Journal of Theoretical and Applied Information Technology
31st March 2019. Vol.97. No 6

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

NEW ALGORITHM IN IMAGE COMPRESSION BASED ON DISCRETE COSINE TRANSFORM

ZYAD THALJI
Management Information System, Imam Abdulrahman Bin Faisal University, KSA
ZYTHALJI@IAU.EDU.SA
ORCID (0000-0002-5703-9307)

ABSTRACT

Digital image compression is the most important field in digital image processing. Communication technologies and storage are using compression to compressed digital images. Digital image compression provides storage space when storing images on storage media and saving time when transferring data over communication networks. This paper aimed to compress an image by resizing the image dimension, the resizing image based on pixel location. The study used many methods to reach its goals. The method of separating the colour image is used to split the image into three intensity images (red intensity images, blue intensity images and green intensity images). The Discrete Cosine Transform (DCT) is used after the splitting the resizing image, resizing the image dimension reduced the dimension of the image to quarter. The new algorithm was applied for ten selected images from the internet, the experiment results show that the new algorithm has a high efficiency in image compression.

Keyword: *Image Compression, Image Resize, Discrete Cosine Transform, Inverse Discrete Cosine Transform, Colour Image.*

1. INTRODUCTION.

Image compression is a new protuberant subject for both armed and marketable academics. Due to fast evolution of numerical broadcasting, the succeeding essential for reduced loading, to communicate the image in a current way. All images type compression efforts to decrease the quantity of mandatory to numeric characterize, while an image upholding its apparent visual quality [1, 2].

Image compression is an important Information Technology issue, specifically when moving data over the Internet or saving it on storage media [3]. Compression of images reduces the file size or recoding the facts in the original image, this means that the image can look dissimilar after pressure than it was before, we need to compress images when we want to store volumes of data on a secondary storage medium or when we want to send amounts of data over the internet, image compression helps us to reduce the size of an image, an image compression fasting the speed of data transmission and distortion [4, 5].

Applied compression can give some amazing ratios with minimal distortion of the original image, it can be said that this idea is the basis of the new field of generation image compression. During the remaining period, the focus will be on developing the redundant information of the image as much as possible. With the removal of the redundant information by putting the resulting data in a new format, that is ideal for coding, compression devices are grouped into two types [6].

1.1 The Lossless Compression.

Lossless compression is a data compression algorithm, that compressed a file by changing the ASCII code of each symbols by a new data. The new code depended on the occurrence of symbols in the original file. Using a lossless compression method, the original data did not loss after decompression, this type of algorithm usually used a statistical occurrence that found in the data. Non-loss pressure is used with texts and images, such as a medical x-ray images, where no data loss can be tolerated. It should be noted that in pressure if the data has statistical equivalent distributed on all the representation of the file or an image, it is not useful to use this type of pressure. In this type of compression, the total difference between the original file and coding file must be equal zero. Length of the code (RLC) and Huffman Coding (Huff) are examples of this type of images compression [7].

1.1.1. Run-length coding.

The text written in English compressed to half at least by repeating the character flowed by a number. An example of this type is text documents scanned in black and white. This will produce an image for each page represented by a twodimensional array of many density values. At the point covered by the text, the density value 1, other points will zero. Since most text pages contain white and black colour, there will be long sequences of zero or one in the density array.

1.1.2. Huffman code.

The Huffman code is a distinct kind, that based on prefix code, usually the algorithm applied to compress information without losing data. Hoffman coding an idea compilation by David Hoffman, who was a student at the Massachusetts Institute of Technology, his paper presented in a 1952, with name "Method for building minimum codes of repetition" [1].

The result of the Huffman code can be shown as a variable length code, the algorithm originates this code from the valued chance or repetition of each possible value of the original code. As with other cryptographic methods of entropy, the most public ciphers represented using fewer symbols than less common symbols. The Huffman algorithm can be performed professionally, it can be developed by using the number of input weights [2, 8].

