DIGITAL IMAGE COMPRESSION USING HYBRID SCHEME USING DWT AND QUANTIZATION WITH DCT FOR STILL DIGITAL IMAGE

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Abstract *The increasing demand of multimedia content like digital images and videos has a great interest in research in compression techniques. The algorithm for higher quality and less expensive image acquisition device has produce steady increase in both image size and resolution. As we know the storage capacity and transfer bandwidth has grown accordingly in recent years, many applications still require compression Image compression is process to remove the redundant information from the image so that only essential information can be stored to reduce the storage size, transmission bandwidth and transmission time. The essential information is extracted by various transforms techniques such that it can be reconstructed without losing quality and information of the image. In this paper work we will discuss analysis of image compression by Hybrid (DCT+DWT) Transform. The goal is to achieve higher PSNR i.e. peak signal to noise ratio where original image means signal and the noise is error in reconstructed image and to reduce MSE mean square error.*

*Key Words***: MSE,DCT, DWT, compression technique, hybrid transform, PSNR.**

1.INTRODUCTION

In today modern era digital transactions are the most common practice between humans and `all over the world these transactions may be of any kind or may be in any form it may be transaction of messages various codes and images or any other form of communication our study based on the storage reduction and sending various messages through compression so that we can save the storage memory for that we have to go through various processes in which two stages are mainly highlighted in our work that is firstly compression of image and then again decoded or decompress by other method. Image compression is important for many applications that involve huge data storage, transmission and retrieval such as for multimedia, documents, videoconferencing, and medical imaging. Digital images in their uncompressed form require considerable storage capacity and transmission bandwidth. The objective of image compression technique is to reduce redundancy of the image data in order to be able to store or transmit data in an efficient form. This results in the reduction of file size and allows more images to be stored in a given amount of disk or memory space

Three basic data redundancies can be categorized in the image compression standard.

1. Spatial redundancy due to the correlation between neighboring pixels.
2. Spectral redundancy due to correlation between the color components.
3. Psycho-visual redundancy due to properties of the human visual system.

The spatial and spectral redundancies are present because certain spatial and spectral patterns between the pixels and the color components are common to each other, whereas the psycho-visual redundancy originates from the fact that the human eye is insensitive to certain spatial frequencies.[1]

In this paper we made a comparative analysis of three transform coding techniques, viz. DCT, DWT and hybrid i.e. combination of both DCT and DWT based on different performance measure such as Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), Compression Ratio (CR), computational complexity.[2]

Keywords

MSE,DCT, DWT, compression technique, hybrid transform, PSNR.

2. Proposed Work

2.1 PROBLEM DEFINITIONS

All the image compression techniques which are previously being used are suffering from so many problems based on the quality and quantity and the major problems which is to be rectified are explained below. In our work we are trying to suppress this kind of problems.

Blocking artifacts

It is a distortion that appears due to heavy compression that appears as abnormally large pixel blocks for higher

compression ratio the perceptible blocking artifacts across the block boundaries cannot be neglected. The example of appearance of blocking artifacts due to higher compression is shown in fig 3.1 below

Figure.1 Illustration of compression using DCT: (a) Original Image compression ratio at
(b) 88%, (c) 96%

2.2 False contouring

The false contouring occurs when smoothly graded area of an image is distorted by an deviation that looks like a contour map for specific images having gradually shaded areas

(a)   (b)   (c)
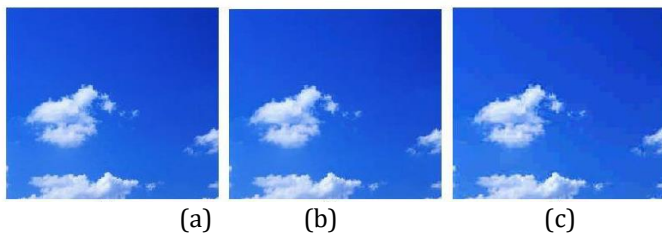
Figure.2 Illustration of compression using DCT: (a) Original Image compression ratio at
(b) 87 %, (c) 97%

