# A Review on image Compression Techniques

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***Abstract-***

***With the rapid a advancement in multimedia technology, it has become possible to generate and transmit more and more multimedia data in military commercial and medical field. Some of these data includes some sensitive information which is required to be accessed by the intended person only. Therefore, security and privacy of these information is of prime concern today. In the last couple of years several encryption methods have been proposed for secure video transmission. Though lots of algorithms of video encryption have been presented but only few are used in real time. In this paper, a brief description and comparison of different video encryption algorithm has been presented. Encryption speed, stream size and security level are used for comparing the performance of these algorithm.***

***Keywords-*** ***AES(Advance Encryption Standard), DES(Data Encryption Standard), Video Transmission, Video encryption***

## I. INTRODUCTION

The advancement in camera technology and with the introduction of digital camera, Image capturing, sharing, transferring and storing has become very simple. The images captured through the digital camera has various advantages over traditional camera images. Since images acquired by the digital camera is in digital form therefore it is easy to process the images for removing the various artefacts from the image. Images captured from the digital cameras are large in size and sharing or transferring these images in internet has been the main issue in the last two decades. Recently with the introduction of social networking site, sharing and transferring the images has become more severe as it require large bandwidth and space. Image Compression can be used to address this problems. Image compression is a techniques which is used to represent the image in comparatively fewer bits which hence reduce the amount of space for storing the image and also the bandwidth requirement is also reduced. So from this discussion it is clear that in digital world, Image compression is one of the important field of research. In a broader sense, image compression can be classified in two different categories i.e. lossy image compression and loss-less image compression. In lossless image compression techniques, the quality of the reconstructed image is same as the original image and hence is widely used in medical image compression and also for compressing the text data. While in lossy compression, The quality of the reconstructed image is degraded. The amount of degradation depends on the compression ratio. More compression degraded the quality of the image more while least compression degrades the image less. In compression algorithm, compression is achieved by eliminating the redundant information from the image. Since lossy image



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compression gives better compression ratio therefore it is preferred over lossless compression algorithm.

Transform coding and predictive coding are the two prominent lossy compression approaches. Transform domain method is most powerful tool for compressing the image [1]. Transform domain methods are also used for data hiding[2], feature extraction application, biometric based application, image quality improvement[3],[4], content based image retrieval[5][6] and also for texture analysis etc.

Earlier ,discrete cosine transform(DCT) was the most powerful and popular method of transform coding for compressing the image. One of the advantage of the discrete cosine transform is it s simplicity and good performance but it has some drawbacks associated with it. One of the prominent drawback of this method is that it produce blocking artifacts in the image. This artefact is introduced because of the correlation across the boundaries of the blocks. It is specially significant for the image of lower bit rate. Later on Wavelet transform is introduced [7] which eliminate this drawback effectively.

In wavelet transform, both time and frequency analysis can be achieved. The wavelet transform of the image can be obtained without dividing the image in to different block and hence gives better performance as compared to the Discrete cosine transform. Moreover the image coding based on the wavelet transform sows more robustness against transmission and decoding errors[8]. One of the key point of the wavelet transform is its multi-resolution property which makes it possible to view the image at different scales. Recent research on the compression are based on the hybrid techniques [9] which is based on fusing the one transform techniques with the another to obtain the advantages of both the transform. As per the past research work, an appropriate proportion of constitute transform can be used to obtain the hybrid wavelet transform which shows better result for some range of compression ratio.

Section II of this paper throw some lights on the existing transform while section III describe the hybrid wavelet transform. Section IV presents the review work in this field and section V outline the conclusion.

## II. RELATED WORK

### *A. DWT BASED IMAGE COMPRESSION TECHNIQUES*

In the year 2012, Prasanthi Jasmine[10] presented a wavelet and ridgelet based compression methods. In this paper, RGB image is first of all converted in to a gray scale image. In the next phase, Gaussian filter is applied on this gray scale image for de-noising. Discrete wavelet transform is then computed for this de-noised image.