1.1.3. Prediction by partial matching (PPM)

Adaptive arithmetical coding density skill depended on appropriate displaying and calculation (PPM). Copies use a set of symbols in the open code to expect the next code in the stream. PPM algorithms can also be used to group data into groups expected in group analysis. PPM compression applications vary greatly in other details. The actual icon selection is usually recorded using the arithmetic encoding, although it is also possible to use Huffman coding or even a type of dictionary encryption technology. The basic form used in most PPM algorithms can also be expanded to predict multiple symbols. It is also possible to use non-Markov modelling to replace or merge PPM with Markov models. The icon size is usually fixed, usually one-byte is used to code symbols, making the general coding processes of any file format is easy to implement [9 - 11].

1.1.4. Bzip2.

Bzip2 is a permitted and open code file compression algorithm that uses the Burrows-Wheeler algorithm. It presses single files only, not an archived file. Established and preserved by Julian Seward. The first public release of bzip2, version 0.15, in July 1996. The stability and popularity of the compressor grew over the next few years, and Seward version 1.0 was released in late 2000 [12, 13].

1.2. The Lossy Compression Method Presses.

Lossy Compression is ignoring any data that are resolute to be needless. The type of data coding algorithm that uses inexact approximations and partial data discarding to represent the content of the image. These techniques are used to reduce data size for storing, handling, and transmitting content. Lossy compression is most usually used to coding multimedia files (images, audio, and video), exclusively in submissions such as streaming data and Messenger. Use lossy compression to reduce sound files or image files if accuracy or colour accuracy is not required and if some data loss is not observable. forms of this kind of pressure are [14]:

1.2.1. Resizing Image.

Changing the size of the image by reducing the length and the width of the image. It is best to use the foundation for base 2 to reduce the image size. For example, if we have a 1024 x 1024 image, the image size can be reduced to (512 x 512), (256 x 256) and (128 x 128).

1.2.2. Reducing the number of colours that used in the image level.

In the grayscale image, we use 256 colours, this colour can be reduced by half. This mothed reduces the number of bits needed to represent each pixel from eight bits to seven bits, but if we reduce the colour number significantly, it will affect clarity and image quality. Figure 1 shown the clarity and quality that affect the image, which used to reduce colours' numbers [15].

1.2.3. The use of bandwidth in the compression of images.

There are several types of algorithms that working in this area, for example, Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT), Fast Fourier Transform (FFT) and Walsh Hadamard Transform (WHT). The steps of using those algorithms are shown in Figure 2 [11].

Converting the image from one format to another (from spatial to Fourier) is not responsible for image compression. But the phase of quantization that follows the conversion phase is responsible for image compression. [10].

Figure 1: The clarity and quality that affect the image.

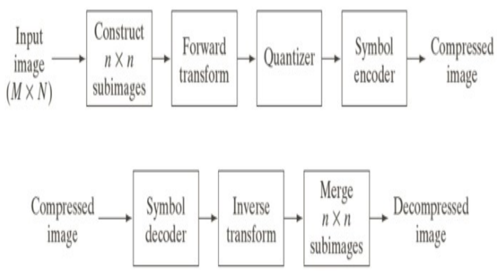


Figure 2: The steps of using bandwidth in the compression. [11].

1.3. The Importance of Compression.

Let's say we have a 10-minute video with use the standard view PAL System where the screen size is 720 x 576 pixels. If we know that the PAL system captures 25 frames per second and the coloured dots-point needs three bytes to represent them than the size of the clap is:

$$\text{size} = 720 * 576 * 3 * 10 * 60 * 25 = 18662400000 \text{ byte}$$

Calculating the final size of the clap, do not forget to multiply the final size with the total time of the film, This is a very large number of bytes, for this reason, image compression is very important. There are several factors that affect the decision to use compression. Such as limited storage capacities of hard drives and the speed of transport in networks, data transfer speed is often slow characterized [16].

