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Fast and Secure Data Transmission Using Hybrid Compression and Deblurring Technique

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Abstract: **With the progress in data exchange today communicators are not only facing the problem of security, but also the speed of communication and size of content. Digital images in their uncompressed form require an enormous amount of storage capacity which in turn needs large transmission bandwidth. Image compression reduces the storage space of image & also maintains the quality of image. Encrytion techniques protects the confidential image data from unauthorized access This paper focus on dual approach of compression and encryption where compression is achieved through DCT and DWT(Haar wavelet transform) and compressed image is encrypted using Deblurring technique. Moreover, the compression approach applied to encrypted image is proved more efficient in terms of Compression Ratio (CR), Mean Square Error (MSE), Peak Signal to Noise Ratio (PSNR). For the implementation of this proposed work we use MATLAB software.**

Keywords: **Encrytion, Compression, DCT, DWT, Haar Wavelet transform, Hybrid technique, Deblurring technique, Compression Ratio(CR), Mean Square Error(MSE), Peak Signal to Noise Ratio(PSNR).**

1. INTRODUCTION

The present network scenario demands exchange of information with more security and reduction in both the space requirement for data storage and the time for data transmission. This can be accomplished by compression and encryption, such kind of system is called compression–crypto system. Encryption is indeed a secure coding technique and data compression is also a coding technique, whose purpose is to reduce both the space requirements for data storage and the time for data transmission. Encryption of data has become an important way to protect data resources especially on the Internet, intranets and extranets. The another challenge in multimedia applications is the transport services to both discrete media such as text and digital images and continuous media such as audio and video with limited bandwidth and huge data size. With the huge demand for bandwidth due to the large data transmitted in multimedia applications, it becomes necessary to apply compression algorithms on transmitted data. So the best way of fast and secure transmission is by using compression as well as encryption of multimedia data.

Dual approach of crypto system is present in which we are using first method.

a) Compression followed by Encrytion (CE): In this sequence an intruder have less cleave to access image but encryption may again increase the size.

b) Encryption followed by Compression (EC): In this sequence size is not again increased but an intruder may have more clues to access the image. In some case sequence size decreased so not efficiently compressed.

This study focuses on CE pattern in which compression is followed by symmetric key encryption. Compression of multimedia data such as images achieved through one lossless algorithm DCT coding and one lossy method DWT transform. Therefore in this paper comparative study of two image compression algorithm and their variety of features discussed and that factors are used to choose best among them for further encryption phase.

2. PROPOSED ALGORITHM AND METHODOLOGY

In this paper CE order i.e. compression is followed by encryption is applied on colour and grayscale image of different size and type. Here compression is performed by Hybrid coding (DWT &DCT) . For resultant compressed data is secured by Blurring encryption algorithm. The schematic block diagram of this proposed approach is given in Figure No.1.