In order to find the coefficients of the wavelet, Finite ridge-let transform is then applied. The image obtained after this image is in the compressed form i.e. having reduced size. Decompression of the compressed image is performed by first computing the finite ridgelet transform and then by applying DWT. This operation result in the construction of the original image. In this method , original image is obtained after uncompressing the compressed image therefore it is a lossless image compression method.

In the year 2012, Indrit Enesi suggested a combination of wavelet transform and GPCA(Generalized Principal Component Analysis) for compressing the multimedia data without



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degrading its quality.In his suggested method, first of all the wavelet transform is applied to the RGB image and then the low frequency coefficients or approximation coefficients are divided in to sub-band tree.Hybrid linear modeling is then applied to the approximation coefficients. Finally entropy encoding is applied to get the compressed image. Reverse operation is performed to get back the original image from the compressed image. Simulation results shows its better performance over simple wavelet based image compression. This method is able to produce the PSNR values 15% larger than the previous method.

In the year 2013, sumithra, presented an algorithmfor compressing the medical images using the multi-wavelet transform. This paper claim that this method is able to provide better efficiency and less computational cost. In this algorithm, first of all the image is resized to 256x256 dimension. If the image is RGB then image is also converted in to a gray scale image. Feature extraction process is performed thereafter. In this way the input image is first segmented and transformed in to the set of some features.

Binary encoding is then applied in this method to achieve compression. Simulation results shows that the proposed method resulted in a better mean square error (MSE) and high compression ratio (CR).

In the year 2013, Meenakshi Choudhary and her associates suggested a compression method which is a combination of modified Fast haar wavelet transform(MFHWT) and wavelet transform by singular value decomposition(SVD). In this method first of all the image is converted in to gary scale image from color image and then Hybrid wavelet transform is applied on this image for getting the approximation and detail coefficients.SVD is then applied to the approximation coefficient to get the sub band. Reverse process is applied to get back the original image. The performance of this method is better than most of the existing method.

### *B. HYBRID IMAGE COMPRESSION TECHNIQUES USING DCT AND DWT*

In the year 2011, Aree ali Mohammed suggested an algorithm for compressing the medical image. This method is based on the combination of DWT and DCT method. The combination of both DWT and DCT is able to achieve better or higher compression ratio.

In this method first of all the RGB image is loaded and then converted in to a Y,Cb,Cr. Forward Discrete wavelet transform is then applied to get the approximation 8x8 band. In the next step, forward discrete cosine transform is then applied to the image followed by the quantization by DCT and DWT.

In order to get only positive values of the coefficients discrete pulse code modulation (DPCM) and variable shift coding is applied. Reverse procedure is applied to decompress the image. Results obtained in this paper revealed that this method is able to preserve the quality of the image if the quantization factor is less than 0.5.

In the year 2011, Parveen Banu presented a novel image compression method which is a combination of three algorithm. In this method, original color image is first changed in to luminance and chrominance components. One level decomposition



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of the of the luminance component is then performed with the help of Daubechies wavelet transform. On the other hand, Lifting wavelet transform is applied to the chrominance components. Since coarse component of the image shows less correlation while the detail component shows the more correlation therefore Huffman encoding is used for encoding the coarse and detail component of the image to get the compressed image. Coarse component being a less correlated, require more number of bytes while the detail component being more correlated, require less number of bytes. Compression ratio(CR), Bit per pixel(BPP) and PSNR(Peak Signal to noise ratio) is used in for comparing the performance of the proposed image. This method achieve the higher compression ratio for color and gray scale image of different size.

In the year 2012, Bheshaj Kumar suggested a image compression algorithm by combining the JPEG technique with the symbol reduction techniques with the help of Huffman coding to get more compression ratio. This algorithm, first of all convert the color iamge in to a gray scale image. In the next step , image is divided in to a block of 8x8 sub-block. The whole image is divided in to a gray scale from -128 to 127. Discrete cosine transform is then applied to each sub block. The obtained coefficients are quantized and less significant coefficients are set to zero. Zig-zag ordering is then applied to obtain the increasing frequency coefficients. Finally entropy encoder is applied. Results revealed the compression ration found in this scheme is more than the original JPEG scheme.