Repetition can be eliminated to reduce file size. There is a lot of duplicate information in files; video, texts, audio, etc., which must be exploited to reduce them, so that we perform a process to compression files. The most important rule in the compression process is repeat units, repeat units are encoded with fewer bits than the non-duplicate units which take extra bits.

1.4. The Mechanisms of Decompression.

The compression mechanisms can be classified according to another criterion [17].

1.4.1. Nonadaptive methods.

It considered that the file stored on the computer, which wants to decompress it. Methods manipulate with files, and it put some statistics for the file to do the compression process.

1.4.2. Adaptive methods.

Adaptive methods are a most used in websites, it publishes live videos and live streams. The file is not completely stored in the storage. The file sent in a fragmented way, so we do the compression according to outcomes of data.

1.4.3. Hybrid methods.

which use both; nonadaptive methods and Adaptive methodologies as needed.

1.5. General Concepts in Image Compression.

1.5.1. Compression Ratio.

$$Cr = \frac{N1}{N2} \qquad (1)\ [18].$$

Where (*N1*): The number of bits in the original image (H). N2: The number of bits in the compressed image (H'). If Cr is bigger than one, the resulting image is smaller than the original image. If *Cr* is less than one, the resulting image is larger than the original image [18].

1.5.2 Error.

Error is the difference between the pixel value in the image after decompression with the corresponding pixel before the compression process [19]

$$e(x, y) = H'(l, h) - H(l, h) \qquad (2)$$

1.6.3 Total error.

The sum of the differences in an equation (2) for each pixel contained the image, can be calculated by.[19].

$$\sum_{x=0}^{M-1} \sum_{y=0}^{N-1} [H'(l, h) - H(l, h) \qquad (3)$$

2. LITERATURE REVIEW.

Doru discussed the coding of Laplacian sources of consistent quantities. Known techniques are used to proposal perfect codes for countless sequential sources for matching inductive foundations that have possible form roles with geometrically engineered atoms. Using the low-source perception, and the final encryptions are got as a sequence of very simple designs, avoiding the need to store cryptographic tables. By associating three identical additions, they find that reliably outclassing in the sense of distortion. Cryptograms considered for two-mutual engineering sources have become the elementary tackles used to compress JPEG-LS images without loss [20].

Tonny showed that the contrast of several lossless compression methods. His study only fears on audio the WAV 2 channel audio presentation. The code prefix to be produced converts appear more diverse, he gives little modification in the instruction model for the distribution of bits to the prefix code generated. His research gives different conclusions based on size and time ratios, toward the existing study. The result of compression can fast-track broadcast of data from one distinct to another. He makes a comparison of performance in Huffman and Shannon-Fano built on a dialogue of the outcome [21].

Hassan proposed a system to RGB photos and YCbCr photos. For evaluation judgment in the performance of his algorithm, he divided each level into 16x16 lumps, he used 1-D DCT to convert the picture level to frequency level. The place of 2-D DCT for the determination of compression decoding time reduction, the operation time compacted by 47:1 for the DCT step only. An adaptive scalar quantization step is functional on all image level in RGB, but for YCbCr colour, the quantization restrictions are compact by half, for the chrominance plane, the snake scan was used to reorganize the information from non-zero little frequency factors to high-frequency coefficients, where the adaptive shift coding was applied that performs Differential Pulse Coding Modulation on the DC coefficients for the entire image and Run Length Encoding for the AC coefficients for the entire image; the shift optimizer was applied to these coefficients to produce the exact number of bits needed to represent each one of them . The attained compression results indicated good efficiency in terms of compression gain while keeping the fidelity level above the acceptable level [22].

In 2018. Duan proposed an algorithm to encrypt images depended on producing variable automatic coding. He used the random slope method to train the inconstant programmed coding group model, and the rate of the model is widely resolute over exercise time, loss purpose, and reform image. The indication top is used to noise ratio and square error means to mount the compression result of the typical. Duan used the competent image data sections to change the generated form data and produce a coding image [23].