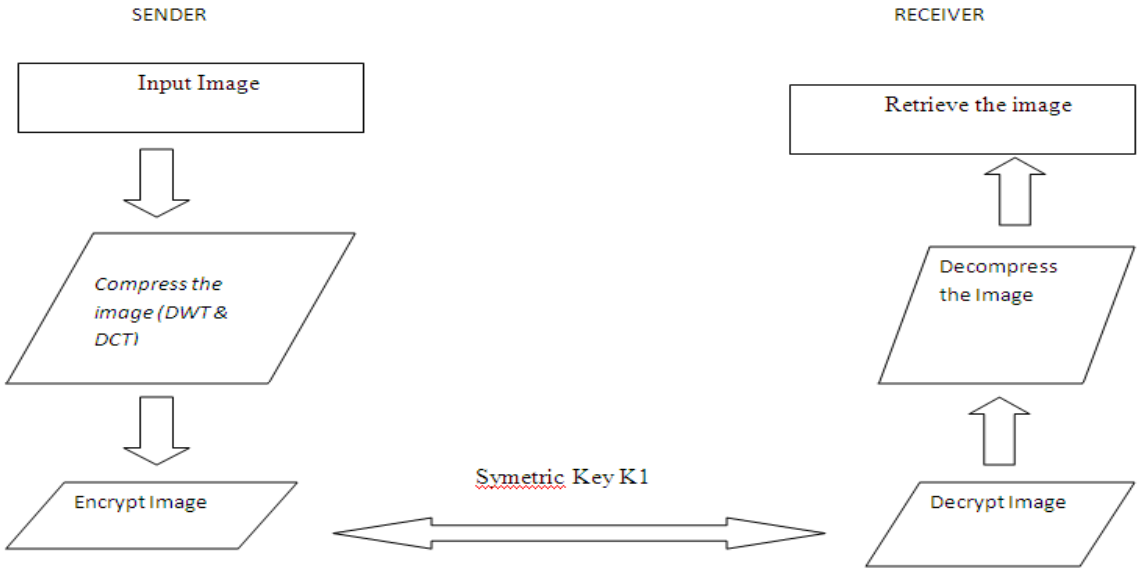

Fig.1 The schematic block diagram of proposed approach

3. DISCRETE COSINE TRANSFORM (DCT)

Typical image compression block is shown in fig.1, which explains flow of process involved in image compression. Discrete Cosine Transform (DCT) exploits cosine functions, it transform a signal from spatial representation into frequency domain. The DCT represents an image as a sum of sinusoids of varying magnitudes and frequencies.

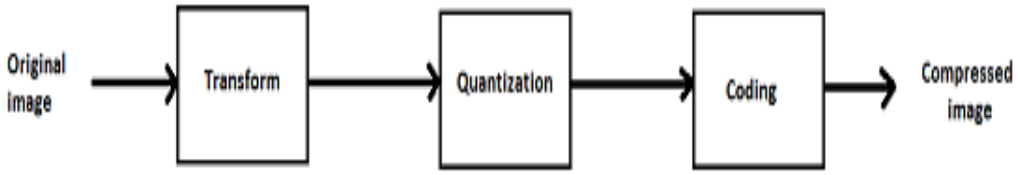

Fig.2 Image compression model

DCT has the property that for a typical image most of the visually significant and information about an image is concentrated in just few coefficients of DCT .After the computation of dct coefficients ,they are normalized according to a quantization table with different scales provided by the JPEG standard .Selection of quantization table affects the entropy and compression ratio. The value of the pixels of black and white image are ranged from 0 to 255, where 0 corresponds to a pure black and 255 corresponds to a pure white. As DCT is designed to work on pixels values ranging from -128 to 127,The original block is leveled off by 128 from every entry. Step by step procedure of getting compressed image using DCT can be illustrated through flow chart as shown in fig 2.

4. DISCRETE WAVELET TRANSFORM (DWT)

Wavelet decomposition of the images is used due to its inherent multi resolution characteristics. The basic idea of using Discrete Wavelet Transform is to reduce the size of the image at each level, e.g., a square image of size 2j ×2j pixels at level L reduces to size 2j/2 × 2j/2 pixels at level L+1. Wavelets are useful for compressing signals. They can be used to process and improve signals, in fields such as medical imaging where image degradation is not tolerated. Wavelets can be used to remove noise in an image. Wavelets are mathematical functions that can be used to transform one function representation into another. Wavelet transform performs multi resolution image analysis. Multi resolution means

simultaneous representation of image on different resolution levels. Wavelet transform represent an image as a sum of wavelets functions, with different location and scales.

In 2D, the images are considered to be matrices with N rows and M columns. Any decomposition of an image into wavelets involves a pair of waveforms-

- One to represent the high frequency corresponding to the detailed part of the image (wavelet function)
- One for low frequency or smooth parts of an image (scaling function).

At each level, the image is decomposed into four sub images. The sub images are labeled LL, LH, HL and HH.

LL corresponds to the coarse level coefficients or the approximation image. This image is used for further decomposition. LH, HL and HH correspond to the vertical, horizontal and diagonal components of the image respectively.

