

# A Review of Lossless and Lossy Based Image Compression Techniques

Roopesh Kumar Kurmi, Sumit Gupta

**Abstract:** Image compression aims to reduce the data size of images and to store or transmit these images efficiently. Therefore, it offers the promise of image/video transmission under limited bandwidth. The past few decades have witnessed an extensive body of literature on both lossless and lossy image compression. This paper presents a literature review of different number of lossy and lossless based image compression technique that have been developed by researchers to perform various application which are based on the various types of images such as medical images, standard images, or with all digital images. This review helps in analyzing the existing lossy and lossless based image compression technique and it discuss the image quality, image compression ratio, image compression rate, PSNR value etc.

**Keywords:** image compression ratio, image compression rate, PSNR value etc.

## I. INTRODUCTION

Digital images are usually encoded by lossy compression methods due to their large memory or bandwidth requirements. The lossy compression methods achieve high compression ratio at the cost of image quality degradation. However, there are many cases where the loss of information or artifacts due to compression needs to be avoided, such as medical, prepress, scientific and artistic images [7]. With the arrival of the internet and the multimedia age, the number of images available online has grown rapidly, and there is an increasing demand for better image compression techniques [3]. Typically, there is a lot of redundancy in the image data (e.g., the nearby pixels are usually correlated). With a sophisticated compression algorithm, we can greatly reduce the space required to store an image. The reversible compression of images requires processing steps, which are themselves invertible. This characteristic is achieved, in general, by using processing steps that map integer input samples to integer output values. This also concerns the color transformation, which aims at decorrelating the color components red, green, and blue (RGB) [4]. The property of self-similitude of fractal items is utilized by fractal pressure and fractal encoding. A portion of the squares got by isolating the shading picture into a few 8×8 pieces are comparable.

In this way, the idea of fractal picture pressure is utilized to avoid performing dreary pressure on a similar square. Fractal picture pressure must be utilized before encoding the quantized picture pieces. Comparable squares in a given information picture are recognized utilizing fractal picture pressure i.e., the coordinated area hinders for every range obstruct in a picture. The Euclidean separation measure is utilized to compute the likeness between the images.

Uncompressed multimedia (graphics, audio, images and video) requires considerable storage capacity and transmission bandwidth. In recent years, there has been rapid progress in storage capacity of storage media, processing/compilation time of processors/compilers, and digital communication system performances. On the same hand, bandwidth consuming applications and number of users are also increasing simultaneously. Therefore the demand for data compression and data transmission bandwidth continues to acts as a ban on technological growth. Due to these developments, the importance of efficient compression methods of audio/video/image data has been increasing tremendously. A compression method consists of definitions of two complex processes compression and decompression. Compression is a transformation of original data representation into different representation characterized by smaller number of bits. Opposite process reconstruction of the original data set is called decompression. There can be distinguished two types of compression: lossless and lossy [16]. In lossless compression methods, the data set reconstructed during decompression is identical as the original data set. In lossy methods, the compression is irreversible the reconstructed data set is only an approximation of the original image. At the cost of lower conformity between reconstructed and original data, better effectiveness of compression can be achieved. A lossy compression method is called “visually lossless” when the loss of information caused by compression-decompression is invisible for an observer (during presentation of image in normal conditions). However, the assessment, if a compression of an image is visually lossless, is highly subjective. Besides that, the visual difference between the original and decompressed images can become visible when observation circumstances change. In the process of image compression we used various methods such as Wavelet transform, Haar transform, Discrete cosign transform, Differential Pulse Coded Modulation (DPCM), Huffman Coding, Image wavelet transform and hybrid methods. All these image compression methods are the following of two methods one is image lossy compression techniques and the second one is image lossless compression techniques.

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With using all these methods we maintain the performance parameter value for the proposed methods.

The rest of this paper is organized as follows in section II we describe a need of image compression and their application area for the various standard image and their formats, in section III we discuss about the rich literature survey for the existing image compression techniques, here we also describe the about comparative study in a table no. 1. In section IV we discuss about the problem formulation and statement, and also presents here the comparative study of existing image compression techniques. In section V we conclude the about our paper which is based on the whole literature survey journey. And finally in section VI we define the future scope of the paper.

