ISSN 2278-3083

International Journal of Science and Applied Information Technology, Vol.7. No.1, Pages : 30-35 (2017)
Special Issue of ICSIC 2017 - Held during 23-24 September 2017 in Amman Arab University, Amman-Jordan
http://www.warse.org/IJSAIT/static/pdf/Issue/icsic2017sp05.pdf

Comparison of 2D-DCT with Linear Quantization and DWT Image Compression

Prof. Khalid Kaabneh
Department of Computer Science, College of Computer Science and Informatics.
Amman Arab University
kaabneh@aau.edu.jo

Dr. Hassan Tarawneh
Department of Mobile Computing, College of Computer Science and Informatics.
Amman Arab University
hassan@aau.edu.jo

Dr. Issam Al-Hadid
Department of Business Information Technology, College of Information Technology.
Jordan University
i.alhadid@ju.edu.jo

***Abstract*—Data compression is defined as the process of encoding data using a representation that reduces the overall size of data. This reduction is possible when the original dataset contains some type of redundancy. Digital image compression is a field that studies methods for reducing the total number of bits required to represent an image. This can be achieved by eliminating various types of redundancy that exist in the pixel values. In general, three basic redundancies exist in digital images that follow. This paper addresses the different visual quality metrics, in digital image processing such as PSNR, MSE. The encoder is used to exchange the source data into compressed bytes. The decoder decodes the compression form into its original Image sequence. Data compression is achieved by removing redundancy of Image. Lossy compression is based on the principle of removing subjective redundancy. Lossless compression is depended on effective SR (Subjective redundancy). The encoder and decoder pair is named by CODEC. This paper presents a new lossy and lossless image compression technique using 2D-DCT with linear quantization and DWT. In this technique, the compression ratio is compared. In the proposed system image compression ratio are compared with sever results. In future image compression will done in DWT.**

Keywords—2D DCT; Discrete Wavelet Transform; PSNR; statistical redundancy; MSE.

I. INTRODUCTION

Lossless image compression algorithms are generally used for images that are documents and when lossy compression is not applicable. Lossless algorithms are especially important for systems transmitting and archiving medical data, because lossy compression of medical images used for diagnostic purposes is, in many countries, forbidden by law. Furthermore, we have to use lossless image compression when we are unsure whether discarding information contained in the image is applicable or not. The latter case happens frequently while transmitting images by the system not being aware of the images' use, e.g., while transmitting them directly from the acquisition device or transmitting over the network images to be processed further [12, 13]. The use of image compression algorithms could improve the transmission throughput provided that the compression algorithm complexities are low enough for a specific system. Some systems such as medical CT scanner. Image performance may be calculated using 2D-DCT and DWT algorithms. The input image is divided in to n x n blocks. Then each block is transformed using 2D DCT and DWT. The 2D-DCT Coefficients of each block are arranged in hierarchical manner for easier analysis.

DWT have different types of Wavelets and thresholding techniques[1, 2, 16]. The first step of the compression algorithm is image decomposition in nxn sub-images. The DWT Coefficients of each block is arranged in Hilbert Fractal Curve. The Wavelet transforms is applied to each vector and some of the high frequency are suppressed based on the some threshold criteria. Wavelet transforms involve representing a general purpose in terms of simple, fixed building blocks are generated from a particular fixed function called mother wavelet function.

2D-DCT with linear quantization only compress the image of lower decorative performance, 2D-DCT is low level image compression. 2D-DCT only offers Lossy transform, meanwhile, DWT offers both Lossy and Lossless transform. The main focus of this work is DWT filter based on achieved compression ratio. The Proposed image compression technique has been tested on well-known image like compared with the JPEG2000 and DWT Techniques [1].At finally lossless compression DWT is followed.

ISSN 2278-3083

International Journal of Science and Applied Information Technology, Vol.7. No.1, Pages : 30-35 (2017)
Special Issue of ICSIC 2017 - Held during 23-24 September 2017 in Amman Arab University, Amman-Jordan
http://www.warse.org/IJSAIT/static/pdf/Issue/icsic2017sp05.pdf

II. RELATED WORK

H.singh et al. [1] presented a hybrid image compression using DWT, DCT & Huffman encoding techniques. Image compression deals with reduce the number of bits needed to indicate an image by removing redundant data. Image compression is extensively categories into two types, namely Lossy and Lossless depending on whether the original image can be recovered with fill mathematic precision from the compressed image.