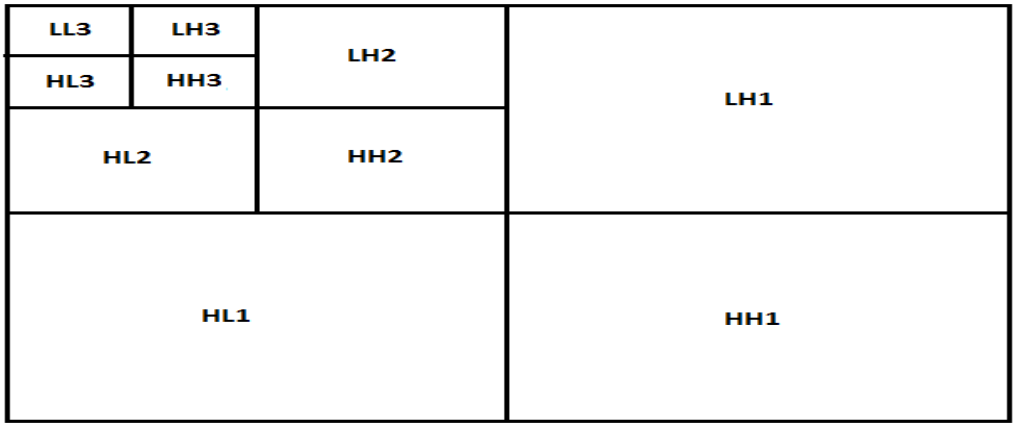

Fig.3 Wavelet Filter Decomposition

5. HYBRID (DCT + DWT) TRANSFORM

The aim of image compression is to reduce the storage size with high compression and less loss of information. In section II and III we presented two different ways of achieving the goals of image compression, which have some advantages and disadvantages, 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.

5.1. Compression procedure:

The input image is first converted to gray image from colour image, after this whole image is divided into size of 32x32 pixels blocks. Then 2D-DWT applied on each block of 32x32 block, by applying 2 D-DWT, 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-band 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.

5.2 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 fig.6 respectively.

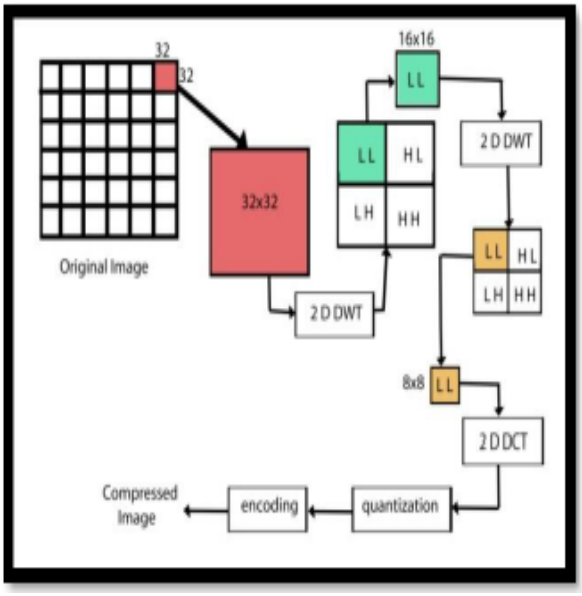

Fig.4 Compression using Hybrid transform

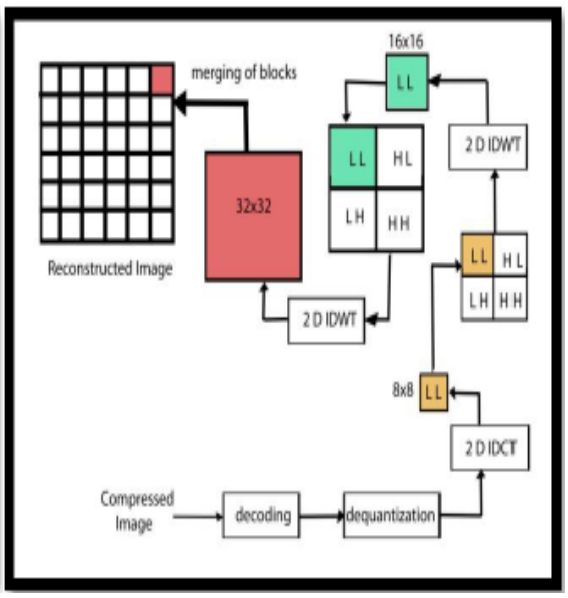

Fig.5 Decompression using Hybrid transform

6. HAAR WAVELET TRANSFORM

Haar wavelet transform is the simplest transform for image compression, the principle behind this is very simple as calculating averages and differences of adjacent pixels. The Haar DWT is more computationally efficient than the sinusoidal based discrete transforms, but this quality is a tradeoff with decreased energy compaction compared to the DCT

7. ENCRYPTION ALGORITHM

The essential concept underlying all automated and computer security application is cryptography. The two ways of going about this process are conventional (or symmetric) encryption and public key (or asymmetric) encryption.

7.1 Private key encryption:

Private Key encryption also referred to as conventional, single-key or symmetric encryption.Private key encryption is used in military, government and private sector applications. It enquires all parties that are communicating to share a common key.