### II. NEED OF IMAGE COMPRESSION AND APPLICATIONS

Image compression addresses the problem of reducing the amount of data required to represent a digital image. This process intended to yield a compact representation of an image; thereby reducing the image storage/transmission requirements. Compression is achieved by the removal of one or more of the three basic data redundancies: Coding Redundancy, Inter pixel Redundancy, Psychovisual Redundancy, PSNR Value, Compression Rate and their Compression Rate etc. Coding redundancy is present when less than optimal code words are used. Thus the inter pixel redundancy results from correlations between the pixels of an image. And Psychovisual redundancy is because of data that is ignored by the human visual system (i.e. visually non-essential information).

Our Proposed algorithm is supposed to produce a good quality image for a given bit rate and will accomplish this task in an embedded fashion i.e. in such a way that all encoding of same image at lower bit rates are embedded in the beginning of the bit stream for the target bit rate. It will be helpful in many applications, particularly for progressive transmission, image compatible Trans coding in a digital hierarchy of multiple bit rates. It is also applicable to transmission over noisy channel in the sense that the ordering of the bits in order of importance leads naturally to prioritization for the purposes of layered protection schemes.

### III. RELATED WORK

[1] Creators presented in this paper is a point by point investigation of different changes like Discrete Cosine change, Singular Value Decomposition, Discrete Hadamard change, Slant change, Discrete Haar change which are connected to an arrangement of considered biomedical pictures to accomplish picture pressure. The operations on pictures are performed in change space where the DC coefficients are put away and truncation operation is performed by setting comparing limit to accomplish craved PSNR to keep up the nature of reproduction. In this paper, the biomedical pictures are subjected to all pressure plans said by setting PSNR to 25dB and 30dB.

[7] This paper presents a new lossless color image compression algorithm, based on the hierarchical prediction and context-adaptive arithmetic coding. For the lossless

compression of an RGB image, it is first decorrelated by a reversible color transform and then Y component is encoded by a conventional lossless grayscale image compression method. For encoding the chrominance images, we develop a hierarchical scheme that enables the use of upper, left, and lower pixels for the pixel prediction, whereas the conventional raster scan prediction methods use upper and left pixels.

[2] In this paper author presents the about the wavelet transformation used for the image compressions the details are like specialists worried with a specific kind of pressure procedures by utilizing wavelet changes. Wavelets are utilized to describe an unpredictable example as a progression of basic examples and coefficients that, when duplicated and summed, repeat the first example. The information pressure plans can be isolated into lossless and lossy pressure. Lossy pressure by and large gives much higher pressure than lossless pressure. Wavelets are a class of capacities used to restrict a given flag in both space and scaling areas. [12] In this actualize they characterized Image pressure implies decreasing the span of representation document, without bargaining on its quality. Contingent upon the recreated picture, to be precisely same as the first or some unidentified misfortune might be acquired, two systems for pressure exist. Two strategies are: lossy methods and lossless systems. This paper presents DWT and DCT usage on the grounds that these are the lossy strategies. This paper goes for the pressure utilizing DCT and Wavelet change by selecting legitimate technique, better outcome for PSNR have been gotten.

[8] This paper presents an encoder for the lossless compression of color filter array (CFA) data, which consists of a hierarchical predictor and context-adaptive arithmetic encoder. In hierarchical prediction, the subsampled images are encoded in order; each of the subimages contains only one color component (red, green, or blue) in the case of a Bayer CFA image. By subsampling, the green pixels are separated into two sets, one of which is encoded by a conventional grayscale encoder, and then is used to predict the green pixels in the other set. [16] The aim of the proposed paper is to improve the compression rate using Super-Spatial Structure Prediction technique and HCC. Medical image compression is unavoidable due to large amount of storage space or high bandwidth for communication in its original form. In hospitals sequence of images are produced which are much correlated. Hence lossless image compression technique is required. To exploit the correlation a new algorithm is proposed in this paper. [3] They build up some straightforward capacities to figure the DCT and to pack pictures. A picture pressure calculation was grasped utilizing Matlab code, and altered to perform better when actualized in equipment depiction dialect. The IMAQ square and IMAQ piece of MATLAB was utilized to dissect and examine the consequences of Image Compression utilizing DCT and shifting co-efficients for pressure were created to demonstrate the subsequent picture and blunder picture from the first pictures.