2.3 PROPOSED SOLUTION

We presented two different ways of achieving the goals of image compression i.e. discrete wavelet transform and discrete cosine transform, which have some advantages and disadvantages like compression ratio, blocking artifacts, False contouring, computational complexity. In this section we are proposing a transform technique that will exploit advantages of DCT and DWT, to get compressed image. Hybrid DCT-DWT transformation gives more compression ratio compared to JPEG and JPEG2000, preserving most of the image information and create good quality of reconstructed image. Hybrid (DCT+DWT) Transform reduces blocking artifacts, false contouring and ringing effect.
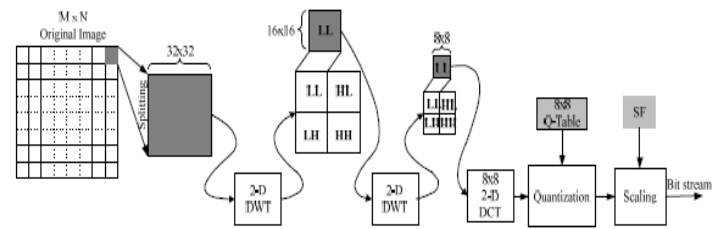

Figure 3 Block diagram of the proposed hybrid DWT-DCT algorithm: Compression

By using hybrid DCT-DWT we can achieve higher compression ratio but loss of information is more. DWT gives better compression ratio without losing more information of image. Pitfall of DWT is, it requires more processing power. DCT overcomes this disadvantage since it needs less processing power, but it gives less compression ratio. DCT based standard JPEG uses blocks of image, but there are still correlation exits across blocks. Block boundaries are noticeable in some cases. Blocking artifacts can be seen at low bit rates. In wavelet, there is no need to block the image. More robust under transmission errors. It facilitates progressive transmission of the image (scalability). Hybrid transform gives higher compression ratio but for getting that clarity of the image is partially trade off. It is more suitable for regular applications as it is having a good compression ratio along with preserving most of the information [9]

Coding scheme

(a) Compression procedure

The input image is first converted to gray image from color image, after this whole image is divided into size of 32x32 pixels blocks. Then 2D-DWT applied on each block of 32x32 blocks, by applying 2 DDWT, four details are produced. Out of four sub band details, approximation detail/sub band is further transformed again by 2 D-DWT which gives another four sub-bands of 16x16 blocks. Above step is followed to decompose the 16x16 block of approximated detail to get new set of four sub band/details of size 8x8. The level of decomposition is depend on size processing block obtained initially, i.e. here we are dividing image initially into size of 32x32, hence the level of decomposition is 2. After getting four blocks of size 8x8, we use the approximated details for computation of discrete cosine transform coefficients. These coefficients are then quantize and send for coding .
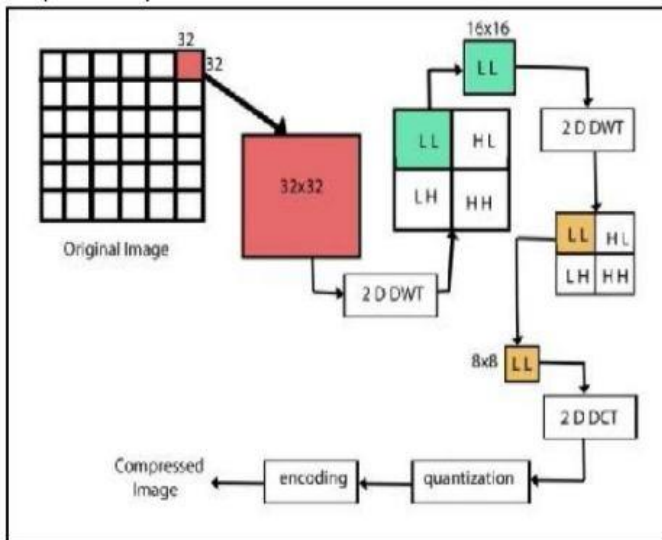
Figure 4. Compression technique using Hybrid transform