7.2 Public key encryption:

Public key encryption algorithms are based on the premise that each sender and recipient has a private key, known only to him/her and a public key, which can be known by anyone. Each encryption/decryption process requires at least one public key and one private key. A key is a randomly generated set of numbers/ characters that is used to encrypt/decrypt information.

8. BLURRING TECHIQUE

In this method, the image used will have their RGB colors extracted from then and then encrypted to have a ciphered image portion. The cipher-ing of the image for this paper will be done by using the RBG pixel values of the selected portion of the images. There are no changes of the bit values and there is no pixel expansion at the end of the encryption process. Instead the numerical values are transposed, reshaped and concatenated with the RGB values shifted away from its respective posi-tions and the RGB values interchanged in order to obtain the cipher image. This implies that, the total change in the sum of all values in the image is zero. The image is looked at as a decomposed version in which the three principle component which forms the image is cho-sen to act upon by the algorithm. The R-G-B components can be considered as the triplet that forms the characteristics of a pixel.

With the proposed method in this paper, the shuffling of the image will be ultimately done by solely displacing the RGB pixels and also interchanging the RGB pixel values.in the receiver side deblurring technique is used to retrieve the original signa .DeConvolution technique is used in the transmitting side.

8.1: The Algorithm:

1. Start
2. Import data from the selected portion and create an image graphics object by interpreting each element in a matrix.
3. Extract the red component as ‘r’
4. Extract the green component as ‘g’
5. Extract the blue component as ‘b’
6. Get the size of r as [c, p]
7. Let r =Transpose of r
8. Let g =Transpose of g
9. Let b =Transpose of b
10. Reshape r into (r, c, p)
11. Reshape g into (g, c, and p)
12. Reshape b into (b, c, and p)
13. Concatenate the arrays r, g, b into the same dimen-sion of ‘r’ or ‘g’ or ‘b’ of the original image.
14. Finally the data will be converted into an image format to get the encrypted image.

9. RESULT AND ANALYSIS

Fig6. Image compression using DCT technique

Fig7. Image compression using using DWT Technique

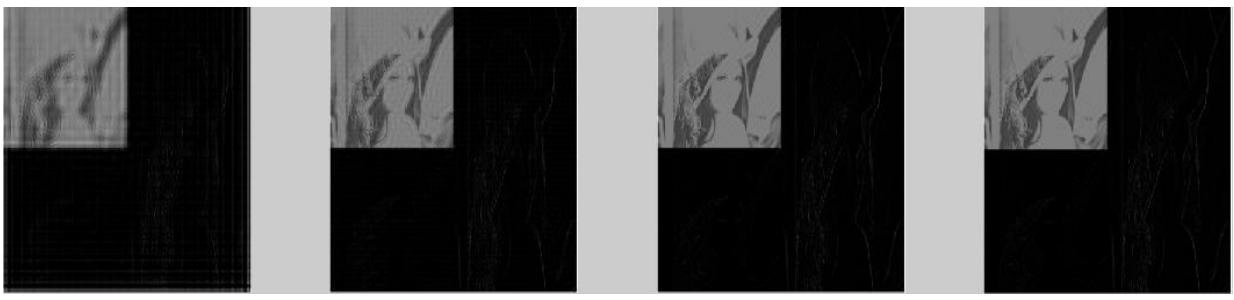

Fig8.image compression using Hybrid Method

Fig9. Reconstructed Image using DCT,DWT,HYBRID(DCT-DWT)