In the year 2012, Harjeetpal singh proposed a image compression method which is a combination of the Discrete Cosine Transform(DCT) and Discrete Wavelet Transform(DWT). In his paper, he also shows that this method perform better than standalone DCT based or DWT based image compression method. In this method, first of all image is divided in to a block of 16x16 and then 2-level DWT decomposition is applied. On the approximation coefficients, Discrete cosine transform is applied. At the last stage of the algorithm Huffman coding is applied to get the compression. Reconstruction process is done at the receiver side. Results of this method reveals that this method is able to achieve better compression ratio as well as the PSNR ratio (Peak signal to Noise Ratio).

In the year 2012, Sriram and Thayagrajan sugge algorithm which is based on the combination of the DCT and DWT transform. In this scheme also, first of all the color image is converted in to a Y Cb Cr model. In this scheme first the iamge is divided in to a block of 32x32. This sub image is then undergoes with the 2-D forward wavelet transform to get the approximation sub-band. These DWT coefficients are then scales with the help of 8 point DCT. Quantization is then applied by setting the higher frequency component to zero. In order to get minimum degradation to the fine detail of the image, laplacian enhancement is performed along with the arithmetic coding. The simulation results shows that this scheme obtained the higher compression ratio without affecting the quality of the image. Blocking artefacts and false contouring can also be minimized in this scheme.



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In the year 2012, Ali Moustafa Alsayyh developed another image compression scheme which is also a combination of DCT(Discrete Cosine transform) and DWT(Discrete Wavelet Transform) and found that this scheme has better performance than other schemes.

In this scheme, first of all the source image is decomposed in to a block of 8x8 or 16x16. Discrete Cosine transform of each block is computed to get the DCT coefficients. These coefficients are then quantized to achieve compression.DWT of this compressed image is then computed to get even more compression.

Another Hybrid scheme of image compression was present in the year 2012 by Manisha Singh which was also based on the combination of DCT and DWT. In this scheme, RGB image is converted in to Luminance and Chrominance component by applying the compression algorithm. Haar transform based DWT is applied to the Image for decomposition. Image is then passed through the 2-D filter. This method shows satisfactory performance for image quality as well as the compression ratio.

In the year 2012, ramandeep kaur suggested a DWT-DCT based Image compression method.

In this scheme, Image is first of all divided in to a block of NxN. 2-dimensional Discrete wavelet Transform is then performed on this block to get the four different frequency bands. Out of these bands only the low frequency components are passed to the next stage while rest of the frequency component are discarded. Low frequency component is then quantized by using 8-point DCT and JPEG Quantization. Results of simulation show that this scheme is good at noisy environment. False countering and blocking artefacts are also reduced using this scheme.

In the year 2013, Kirti Mishra, suggested a novel algorithm for achieving higher compression rate by using different threshold for LL and HH frequency component. Discrete cosine transform is applied to the LH and HL component to maintain the quality of the image.

In this method, DWT, DCT along with entropy coding and lifting based filter is used to get better quality and high compression ratio. Due to this facts it is widely used in medical imaging.

In the year 2013,Bharath suggested another hybrid image compression technique which is s combination of DCT, DWT and Huffman coding for reducing the blocking artifacts and false contouring which occurs during DCT based techniques.

Following are the steps involved in the method-

i. First of all the 256x256 image is divided in to a 32x32 window.
ii. In the next step one dimensional DWT is applied and image is divided in to a 16x16 size.
iii. In the next step, two dimensional DWT is applied to the image tog get the 8x8 size image.
iv. In the next step, image is then quantized.
v. In the next step, Huffman coding is applied to get the better compression.

The proposed method is said to have a decreased contouring effect produced due to the DCT.



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In the year 2013, Nikita Bansal and Sanjay Dubey suggested transform based hybrid image compression techniques. Main objective of his work is to achieve high compression ratio and good quality and also less computational power. Following are the steps of algorithm.

i. Input the 256x256 image.
ii. Divide it in to a 32x32 size using DCT technique
iii. Apply two dimensional DWT on this image to get the image of size 16x16.
iv. Apply again the second level of 2D DWT on the on the 16x16 image to get the image of size 4x4.
v. Perform the scaling operation.

