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Image Compression Using Discrete Cosine Transform and Discrete Wavelet Transform

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Abstract
in this hybrid model we proposed Hybrid technique combination of sundry compression techniques. Image compression is reduce the number of bits required to represent an image without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space and reduces the time required for images to be sent via the Internet. Storage capacity and the speed of transmission are the two important factors that arise during the heavy duty of multimedia over Internet. The best image quality at a given bit-rate (or compression rate) is the main goal of image compression.
we implement lossless technique so our PSNR and MSE will go better than the old algorithms and due to DCT and DWT we will get good level of compression. Hence overall result of hybrid compression technique is good.

1. Introduction

Now a days millions of images and videos are circulated via the Internet all over the world. Storage capacity and the speed of transmission are the two important factors that arise during the heavy duty of multimedia over Internet. The best image quality at a given bit-rate (or compression rate) is the main goal of image compression. A huge amount of internet information is used either graphical or pictorial in nature. The requirements for storage and communications are high. Compressing the data is one of the way out for this problem. In this work we proposed a approach to integrate many method to introduce an efficient image compression technique that may be a good method compared with the existed methods(Mohamed A. El-Sharkawy, 1997 IEEE).
Image compression is important in the transmission and storage of image information as a result of bandwidth and storage limitations. Image compression techniques are the two categories : Lossless compression and Lossy compression. the Lossless compression is beneficial in imag archiving, the reconstructed image is identical to the original image and results the compression ratio is very less as 2:1 to 3:1. On the other hand, Lossy compression is beneficial in television transmission and video conferencing etc., Its main advantage higher compression ratio, it can provide compression ratios more than 10:1 but the reconstructed image is not identical to the original images and may lose vital information of the image(Ali Al-fayed, Abir Jafar Hussain, Paulo Lisboa and Dhiya Al-Jumeily, IEEE, 2008).(XiwenOwenZhao, ZhihaiHenryHe, vol. 17, no. 4, April 2010),(Jaemoon Kim, Jungsoo Kim and Chong-Min Kyung , 978-1-4244-4291 / 09 2009 IEEE. ICME 2009),
image compression is one of the most used techniques in the field of image processing. JPEG using the discrete cosin transform, DCT is the widely used technique for compression,some of the application 2D-DCT involve compression of individual video frames and MD-DCT used for compression of video streams and volum spaces, but results in blocking artifacts, ringing effects and false contouring appreciably for high compression ratio. Discrete Wavelet Transform (DWT) based coding, is another efficient technique used for image compression. The ability to display image at different resolutions like low frequencies and high frequencies simultaneously makes it a better method compared to others. Utilizing the benefits of both DCT and DWT popular coding techniques a new technique known as hybrid transform technique has been introduced where these two coding schemes are implemented together(M.Mohamed Sathik, K.Senthamarai Kannan and Y.Jacob Vetha Raj, SIPIJ Vol.2, No.1, March 2011)

2. Wavelet Transforms

Wavelet transform (WT) is the basis for representing images in the different degrees of resolution. Wavelet transforms is just the representation of functions by a wavelet, which is a mathematical function, dividing the function into various frequency component matching the resolution.
A wavelet transform is represented as image as a sum of wavelets on multi resolution level where each analysis is implemented via high pass filters (wavelets) and low pass filters (scaling function).
The wavelet transform function is based on the conversion of one- dimensional function is transformed into two- dimensional space,wher it is approximated by coefficients that depend on time(determined by the

translation parameter)and on scale,(determined by the dilation parameter). Both the high and low frequency supports well for wavelet transform hence are well suited for image compression.

3. Cosine Transform

A discrete cosine transform reflects a sequence of numerous data points are limited in terms of total functions cosine oscillate at various frequencies. And DCT an important for numerous applications in the field of science and engineering, from lossy of the audio and images. Use rather than cosine functions necessary condition for these applications, show that compression and cosine functions are more efficient.

The two-dimensional DCT of an M-by-N matrix A is defined as follows.

$$B_{pq} = \alpha_p \alpha_q \sum_{m=0}^{M-1} \sum_{n=0}^{N-1} A_{mn} \cos\frac{\pi(2m+1)p}{2M} \cos\frac{\pi(2n+1)q}{2N}, \quad \begin{matrix} 0 \le p \le M-1 \\ 0 \le q \le N-1 \end{matrix}$$

$$\alpha_p = \begin{cases} 1/\sqrt{M}, & p = 0 \\ \sqrt{2/M}, & 1 \le p \le M-1 \end{cases} \quad \alpha_q = \begin{cases} 1/\sqrt{N}, & q = 0 \\ \sqrt{2/N}, & 1 \le q \le N-1 \end{cases}$$

The values B_{pq} are called the *DCT coefficients* of A. (Note that matrix indices in MATLAB always start at 1 rather than 0; therefore, the MATLAB matrix elements A(1,1) and B(1,1) correspond to the mathematical quantities A_{00} and B_{00}, respectively.)