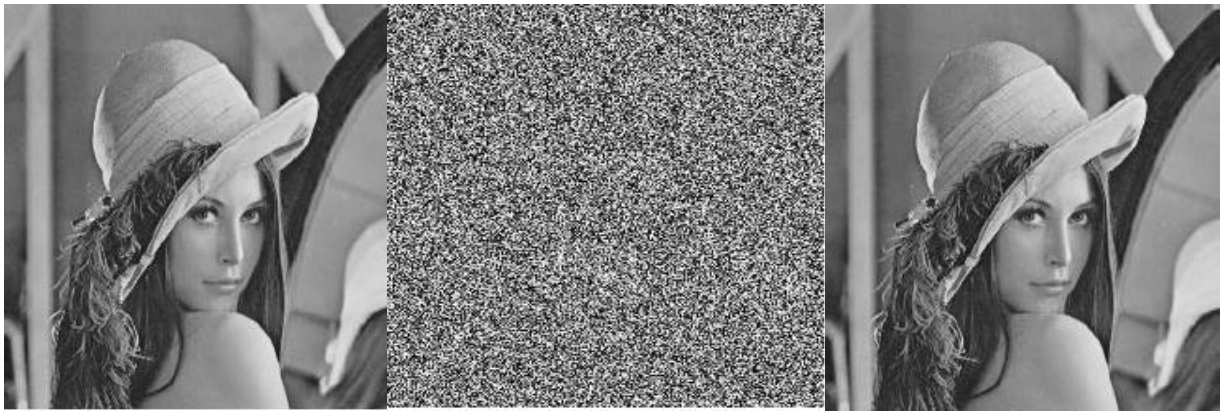

Fig10.1 Original Figure **10.2 Encryted Image** **10.3 Decryted Image**

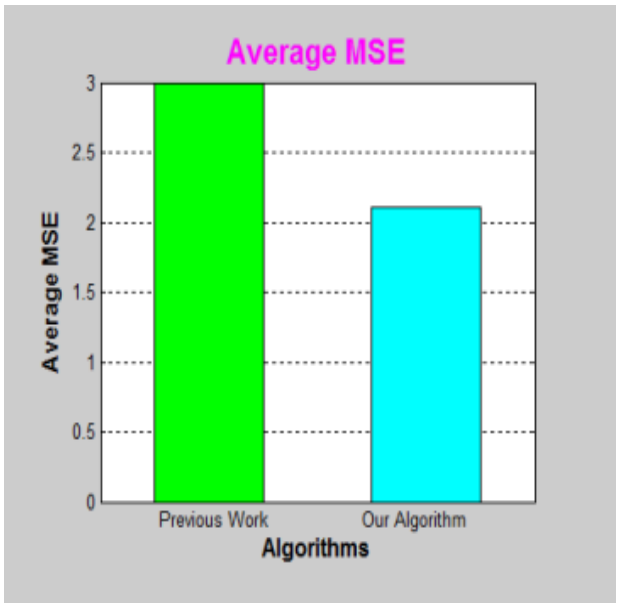

Figure 11: MSE Graph

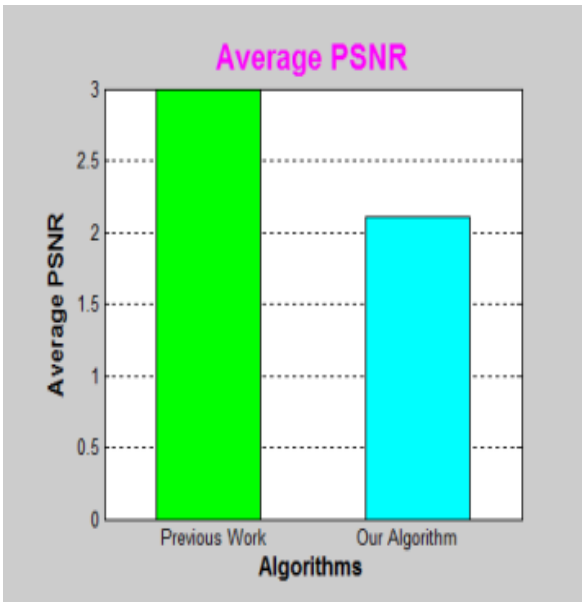

Figure 12: PSNR Graph

10. CONCLUSION

In this research work, we have designed an efficient image Compression-Encryption system. Within the proposed framework, the image encryption has to be achieved via Blurring method Highly efficient encryption of compressed image has been realized by a new image compression algorithm of Haar wavelet transform and dct. To proposed 'Fast and Secure Data Transmission using Hybrid Compression and Image Encryption Technique. In this method the pixel values are same after encryption but their position will be changed. The image obtained is nearly similar to the original image due to high correlation between the adjacent pixels. Encryption is found to be satisfactory visually. But the proposed algorithm is having some drawbacks with respect to key sensitivity. It is observed that the encryption can get compromised if the key decryption is 80% similar to that of original key. The decrypted image to some extent reveals the information of original image. The images considered are only gray scale images of size 256x256 pixel resolution only. In future, an attempt to improve for the proposed algorithm to address the mentioned drawback will be made. Encryption algorithm will be extended for color and higher resolution images as well.

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