Alshehri suggested a technique in which Neural network is used in the image depressed phase. The image depressed into an eight-part each equivalent to the morals in the bit location. The arrangements are kept in a summary shape to form the depressed image. The Neural network is formed to guess the values unconcerned from, the summary arrays to crop the image from the original size. This technique produces suitable and similar image quality. A depressed ratio of 81% was realized while the conjunction time was insignificant [24].

Leni proposed an adaptation of the Kolmogorov concept of the Igelnik overlay, identified as the Kolmogorov web (KSN), in which the representation approaches the quantity and arrangements of exact purposes of a flexible. Using this illustration, she deals with the limited linking and outdated examination of each line, as opposed to a more uniform representation of images, allowing the compression tasks to be handled in an essentially diverse illustration. Charities are the portion of several policies presented to adopt the KSN system, with massive construction, various simplification strategies, suggest a more suitable representation of the original image using waves, and include this drawing as an extra sheet in JPEG 2000 density appliance, demonstrated for several pictures at dissimilar bit outpouring [25].

Samir Kumar proposed a system for lossless picture depressing plain from the process, that image data (pixel values) are mined from the depressed information torrent without any loss. This is possible because the compression process does not ignore or discards any novel pixel worth. Also, methods such as an estimated similar and run length programming system are basically lossless. This depressing method shows to be very active for pictures with a big comparable neighbourhood of layout pixels. This method will discover wide use in a medical imaging sector because of its lossless characteristics and the medical images have a large area of similar pixel layout design, like in X–ray pictures, that more area is black [1].

Setyaningsih presented three cases of compression of images. The first case of encryption and compression focuses on the security of the second pressure mode. The compatibility between the two cases of encryption and compression and the third case focuses on the integrity of the data to enhance the efficiency of data security in the transmission of information.

He explained that the use of lossless compression maintains the integrity of data from loss and is preferred to use when the accuracy of data is of high importance and that the hybrid algorithm combines two types if the appropriate key can be found for encryption [26].

Suma provided an impression of depressed radiographic images. He says that there is little research in this area because most of the powerful algorithms are losing data. Such as DWT and says that his system presents better stability among

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

rigidity and copy class. She found that the possible features of video images to addressing difficulties in depressing. Moreover, not demoralized in that study [27].

Tamer developed a lossless model based on the science of concealment for compression and quality. The study conducted on high-resolution colour images obtained by cameras, combining their plan between the image processing in the field of spatial domains. Where the field of space exploitation of colour separation is oppressed. Which is working in both areas, concurrently allows a high-determination image decompressed system that reports both quality and volume subjects, which has shown significant improvements to the Fourier-domain image compression model [28].

Rehna studied diverse mix systems of compressing images were discussed. It handles hybrid encoding for images joining two or more old-style methods, to improve separate devices and reach improved value images reconstructed with the developed compression percentage. Present old-style image compression knowledge can be established by joining high presentation cryptographic processes in suitable behaviours. Also, the rewards of both pieces of knowledge are completely oppressed. Progress and extensive search part to the intellect that different old-style image decompressed procedures, it can be allowed by using diverse fruitful procedures for improved performance [29].

3. MAIN WORK.

The algorithm combined between the resize image and Discrete Cosine Transform (DCT), due to the difficulty of processing colour images at programming languages, it is easy to convert a colour image to a grayscale image programmatically. Then convert the image from grayscale to a colour image, according to its original position programmatically. Of course, the original colour of the image required to be verified, not just colouring it with any colour, a colour image can be converted to a grayscale, but the actual colour of the image may not be blue, that meaning, we want to study colour density, but when you return it, to its original colour. You must specify the intensity of the colour; this value is maybe not real as the original image. So that this algorithm has created a new way to solve this problem as we will see soon.