The DCT is an invertible transform, and its inverse is given by

$$A_{mn} = \sum_{p=0}^{M-1} \sum_{q=0}^{N-1} \alpha_p \alpha_q B_{pq} \cos\frac{\pi(2m+1)p}{2M} \cos\frac{\pi(2n+1)q}{2N}, \quad \begin{matrix} 0 \le m \le M-1 \\ 0 \le n \le N-1 \end{matrix}$$

$$\alpha_p = \begin{cases} 1/\sqrt{M}, & p = 0 \\ \sqrt{2/M}, & 1 \le p \le M-1 \end{cases} \quad \alpha_q = \begin{cases} 1/\sqrt{N}, & q = 0 \\ \sqrt{2/N}, & 1 \le q \le N-1 \end{cases}$$

The inverse DCT equation can be interpreted as meaning that any M-by-N matrix A can be written as a sum of *MN* functions of the form

$$\alpha_p \alpha_q \cos\frac{\pi(2m+1)p}{2M} \cos\frac{\pi(2n+1)q}{2N}, \quad \begin{matrix} 0 \le p \le M-1 \\ 0 \le q \le N-1 \end{matrix}$$

These functions are called the *basis functions* of the DCT. The DCT coefficients B_{pq}, then, can be regarded as the *weights* applied to each basis function. For 8-by-8 matrices, the 64 basis functions are illustrated by this image.

4. The Proposed System

The hybrid image compression system is proposed to be implemented in order to get an efficient compression technique. The input image is initially segmented into background and foreground portions, then the image is subdivided into 8x8 blocks and DCT coefficients are computed for each block. The quantization is performed conferring to quantization table. The quantized values are then rearranged according to zig-zag arrangement. The lesser values are discarded from the list in the zig-zag arrangement by the selector as per the block's presences recognized by the classifier. If the block is being present in foreground area then the threshold level is set to high by the selector, otherwise a lower value for threshold is set by the selector. After discarding insignificant coefficients the remaining coefficients are compressed by the typical entropy encoder based.

The proposed image compression Algorithm is listed below:

- Introduces the image to be compressed.
- Preprocessing the original image.
- Starts the DCT processor.
    - Segment the input image into background and foreground based on edges.
    - Subdivide the input image into 8x8 blocks.
    - Find the DCT coefficients for each block.
    - Quantize the DCT coefficients based on quantization table.
    - Discard lower quantized values depend on the threshold value selected by the selector.
    - Compress remaining quantized values by Entropy Encoder
- Starts DWT processor.
    - Apply low pass filters on rows.

- Apply low pass filter on columns of previous step, this generate LL-band.

The architecture of the proposed system is presented in figure 1, and then the results are illustrated in figure 2.