M.Aharon et al. [2] obtainable the nonlinear PDE based filters have been extensively implemented in image de-noising. However in common, nonlinear filter needs more computing time than most of the linear filters.

I.Daubenchies et al. [3] identified DWT that is used in lossless JPEG2000 compression of grayscale images, reduced to essentials. The high level DWT transforms that provide multi resolution image representation are obtained by mallet decomposition. Advantageous properties of a lifting scheme made it useful to construct significant transforms for the lossless image including discrete wavelet transform

Chen et al. [4] acknowledged the discrete wavelets transforms adaptively choose the best lifting way and use the Lagrange interpolation Procedure to make predictions according to its local characteristics. Discrete Wavelets Transform, which can adaptively choose the best lifting directions and use the Large range interpolation technique to make predictions according to its local uniqueness.

C.H.son et al. [5] JPEG 2000 is a high performance of image compression algorithm .the algorithm have been divided into two groups Lossy Image compression and Lossless Image compression. Lossy compression algorithms aim at high compression Proportion compared with Lossless aim at high compression Proportion. Santa-cruz D. [6] Presented the input image is divided into Non-overlapping n x n blocks. Then each block is transformed using DCT. The DCT confidents of each block are accepted in a wavelet like hierchical manner. Through there exists a number of possible arrangement of coefficients.

2D-DCT with linear quantization only compress the image of lower decorative performance, 2D-DCT is low level image compression. 2D-DCT only offers Lossy transform, meanwhile, DWT offers both Lossy and Lossless transform. The main focus of this work is DWT filter based on achieved compression ratio. The Proposed image compression technique has been tested on well-known image like compared with the JPEG2000 and DWT Techniques [1].At finally lossless compression DWT is followed.

L.Zhang et al. [7] had known a new frame work for image compressive sensing recovery using adaptively learned scarifying basis via L0 minimization. The intrinsic sparsely of natural images is enforced significantly by sparsely instead of overlapped image patches using the adaptively learned scarifying basis minimum the form of L0 norm, greatly reducing locking artifacts and confining the Cs solution space.

Z.Gao et al. [8]offered the non-adaptive outcrop representation for the Usual images by conventional CS (CCS) framework may lead to an ineffective compression presentation when comparing to the classical image compression standards such as JPEG and JPEG2000. DCT is used to improving the compressed image quality.

G.BheemeswaraRao et al. [9] identified the Lossy Compression image which does not give good vision of the image, but achieves good compression ratio. After DWT Processing the Bit plane Encoder handles DWT coefficient for statistics compression. The bit Plane encoder encodes a segment of images from most significant bit to least significant bit.

HanyFarid et al. [10] accessible Detection of double image compression is important to the analysis of tampered image and image steganalysis. Below the JPEG standard, the 2D-DCT Coefficients will have a Phenomenon of interrupted decrease or disappearance duo to recompression the image, which can be used to detect the double JPEG format image.

III. IMAGE COMPRESSION AND TECHNIQUE

The term data image compression refers to the process of reducing the amount of data required to represent a given amount of information. A clear distinction must be made between data and information. Data redundancy is a central issue in digital image compression.

There are two types if image compression technique Lossy technique and Lossless technique

ISSN 2278-3083

International Journal of Science and Applied Information Technology, Vol.7. No.1, Pages : 30-35 (2017)
Special Issue of ICSIC 2017 - Held during 23-24 September 2017 in Amman Arab University, Amman-Jordan
http://www.warse.org/IJSAIT/static/pdf/Issue/icsic2017sp05.pdf

2D-DCT is used in signal, image processing especially for Lossy compression because it has a strong energy compaction to create predictions according to its local uniqueness. The Lossy image compression did not give Proper vision of the image, but it gives good compression ratio of the image. DWT is used to separate the image into a pixel. DWT is used in signal and image processing especially for lossless image compression. DWT is also used for Lossy compression. The Lossless image compression is mostly used in DWT Lossless image compression give the good quality of the image and also the compression ratio of the image also good. The PSNR ratio of the image is also good in the Lossless compression.

A. LOSSY TECHNIQUE:

Lossy compression technique relies on removing image redundancies by splitting the image into nxn matrix. Lossy compression image was slow and didn't give good subjective results of the compressed image.