3.2. Steps of the Algorithm.

3.2.1. The coding steps.

Read the image colour from the file, the picture can be any kinds of images (TIFF, JPG, PNG, GIF, etc., ...)

Split the image colour into three main sections (red, blue, green) to keep the original image colours, which we will use in the stage of restoring the image to its original form before treatment, because digital image processing is based on grayscale images, we need to restore the image to what it was before processing. The Figure 3 shown the original colour image at the left, next to three grayscale images; red, blue and green value colour.

Minimize three images: Minimization depends on the pixel location. We will select several pixels to represent the image, the pixels' selection method is as follows: Before we begin the steps, the length and width of the image must be an even number. It can be verified that, if it's an even number by examining the rest of the division on two, if the result is zero then it is true, otherwise, we must resize row or column.

After that choose the pixel and leave the pixel until we reach the end of the first row, leaving the second row, and then move to the third row, we choose the pixel and leave the pixel until we reach the end of the row, so to the end of the image, the Figure 4 illustrates this method.

In order to reduce distortion in the image, we calculate the arithmetic mean of the four adjacent pixels and place a result for the first pixel in the cut-out image, According to equation (4)

$$H1 = \frac{ar(l,h) + ar(l+1,h) + ar(l,h+1) + ar(l+1,h+1)}{4} \quad (4)$$

Where *H1*: mean value, ar: a grayscale image and (i, j) are locations.

An example to explain the idea, we take an image with dimension (4 ×4) pixels, the dimension result of an image must be (2× 2) pixels, the four-pixels that have value (136,122,137,133), see Figure 4, an arithmetic mean is calculated, the result value is stored in the last row of the matrix (b),the last value that will store in the file is equal 132. Repeating those steps to the three images (red, green and blue). So, we have resized the image.

The splitting of the colour image into three intensity images are shown in Figure 5, where (a) an original colour image, (b, c and d) intensity images, (e, f and g) resize images, from the Figure 5 we see that there is no different in view between

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

the last six images, Figure 6 confirms this fact, there is no different in histogram of the six image.

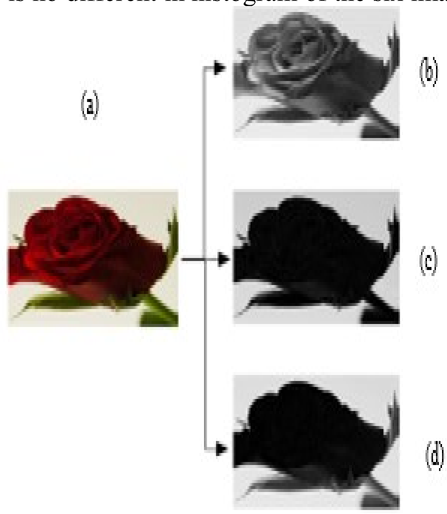


Figure 3: (a) The original image, (b) red image, (c)blue image and (d)green image

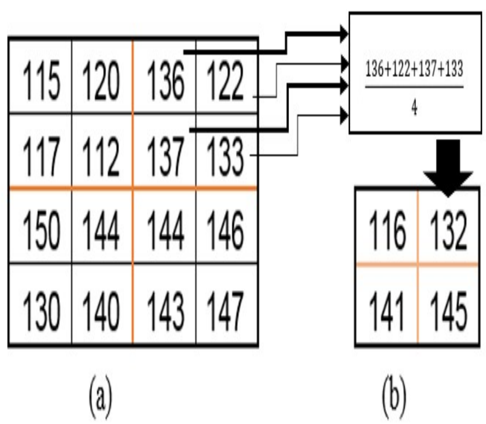
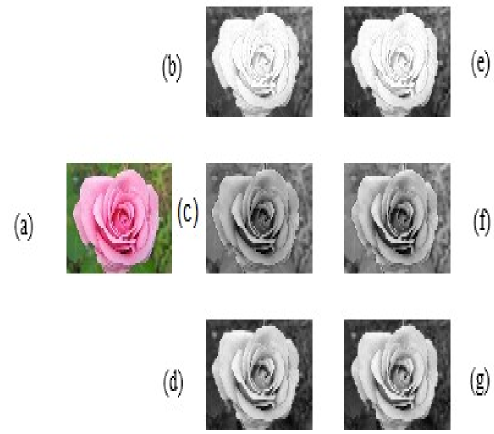
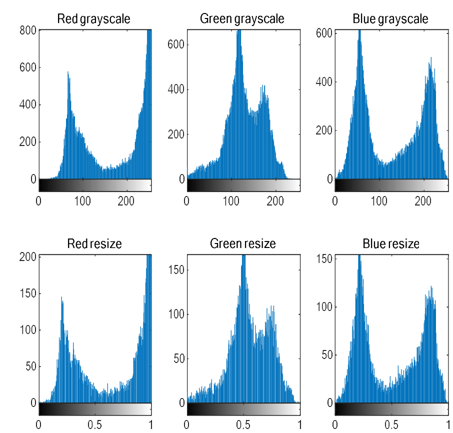