(b) Decompression procedure

At receiver side, we decode the quantized DCT coefficients and compute the inverse two dimensional DCT (IDCT) of each block. Then block is dequantized. Further we take inverse wavelet transform of the dequantized block. Since the level of decomposition while compressing was two, we take inverse wavelet transform two times to get the same block size i.e. 32x32. This procedure followed for each block received. When all received blocks are converted to 32x32 by following decompression procedure, explained above. We arrange all blocks to get reconstructed image. The complete coding and decoding procedure is explained in Figure respectively
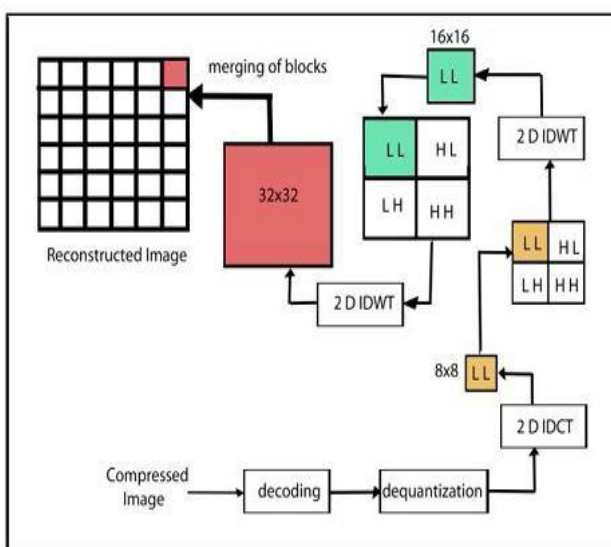

Figure 5 Decompression technique using Hybrid transform

3.RESULT

S. NO.	IMAGES SIZE	TECHNIQUES	COMPRESSION RATIO	MSE	PSNR
		Peppers			
1	512*512	DCT	26.867	0.9937	47.938
		DWT	28.6839	1.0586	45.0857
		HYBRID	**58.9857**	**0.5102**	**67.8556**
		Flintstones			
2	512*512	DCT	25.816	0.576	46.898
		DWT	31.001	2.0998	43.056
		HYBRID	**59.9986**	**0.05453**	**66.8964**
		Baboon			
3	512*512	DCT	27.076	1.0778	49.065
		DWT	29.021	1.1329	44.023
		HYBRID	**59.083**	**0.03654**	**64.9934**

4. CONCLUSIONS

After simulation results we conclude that hybrid compression technique algorithm outperforms the JPEG based DCT and DWT algorithms. performs better for the images that consists of bright colour and images consists of gradients. Hence it can be implemented for natural images. We observe that in DWT compression technique the reconstructed image quality is very poor whereas in case of DCT it is affected by artifacts and false contouring which is discussed above in problem identification topic. From the above simulation results we can easily get that the MSE and PSNR are improved in this technique and various drawbacks of both conventional techniques overcome by our mix technique.

By using hybrid DCT-DWT we can achieve higher compression ratio. There is a trade-off between compression ratio and quality of image (pixel value) and in this project we are trying to minimize the trade-off. DWT gives better compression ratio without losing more information of image. DCT overcomes this disadvantage since it needs less processing power, but it gives less compression ratio. DCT based standard JPEG uses blocks of image, but there are still correlation exits across blocks. Block boundaries are noticeable in some cases. Blocking artifacts can be seen at low bit rates. In wavelet, there is no need to block the image. More robust under transmission errors. It facilitates progressive transmission of the image (scalability). Hybrid transform gives higher compression ratio but for getting that clarity of the image is partially trade off. It is more suitable for regular applications as it is having a good compression ratio along with preserving most of the information.

ACKNOWLEDGEMENT

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