1) Singular Value Decomposition Image Compression (SVD) is lossy due to the nature level of the process. The basic idea here is each image can be represented as a matrix and we apply linear algebra (SVD and Wavelet) on this matrix and get a redcuced matrix out of this original matrix and the image corresponding to this reduced matrix requires much lesser storage space as compared to the original image. The SVD compression technique offers very good PSNR values but low compression ratios.
2) WDR technique combines run-length coding of the significance map with a well-organized illustration of the run-length symbols to produce relates embedded image coder. SPIHT and WDR both have techniques, the zerotree data structure is precluded, but the embedding principles of lossless bit plane coding and set partitioning are sealed. Rather than using the zerotrees, each coefficient during a off wavelet pyramid is appointed a linear position index in the WDR algorithm. Output of the WDR encoding can be arithmetically compressed The WDR compression offers very good PSNR value and good compression ratios.
3) The 2D-DCT lossy image compression technique gives the best result for the lossy image compression. The value of the 2D-DCT Lossy image compression PSNR value is good in high compression ratio. In the lossy compression technique the quality of the image is low and the compression ratio was good.
4) Discrete Wavelet Transform (DWT) is wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has overFourier transforms is temporal resolution: it captures both frequency and location information (location in time) DWT lossy image compression technique did not give the best result because of lossy image compression. The value of the DWT image compression PSNR value is low in high compression ratio. In the Lossy compression ratio was good but average quality of the image.

B. LOSSLESS TECHNIQUE:

Lossless is also a one type of image compression technique, it is based on SR effect. In the lossless technique, the compressed image gives a good subjective and objective quality of the original image. In the lossless image compression the output result of PSNR value is also good.

1) SVD based compression is lossless due to the nature of the process. That the qualitative lossless is not noticeable up to some point. The SVD compression technique offers very good PSNR values but high compression ratio.
2) WDR based compression is lossless due to the nature of the process. However the qualitative lossless is visible in some point. The compression measure of the lossless image is also high value. The WDR compression offers very good PSNR value and good compression ratios.
3) The 2D-DCT lossless image compression technique gives the average result for the lossless image compression. The value of the in the lossless compression technique 2D-DCT did not give the best result for the image compression. The PSNR value of lossless compression is good.
4) DWT image compression is the technique mostly used in the lossless image compression. In this technique lossless gives the best compression result. The PSNR value of Lossless Image is good quality. The lossless image compression ratio was good, and also the quality of the lossless image compression also good.

ISSN 2278-3083

International Journal of Science and Applied Information Technology, Vol.7. No.1, Pages : 30-35 (2017)
Special Issue of ICSIC 2017 - Held during 23-24 September 2017 in Amman Arab University, Amman-Jordan
http://www.warse.org/IJSAIT/static/pdf/Issue/icsic2017sp05.pdf

IV. FRAMEWORK

2D-DCT and DWT Image compression technique have the best compression Framework Diagram. The Framework delivers the best result of the 2D-DCT and DWT Image Compression. It is easy way to understand the technique. Through the diagrammatic representation 2D-DCT and DWT Image compression technique is easily understand. 2D-DCT of Lossy image compression may have the high compression ratio, but the outcome of the image was not good. But the DWT image compression technique the quality of the image ratio and the outcome of the image was good. Using the lossless image compression the output of the image was good us expected.

2D-DCT also have best image compression ratio in the image compression technique, but the output of the image in lossy compression was not good us expected. The 2D-DCT transformation of the image is taken in to the pixel ratio us nxn matrix formation. Then the image is transforms into the 2D-DCT quantization. After that the 2D-DCT image will move to the DPCM encoder. Then the compressed image will come us output. In the DWT transformation, the image is taking into HL, LH, HH, LL Ratios. Then the image is moved into DWT transforms, and then DWT Quantization is processed. After that the process is move to DPCM encoder. Then the compressed image will come us the output. The output image has the good compression ratio. The PSNR value of the compressed image is good us expected.

