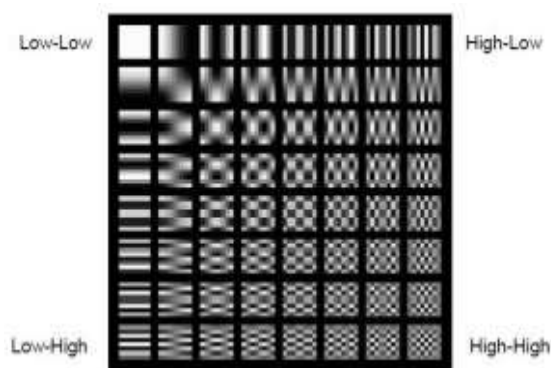**Fig.no.4 DCT Coefficients**

PROPOSED METHODOLOGY:

In this paper, a technique based on discrete cosine transform and discrete wavelet transform has been proposed and compared for enhancing the contrast of gay 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 frequency DCT coefficients. Hence separating low and high frequency coefficients and modifying DCT coefficients by multiplying proper scaling factor, a new enhanced gay image is obtained. For obtaining enhanced image from modified coefficients inverse DCT is used. Assume A is a gay image, Axis an enhanced image.

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	O
m	m	n	n	n	n	O	O
m	n	n	n	n	O	O	O

*Fig. no.5 DCT 8*8 proposed scaling mask*

The following are the steps for proposed technique. Step1: Read a Gray 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 Afro modified DCT coefficients

Results and discussion:

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

DISCRETE COSINE TRANSFORM O/P:

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

Table No.1 DCT Scaling factor analysis

DISCRETE WAVELET TRANSFORM O/P:

Fig. No.6 DWT Output for lena.jpg

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Lena.jpg	Scaling Factor				For noiseless image	
Sr. no.	m	n	p	q	PSNR	Contrast
1	1.0100	0.7080	1.0100	0.0100	43.1187	0.2856
2	1.0200	0.7160	1.0200	0.0200	44.4010	0.2915
3	1.0300	0.7240	1.0300	0.0300	45.6292	0.2954
4	1.0400	0.7320	1.0400	0.0400	46.8408	0.2987
5	1.0500	0.7400	1.0500	0.0500	48.0922	0.3025
6	1.0600	0.7480	1.0600	0.0600	49.3582	0.3052
7	1.0700	0.7560	1.0700	0.0700	50.6504	0.3095
8	1.0800	0.7640	1.0800	0.0800	52.0282	0.3114
9	1.0900	0.7720	1.0900	0.0900	53.4572	0.3150
10	1.1000	0.7800	1.1000	0.1000	54.9756	0.3216
11	1.1100	0.7880	1.1100	0.1100	56.5583	0.3279
12	1.1200	0.7960	1.1200	0.1200	58.2372	0.3338
13	1.1300	0.8040	1.1300	0.1300	59.9137	0.3384
14	1.1400	0.8120	1.1400	0.1400	61.7487	0.3398
15	1.1500	0.8200	1.1500	0.1500	63.6949	0.3403
16	1.1600	0.8280	1.1600	0.1600	65.5842	0.3431
17	1.1700	0.8360	1.1700	0.1700	67.7647	0.3440
18	1.1800	0.8440	1.1800	0.1800	69.5470	0.3453
19	1.1900	0.8520	1.1900	0.1900	71.3960	0.3466

Table No. 2 DWT scaling factor analysis

CONCLUSION

From above results we conclude that for enhancement of gay image discrete cosine transform outperforms better than discrete wavelet transform. Using discrete cosine transform obtained highest PSNR value is 96 db. The image quality is better than discrete wavelet transform

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