[4] In the actualize, creators characterized that the specific wavelet picked and utilized here is the least complex wavelet shape in particular the Haar Wavelet. The 2D discrete wavelet change (DWT) has been connected and the detail lattices from the data framework of the picture have been evaluated. The reproduced picture is integrated utilizing the evaluated detail networks and data lattice gave by the Wavelet change.

[17] This paper have three version of KG technique which named as KG1, KG2 and KG3. These technique are very useful in image compression but all have different way to compress image. Compression ratio of image are also different in these three version and better to each other which depends upon what types of image chosen for compression. The need for an efficient technique for compression of Images ever increasing because the original images need large amounts of disk space seems to be a big disadvantage during transmission & storage. Even though there are so many compression technique already present a better technique which is faster, memory efficient and simple which surely suits the requirements of the user.

[6] In this work, they discuss the suitability of lossy compression for DNA microarray images and highlight the necessity for a distortion metric to assess the loss of relevant information. They also propose one possible metric that considers the basic image features employed by most DNA microarray analysis techniques. Experimental results indicate that the proposed metric can identify and differentiate important and unimportant changes in DNA microarray images.

[11] They talked about, amid picture pressure, the extent of a design record is diminished in bytes without exasperating the nature of the picture past a satisfactory level. A few strategies, for example, Discrete Cosine Transform (DCT), DWT, and so forth are utilized for

packing the pictures. Be that as it may, these strategies contain some blocking ancient rarities. With a specific end goal to beat this trouble and to pack the picture effectively, a mix of DCT and fractal picture pressure procedures is talked about.

[5] They portrayed the execution of three most broadly utilized strategies to be specific DCT, DWT and Hybrid DCT-DWT are talked about for picture pressure and their execution is assessed regarding Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE) and Compression Ratio (CR). The test comes about got from the study demonstrates that the Hybrid DCT-DWT procedure for picture pressure has when all is said in done a superior execution than individual DCT or DWT.

[15] In this paper, an efficient technique for hyper ghostly picture pressure is introduced. The examined calculation, in view of Discrete Wavelet Transform and Tucker Decomposition (DWT-TD), abuses both the ghostly and the spatial data in the pictures. The center thought behind they talked about method is to apply TD on the DWT coefficients of ghostly groups of HSIs. They utilize DWT to adequately isolate HSIs into various sub-pictures and TD to efficiently minimal the vitality of sub-pictures.

[14] They considers the plan of a lossy picture pressure calculation committed to shading still pictures. After a preprocessing step (mean expelling and RGB to YCbCr change), the DCT change is connected and took after by an iterative stage (utilizing the cut strategy) including the thresholding, the quantization, dequantization, the reverse DCT, YCbCr to RGB change and the mean recuperating.

**Table 1: Shows that the comparative study of various image compression techniques for the various image and using transform and coding techniques.**

Ref No.	Author	Title	Proposed Techniques	Publication
[1]	Shruthi K N, Shashank B M, Y.SaiKrishna Saketh, Dr. Prasantha .H.S and Dr. S.Sandya	Comparison Analysis Of A Biomedical Image For Compression Using Various Transform Coding Techniques	Author presents here various compression comparative analysis on biomedical images.	IEEE2016
[2]	V. V. Sunil Kumar and M. Indra Sena Reddy	Image Compression Techniques by using Wavelet Transform.	In this article author shows the comparative result analysis using wavelet based image compression techniques.	IJEA 2012
[5]	Kiran Bindu, Anita Ganpati and Aman Kumar Sharma	A Comparative Study Of Image Compression algorithms	Here author presents the Comparative study of image compression algorithms.	IJRCS2012.
[15]	Azam Karami, MehranYazdiand Grégoire Mercier	Compression of Hyperspectral Images Using Discrete Wavelet Transform and Tucker Decomposition.	Here author shows the hyperspectral image compression using wavelet and Tucker Decomposition.	IEEE 2012
[12]	Navpreet Saroya and Prabhpreet Kaur	Analysis of IMAGE COMPRESSION Algorithm Using DCT and DWT Transforms	Here they discuss about the image compression algorithms using DCT and DWT transform coding.	IJARSE, 2014
[9]	Mai Xu, Shengxi Li, Jianhua Lu, Wenwu Zhu	Compressibility Constrained Sparse Representation With Learnt Dictionary for Low Bit-Rate Image Compression	In this article author presents the image compression with using sparse representation.	IEEE 2014