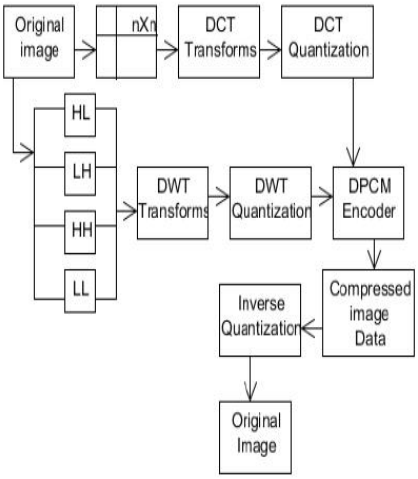

Fig.1: Architecture of 2D-DCT and DWT Comparison

V. EXPERIMENTAL RESULT

a) 2D-DCT (Two Dimensional Discrete Cosine Transform:

The discrete cosine transform (2D-DCT) is used to separate the image in to pixel. 2D-DCT is used in signal, image processing especially for lossy compression because it has a strong energy compaction. The lossy image compression ratio of the image was good in number. But the outcome of the image was not good. The quality of the image was not good us lossless image compression technique. 2D-DCT image compression may compress the image in nxn metric formation. The 2D-DCT transforms the image into the pixels. The pixel of image is transformed in to the level of compression process. Then the image is transformed in to quantization process.

b) DWT (Discrete Wavelet Transforms):

DWT is used to separate the image into a pixel. DWT is used in signal and image processing especially for lossless image compression. DWT is also used for lossy compression .DWT is used in lossy and lossless image compression technique. DWT is used in lossless image (jpeg 2000) compression of gray level image.DWT transforms a discrete signal .L represent the low-pass filtered signal L(low frequency)allows the perfect reconstruction of original Image. H represents the high-pass filtered signal. The DWT represents the two images representing the technique to transform the DWT process. Then the DWT image will move on to the quantization process. That the process is doing again and again to get the best result. Thus the output of the DWT image compression is good. The PSNR value is also good in compression ratio. The quality of the DWT image is also good. Now a day's DWT image compression technique is used to get the best output, and also to get the quality of the image.

ISSN 2278-3083

International Journal of Science and Applied Information Technology, Vol.7. No.1, Pages : 30-35 (2017)
Special Issue of ICSIC 2017 - Held during 23-24 September 2017 in Amman Arab University, Amman-Jordan
http://www.warse.org/IJSAIT/static/pdf/Issue/icsic2017sp05.pdf

VI. FIGURES AND TABLES

TABLE I: COMPARISON OF IMAGE COMPRESSIONS.

Table I	IMAGE COMPRESSION TECHNIQUE				
S.No	*Image Name*	*Paper-A DWT*	*Paper-B DCT*	*Paper-c DWT*	*Paper-D DCT*
I	Lena	39.05	29.50	17.65	34.65
II	Peppers	39.12	35.17	15.74	35.17
III	Boats	33.81	38.30	17.39	35.51
IV	Goldhill	37.77	27.75	12.05	32.30
V	Barbara	31.61	24.15	19.59	32.04

In the above table, the compression ratio is specified. The image is Lena, peppers, Boats, Goldhill ,and Barbara images are specified. The compression ratio must be in high. In this table, Paper1 and Paper 3 got highest compression ratio.

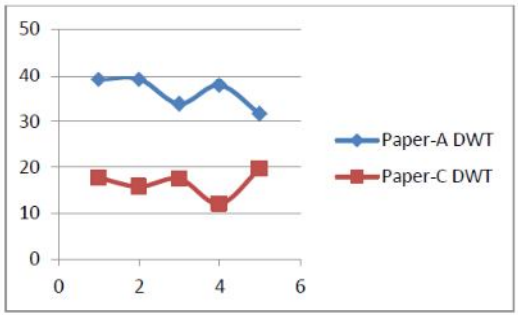

Fig. 2: Compression of DWT

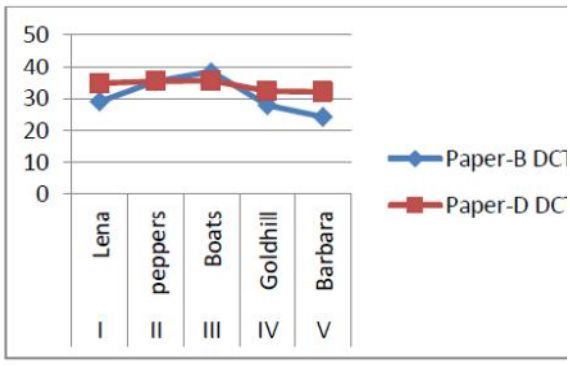

Fig.3: Compression of 2D-DCT

VII. CONCLUSION

Digital image compression has been the focus of a large amount of research in recent years. As a result, data compression methods grow as new algorithms or variations of the already existing ones are introduced. All these digital image compression methods are concerned with minimization of the amount of information used to represent an image. They are based on the same principles and on the same

theoretical compression model, which effectively reduces three types of redundancy, such as psycho-visual, inter-pixel and coding, inherited in gray-level images.