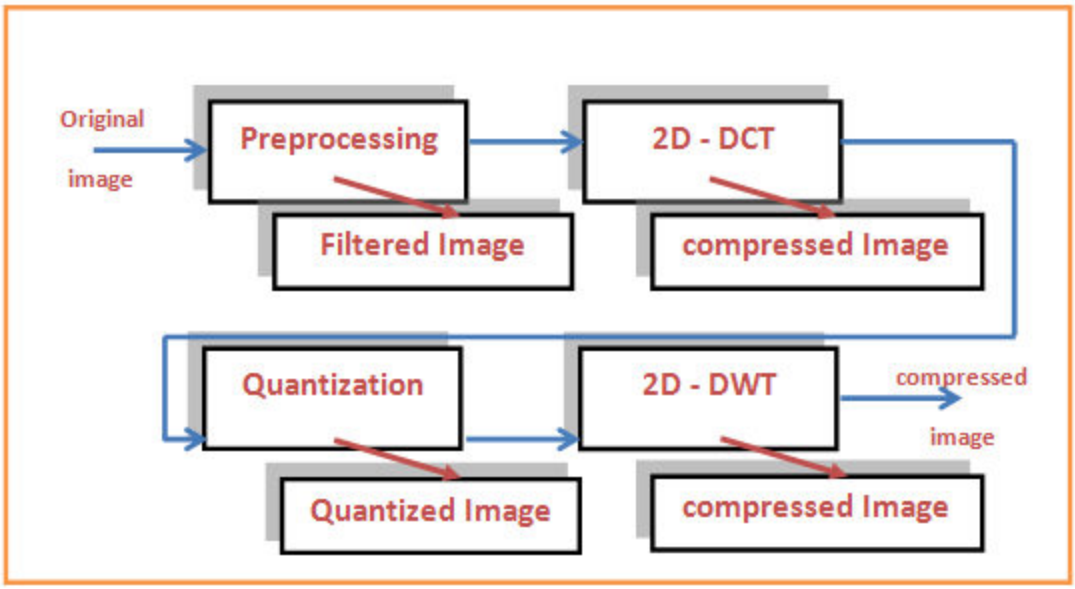

Figure 1 image compression approach

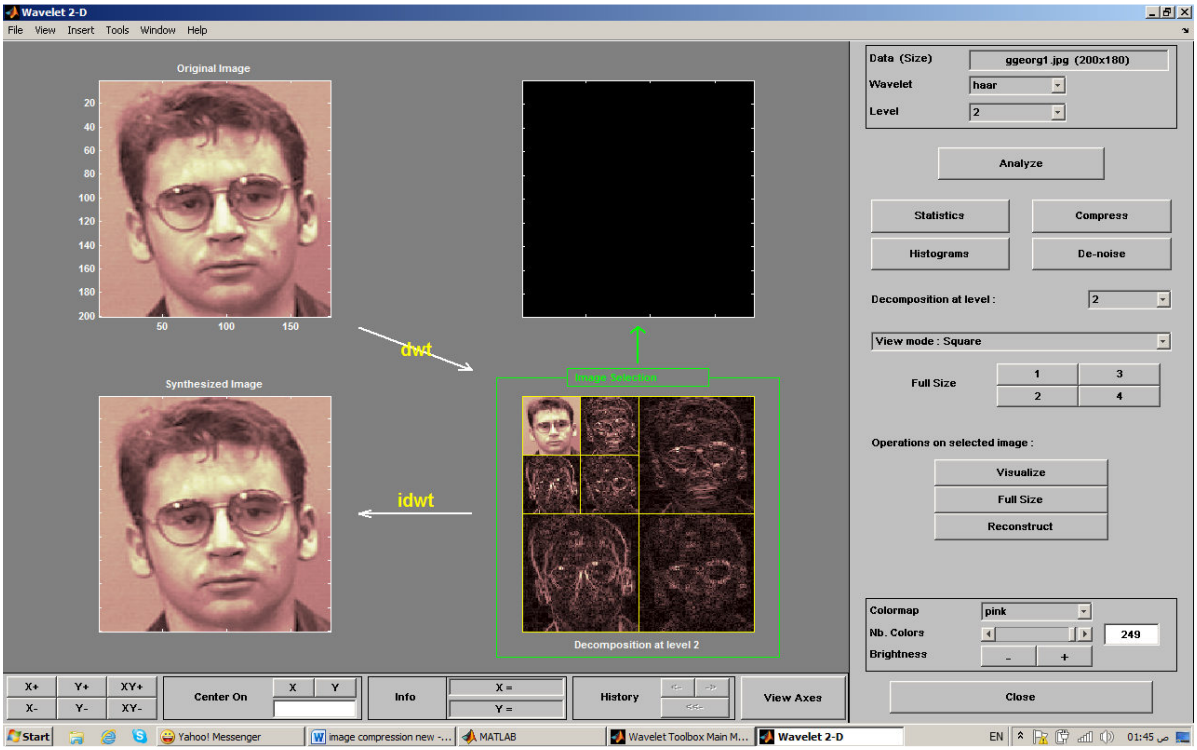

Figure 2 Image compression results

5. CONCLUSION

We proposed a new compression method which is a combination of two compression schemes DCT, DWT compression. DCT and DWT is very good to cope up compression ratio but as they are lossy techniques so our quality measurement which we are concluded with the help of PSNR is decreasing due to so, further to enhance CR . This concludes that after applying lossy techniques it's better to use lossless too to enhance compression at same PSNR. Future scope Proposed a new compression method gives very good results and it leaves good probability for further expansion. This work can be expanded with applying it for the videos to get better PSNR at high CR.

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