Figure.4: The resize of the image (a)with size (4x4) it's become image b with size (2x2).



F
igure 5: (a) A colour image, (b, c and d) grayscale images, (e, f and g) resize images



F
igure 6: The histogram of images and resize images

Apply the algorithm Discrete Cosine Transform (DCT) to the three images, it is known that algorithm DCT splits the image into groups, the size of each is (8 × 8), the image size must be changed to fit with this algorithm, according to the following equation

$$c = length \bmod 8 \quad (5).$$

$$newlength = length - c \quad (6)$$

Our 8×8 block of the DCT coefficients is now ready for compression by quantization a remarkable and a highly useful feature of the DCT process is that in this step, varying levels of image compression and quality are obtainable through a selection of specific quantization matrices. The

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

compression rate depends on the quantity of coefficients that are non-zero after quantization has been performed. The quantization matrix illustrated using the sample code that performs part of the JPEG routine, forward, the DCT (8x8), quantization of each 8x8 block followed by the inverse of DCT (8x8). The Figure 7 shows the quantization matrices.

16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	62
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

Figure 7: The quantization matrix

Finally combine three grayscale images with each other in a single matrix, which is the compressed image colour Figure 8 and Figure 9 show the three grayscale images and the combined compression colour image. Note that, it can be used in cryptography to keep data confidential.

5.1.2. The Decoding steps. The Coding image Arrived at receiver, the new algorithm is disjoint the image into three parts, a red part, a blue part, and a green part.

Reconstruction of our image begins by decoding the bit-stream representing the quantized matrix. Each element multiplied by the corresponding element of the quantization matrix originally used

Applied Inverse Discrete Cosine Transform (IDCT) to the three grayscale images, that obtained from the last step.

Return the image to the normal size it was before encoding, according to the following equations.

$$Z1(q1, q2) = C1(i, j) \quad \ldots \ldots \quad \ldots \ldots (7)$$

$$Z1(q1, q2+1) = C1(i, j) \ldots \ldots \ldots \quad \ldots (8)$$

$$Z1(q1+1, q2) = C1(i, j) \quad \ldots \ldots \ldots \ldots (9)$$

$$Z1(q1+1, q2+1) = C1(i, j) \ldots \ldots \; .(10)$$

Applied, all steps above to the three images, a red grayscale image, a blue grayscale image, and a green grayscale image.

Combine the three images of the grayscale together, to extract the coloured image. So that the image colour return to its original, Figure 8 and Figure 9 Show steps of coding and decoding of the new algorithm.