In this paper, we have compared two compression transform coding technique 2D-DCT and DWT. Discrete cosine Transform provides higher compression ratio & can avoid noise that may affect the transferred image, allows good localization both in spatial & frequency domains. Based on PSNR and MSE values 2D-DCT is better than DWT with large coefficients and high compression ratio. The Proposed technique was using DWT in order to get the high compression technique. The DWT achieved better PSNR values. In addition, it performed better when we applied noise to the compressed image and when the noise elements are located in a high frequency. Wavelet represents an excellent tool in image processing to increase the result in quality and Performance.

REFERENCES

[1] Awwal Mohammed Rufai,"Lossy image compression using singulat vale decomposition and wavelet dofference reduction",Elsevier, Digital Signal Processing,No.24,PP.117-123,2013.

[2] Y.-T. Shih,"An adaptive parameterized block-based singular value decomposition for image denoising and compression",Elsevier, Applied Mathematics and computation, No.218,PP.10370-10385,2012.

[3] Roman Starosolski,"Application of reversible denoising and lifting steps to DWT in lossless JPEG 2000 for improved bitrates",Elsevier,Signal Processing:Image Communication,No.39,PP.249-263,2015.

[4] Shutuan Yang,"Improved Bandelet with heuristic evolutionary optimization for image compression",Elsevier,Engineering Applications of Artificial Intelligence,No.31,PP.27-34,2014.

[5] Long Yang, "A Low complxity block-based adaptive lossless image compression",Elsevier,Optik,No.124,PP.6545-6552,2013.

[6] Ranjan ,"Listless block-tree set partitoning algorithm for very low bit rate embedded image compression",Elsevier,International Journal of

ISSN 2278-3083

International Journal of Science and Applied Information Technology, Vol.7. No.1, Pages : 30-35 (2017)
Special Issue of ICSIC 2017 - Held during 23-24 September 2017 in Amman Arab University, Amman-Jordan
http://www.warse.org/IJSAIT/static/pdf/Issue/icsic2017sp05.pdf

Electronics and Communications(AEU),No.66,PP.985-995,2012.

[7] Jian Zhang, "Image compressive sensing recovery using adaptively learned sparsifying basis via LO minimization",Elsevier,Signal Processing,No.103,PP.114-126,2014.

[8] Zhiring Gao, "Image representation using block compressive sensing for compression applications",Elsevier,J.Vis.Commun.Image R,

No. 24,PP.885-894.2013.

[10] Dhara Shah,"Development of Lossy Image Compression Using CCSDS Standard Algorithm Using MATLAB",IEEE,PP.978-1-47799-9.2015.

[11] WANG WEI,"The Analysis and Detection of Double JPEG2000 Compression Based on Statistical Characterization of DWT Coefficients",Elsevier,Future Electica Power and Energy System,No.17,PP.623-629,2012.

[12] Al-Hadid, I., Khwaldeh, S., Kaabneh, k., Tarawneh, H., Efficient Big Data Transfer Technique for Static Routing Networks, International Journal of Applied Engineering Research, Vol. 12 (9), pp 2071-2078. 2017.

[13] aabneh, K., Tarawneh, H., Alhadid, I., Encrypted data Inquiries Using Chained Perfect Hashing (CPH), In International Conference on Mathematical Methods & Computational Techniques in Science & Engineering, University of Cambridge, UK. 2017.

[14] Anzhou Hu, "Image quality assessment using a SVD-based Structural projection",Elsevier,Signal Processing:Image Communication,No.29,PP.293-302,2014.

[15] Yousef, Nidal, Hassan Altarwaneh, and Aysh Alhroob. "Best Test Cases Selection Approach Using Genetic Algorithm." Computer and Information Science 8.1, 2015.

[16] Khalid A. Kaabneh, "High Fidelity Image Watermarking Using FWT by Exploiting the RGB and HSV Models", International Journal of Computer Technology and Applications (IJCTA), V. 5(2), April 2014.