**IV. PROBLEM STATEMENT AND COMPARATIVE STUDY**

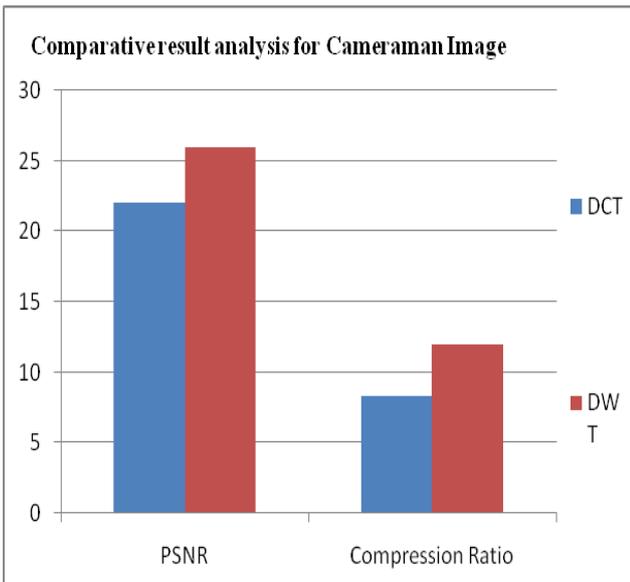
In the process of literature review we have studied various research paper related to image data compression in terms of lossless and loosy image compression techniques. All these techniques have certain limitation over certain pros and cons. The performance evaluation parameter decides the correctness and efficiency of various image compression algorithms, the compression techniques may be lossy or lossless compression techniques. According to all these techniques some algorithm provides lower rate of PSNR value, and compression ratio therefore we suffered from these above mentioned issues or challenges during the image compressions. Some authors used the hybrid image compression techniques for improve the quality of an image and better value for the performance evaluation parameters.

**Table 2: Shows that the PSNR, and Compression Ratio using DCT, DWT, IWT and HYBRID method for Cameraman.jpeg image.**

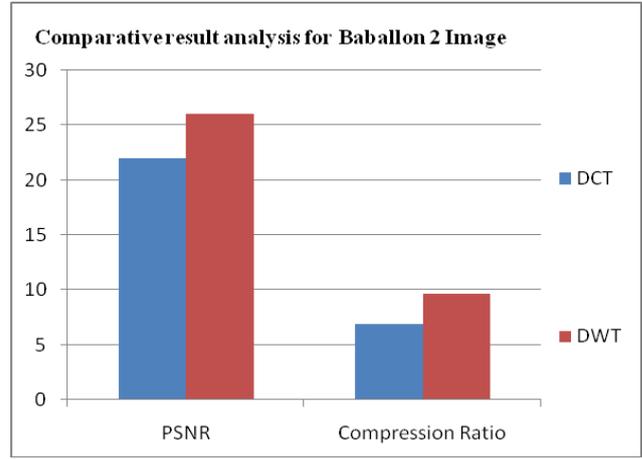
Image	TECHIQUES	PSNR	Compression Ratio
Cameraman	DCT	22	8.3
	DWT	26	12

**Table 3: Shows that the PSNR, and Compression Ratio using DCT, DWT, IWT and HYBRID method for Baballon2.jpeg image.**

Image	Techniques	PSNR	Compression Ratio
Baballon2	DCT	18	6.79
	DWT	21	9.79



**Figure 1: Shows that the comparative result graph for cameraman image as an input image with two different methods such as DCT and DWT, also find the value of PSNR, Compression Ratio.**



**Figure 2: Shows that the comparative result graphs for Baballon 2 image as an input image with two different methods such as DCT and DWT, also find the value of PSNR, Compression Ratio.**

**V. CONCLUSION**

Image compression is the application of data compression on digital images. In effect, the objective is to reduce redundancy of the image data in order to be able to store or transmit data in an efficient form. Image compression can be lossy or lossless. In this paper we describe the rich literature survey on the existing image compression techniques; the types of image involve some standard images, digital images, bio-medical images etc. for the image format .png, .jpeg, .bmp, etc. after the literature survey we found the some issues and challenges with image compression techniques such as PSNR value of image, Compression ratio, Computed time etc.