At the receiver side rescaling, inverse of DWT and inverse of DCT is applied to get back the original image. This technique has advantages of both the techniques.

*C. SPIHT BASED IMAGE COMPRESSION TECHNIQUES*

In the year 2013, Prathyusha Reddi suggested a compression scheme which is combination of the Hyper Analytical Wavelet Transform(HWT) and Set partition in Hierarchical tree(SPIHT).This scheme of image compression is able to achieve higher value of PSNR and Higher compression ratio.

Following are the steps of algorithm-

i. Convert the source image in to a hyper analytical image by using Hilbert transform.
ii. Take the 2D-DWT of the image obtained at the first step.
iii. In the next step, SPIHT method is used for encoding the image obtained at the second step for getting higher compression ratio.

At the receiver side, reverse operatyion is performed to reconstruct the image. Simulation result obtained in this method reveals that this method produce better quality reconstructed image as compared to the method DWT and SPIHT.

In the year 2013, Salija, suggested a new technique of image compression which is combination of the hybrid transform, SPIHT and block based seam carving algorithm. This is done to achieve higher compression ratio.

Following are the steps of algorithm-

i. Input the RGB image and convert it in to a Y Cb Cr format.
ii. Extract the region of interest by image analysis.
iii. Define the region manually and sharpen the ROI to get the high weighing factor.
iv. Apply the DWT coefficient to get the wavelet coefficients.
v. Apply the DCT to the coefficients of the wavelet.
vi. Apply the SPIHT for encoding the transformed wavelet coefficients.

Reconstruction is accomplished at the receiver side by reverse operation. The advantages of this methods are as follows

i. High Compression ratio.
ii. Least degradation in the image quality for a given bit rate.



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iii. Less complexity.
iv. Good Efficiency.

### *D. NEURAL NETWORK BASED IMAGE COMPRESSION TECHNIQUE*

In the year 2013, Sridhar, presented a new concept of image compression by combining the wavelet transform and neural network.

Following are the steps of the algorithm-

i. Input the color Image.
ii. Apply DWT transform on the color image to get the approximation coefficients.
iii. Compress these coefficients using DPCM and Neural Network.
iv. Apply Huffman coding to get the compressed image.

At the receiver side, reverse process is applied to reconstruct the image. This method improve the reconstructed quality of the image and at the same time reduce the artefacts produced by the DCT.

In the year 2013, Abdul Khader Jilani presented another method of image compression in which he first convert the image in to a another domain with the help of ridge-let transform and then quantized the coefficients.

The steps of algorithms are as follows-

i. Input the color image.
ii. Apply the ridgelet transform on this image.
iii. High apss and low pass filter is applied to approximation band.
iv. Partition the window.
v. Apply the hybrid back-propagation algorithm to this input to get the compressed image.

At the receiver side, reconstructed image is obtained by performing the reverse process.

Advantages of this method are as follows-

1. Simple algorithm.
2. Good quality reconstructed image.
3. No need for complicated bit allocation procesdure.

In the year 2013, Venkata Subbaroa proposed a lossy compression method which can be applied to image as well as to the video. This method is a combination of the Discrete Wavelet Transform(DWT) and Neural Network technique. In this method two level compression is achieved.

In the first level compression, DWT is applied to the original image. Compressed iamge is then passed to the next level. The next level is multiple level compression which is achieved by applying neural network. lastly image is quantized to get the final compressed image. Reverse process is applied to reconstruct the image.

The advantages of this method are as follows-

i. High Compression ratio.
ii. Work very well under noisy condition.

## III. CONCLUSION

Image compression is one of the essential tool in the present era of internet. This paper present an extensive survey on the different techniques of image compression. Fro the survey work it can be concluded that DCT, DWT and SPIHT based image compression provides higher compression ratio and at the same time provides good quality image. But in case of noisy environment, the performance of this method is affected to greater extent. Image Compression



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technique based on the soft computing also gives good quality reconstructed iamge along with the higher compression ratio. Image compression techniques which incorporate the neural network achieve better quality reconstructed iamge along with the higher compression ratio. It also eliminates the blocking effect produced due to the use of DCT.

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