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Contrast Enhancement of Gray Image using proposed mask in Discrete Cosine Transform Domain

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ABSTRACT: In this paper contrast of gray image is enhanced using proposed mask in discrete cosine transform and discrete wavelet transform domain. In this technique the image is converted into DCT and DWT domain and respective coefficients are modified using proposed mask for its domain then the enhanced image is reconstructed using inverse transform. The discrete cosine transform outperforms with better image quality and highest PSNR value. We compare this approach with enhancement based on the discrete wavelet transform.

KEYWORDS: Discrete cosine transform, Discrete wavelet transform.

1 INTRODUCTION

Image Contrast Enhancement is an important in enhancing images quality where features are hardly detectable by eye. It improves the visual quality of an image. In satellite, medical field the contrast enhancement techniques are used to enhance the images brightness and contrast. Histogram equalization is one of spatial domain method for enhancement of images. In Transform domain approach the discrete wavelet transform and discrete cosine transform approach consists of first transforming the image using the transform. Then the coefficients are modified by multipling by constant at scale. Finally, the enhanced image is obtained by taking the inverse transform from the modified coefficients.

2 OVERVIEW OF DWT AND DCT

In this paper,mask in discrete cosine transform domain for enhancing the gray image has been proposed and compared with discrete wavelet transform.

2.1 DISCRETE WAVELET TRANSFORM

The discrete wavelet transform separates the image in two wavelet coefficients that are the approximate and detail. Approximate coefficients are high scale, low frequency components and the detail coefficients are low scale,high frequency components of an image. These are modified by scaling. Finally the enhanced image is obtained by taking the inverse wavelet transform from the modified wavelet coefficients. The following chart describes the basic decomposition steps for images:

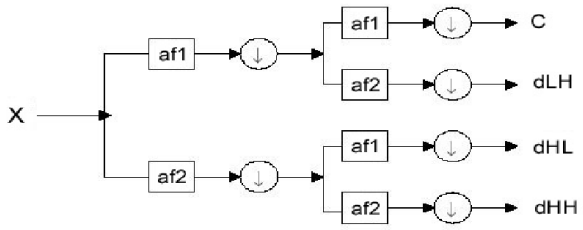

Fig. No.1. Decomposition of image

2.2 DISCRETE COSINE TRANSFORM

The DCT separate the image into three parts. It segments an image in to non overlapping block and applies DCT to each block. After transform it gives three frequency sub-bands: low frequency sub-band, mid-frequency sub-band and high frequency sub-band. Much of the image information lies at low-frequencies sub-band which contains the most important visual parts of the image as shown in fig. No.4.,mid frequency consisits small information of an image and the high frequency components of the image and it is noise.

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

*Fig. no.2 DCT 8*8 scaling mask*

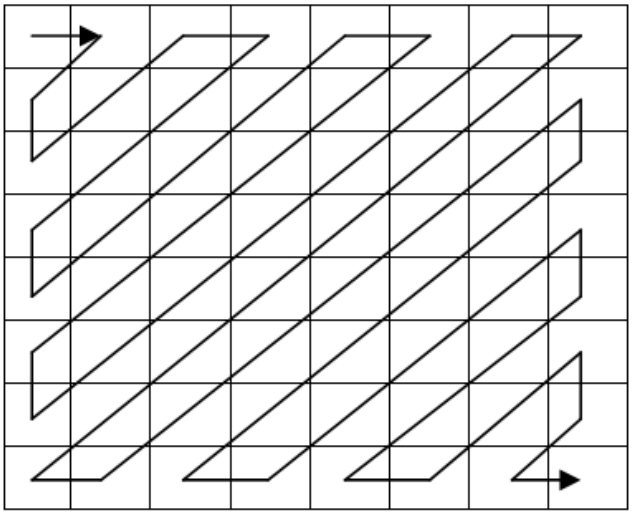

Fig.No.3 zigzag ordering of DCT coefficients

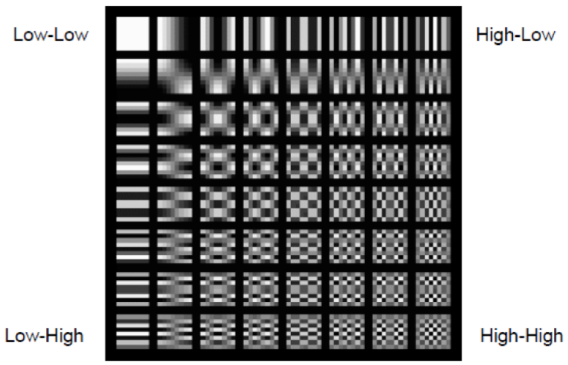

Fig.no.4 DCT Coefficients

3 PROPOSED METHODOLOGY

In this paper, a mask based on discrete cosine transform and discrete wavelet transform has been proposed and compared for enhancing the contrast of gray images. Discrete cosine transform is applied to separate the features of an image. The DCT converts the spatial domain into frequency domain represented by its DCT coefficients. DCT separates higher, mid and lower frequency components .The important information is in low frequency DCT coefficients. Hence low frequency is separated from high frequency coefficients by making high frequency components zero and by scaling low and mid frequencies DCT coefficients are modified. For obtaining enhanced image from modified coefficients inverse DCT is used. Assume A is a gray image and E is an enhanced image.

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 proposed mask each sub block DCT coefficients are modified.

Step5: By applying inverse DCT reconstruct the enhanced image E from modified DCT coefficients.

4 RESULTS AND DISCUSSION

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

4.1 DISCRETE COSINE TRANSFORM O/P

Table No.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

4.2 DISCRETE WAVELET TRANSFORM O/P:

Fig. No.5 DWT Output for lena.jpg

LL*m	LH*n
HL*p	HH*q

Fig.No.6 DWT scaling factor mask

Table No. 2 DWT scaling factor analysis

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
20	1.2000	0.8600	1.2000	0.2000	73.7188	0.3499

Some other results are as below.

From above results we conclude that for enhancement of gray image discrete cosine transform outperforms better than discrete wavelet transform . Using discrete cosine transform obtained highest PSNR value is 93 dB. The image quality is better than discrete wavelet transform

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