**FUTURE WORK**

Every day, a massive amount of information is stored, processed, and transmitted digitally. This process of image compression is done by using two methods that are DCT and DWT. There are two different encoding systems in operation within the compression system, the predictive coding, and the transform coding. In future we compress the image using more than two methods and improve the value of PSNR; Compression Ratio etc. also compress the image with using some optimization techniques for the image compression.

**REFERENCES**

1. Shruthi K N, Shashank B M, Y.SaiKrishna Saketh, Dr. Prasantha .H.S and Dr. S.Sandya “Comparison Analysis Of A Biomedical Image For Compression Using Various Transform Coding Techniques”, IEEE, 2016, Pp 297-303.
2. V. Sunil Kumar and M. Indra Sena Reddy “Image Compression Techniques by using Wavelet Transform”, Journal of Information Engineering and Applications, 2012, Pp 35-40.
3. Maneesha Gupta and Dr.Amit Kumar Garg “Analysis Of Image Compression Algorithm Using DCT”, IJERA, 2012, Pp 515-521.
4. Kamrul Hasan Talukder and Koichi Harada “Haar Wavelet Based Approach for Image Compression and Quality Assessment of Compressed Image”, AJAM, 2010, Pp 1-8.



5. Kiran Bindu, Anita Ganpati and Aman Kumar Sharma "A COMPARATIVE STUDY OF IMAGE COMPRESSIONALGORITHMS", International Journal of Research in Computer Science, 2012, Pp 37-42.
6. Miguel Hernandez-Cabrero, Victor Sanchez, Michael W. Marcellin, Joan Serra-Sagrista "A distortion metric for the lossy compression of DNA microarray images" 2013 Data Compression Conference.
7. Seyun Kim, Nam Ik Cho "Hierarchical Prediction and Context Adaptive Coding for Lossless Color Image Compression" I IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 23, NO. 1, JANUARY 2014. Pp 445-449.
8. Seyun Kim, Nam Ik Cho "Lossless Compression of Color Filter Array Images by Hierarchical Prediction and Context Modeling" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 24, NO. 6, JUNE 2014. Pp 1040-1046.
9. Mai Xu, Shengxi Li, Jianhua Lu, Wenwu Zhu "Compressibility Constrained Sparse Representation With Learnt Dictionary for Low Bit-Rate Image Compression" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 24, NO. 10, OCTOBER 2014. Pp 1743-1757.
10. Vikrant Singh Thakur, Kavita Thakur "DESIGN AND IMPLEMENTATION OF A HIGHLY EFFICIENT GRAY IMAGE COMPRESSION CODEC USING FUZZY BASED SOFT HYBRID JPEG STANDARD" 2014 International Conference on Electronic Systems, Signal Processing and Computing Technologies. Pp 484-489.
11. Chandan Singh Rawat and Sukadev Meher "A Hybrid Image Compression Scheme using DCT and Fractal Image Compression", International Arab Journal of Information Technology, 2013, Pp 553-562.
12. Navpreet Saroya and Prabhpreet Kaur "Analysis of IMAGE COMPRESSION Algorithm Using DCT and DWT Transforms", International Journal of Advanced Research in Computer Science and Software Engineering, 2014, Pp 897-900.
13. S.M.Ramesh and Dr.A.Shanmugam "Medical Image Compression using WaveletDecomposition for Prediction Method", IJCSIS, 2010, Pp 262-265.
14. Fouzi Douak, Redha Benzid and Nabil Benoudjit "Color image compression algorithm based on the DCT transform combined to an adaptive block scanning", Elsevier, 2011, Pp 16-26.
15. Azam Karami, Mehran Yazdani and Grégoire Mercier "Compression of Hyperspectral Images Using Discrete Wavelet Transform and Tucker Decomposition", IEEE, 2012, Pp 444-450.
16. MFerni Ukrit, G.R.Suresh "Effective Lossless Compression for Medical Image Sequences Using Composite Algorithm" 2013 International Conference on Circuits, Power and Computing Technologies. Pp 1122-1126.
17. Krishan Gupta, Dr Mukesh Sharma, Neha Baweja "THREE DIFFERENT KG VERSION FOR IMAGE COMPRESSION" 2014. Pp 831-837.