4. PSEUDO CODE.

4.2. Coding Algorithm.

1. *Read colour image H.*
2. *Resize the H to be even dimension.*
3. *Separate the H to red grayscale (ar), blue grayscale (ab) and green grayscale (ag).*
4. *for i=1:2:x1% length of an image ar.*
    a. *for j=1:2: y1 % width of an image ar.*
    b. *f1=ar1((i, j) + ar1(i+1, j) + ar1(i, j+1) + ar1(i+1, j+1)) / 4.*
    c. *c1(ic, jc) = f1;*
    d. *jc=jc+1;*
    e. *end*
    f. *jc=1;*
    g. *ic=ic+1;*
5. *End*
6. *H1= DCT (c1).*
7. *Repeat 4-6 for two image ab and ag.*
8. *C= Connected (H1, H2 and H3).*
9. *The end.*

4.3. Decoding algorithm.

1. *Read C.*
2. *Separate the C to red grayscale (ar1), blue grayscale (ab1) and green grayscale (ag1).*
3. *C1= DCT (ar1), C2= DCT (ab1), C3= DCT (ag1).*
4. *for i=1:1: w1 %length of an image ar1.*
5. *for j=1:1: w2 % width of an image ar1.*
    a. *z1(q1, q2) = c1(i, j);*
    b. *z1(q1, q2+1) = c1(i, j);*
    c. *z1(q1+1, q2) = c1(i, j);*
    d. *z1(q1+1, q2+1) =c1(i, j);*
    e. *q2=q2+2;*
    f. *end*
    g. *q2=1;*
    h. *q1=q1+2;*
6. *end*
7. *Repeat 4-6 for two image ab1 and ag1.*
8. *C= Connected (z1, z2 and z3).*
9. *The end*

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

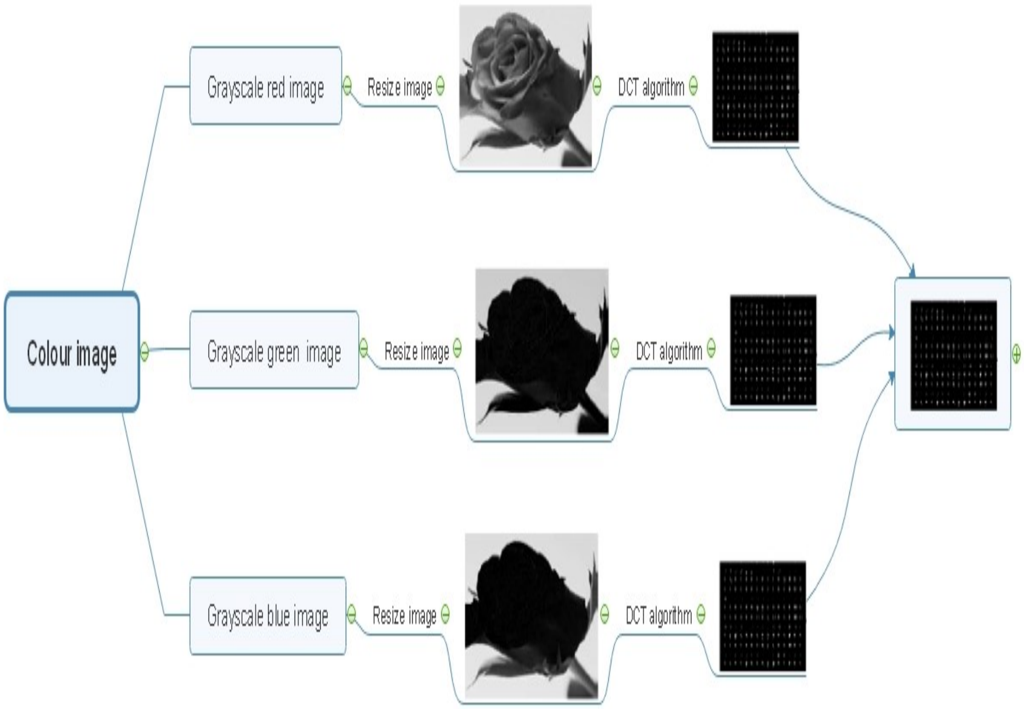


Figure.8: Coding the new algorithm

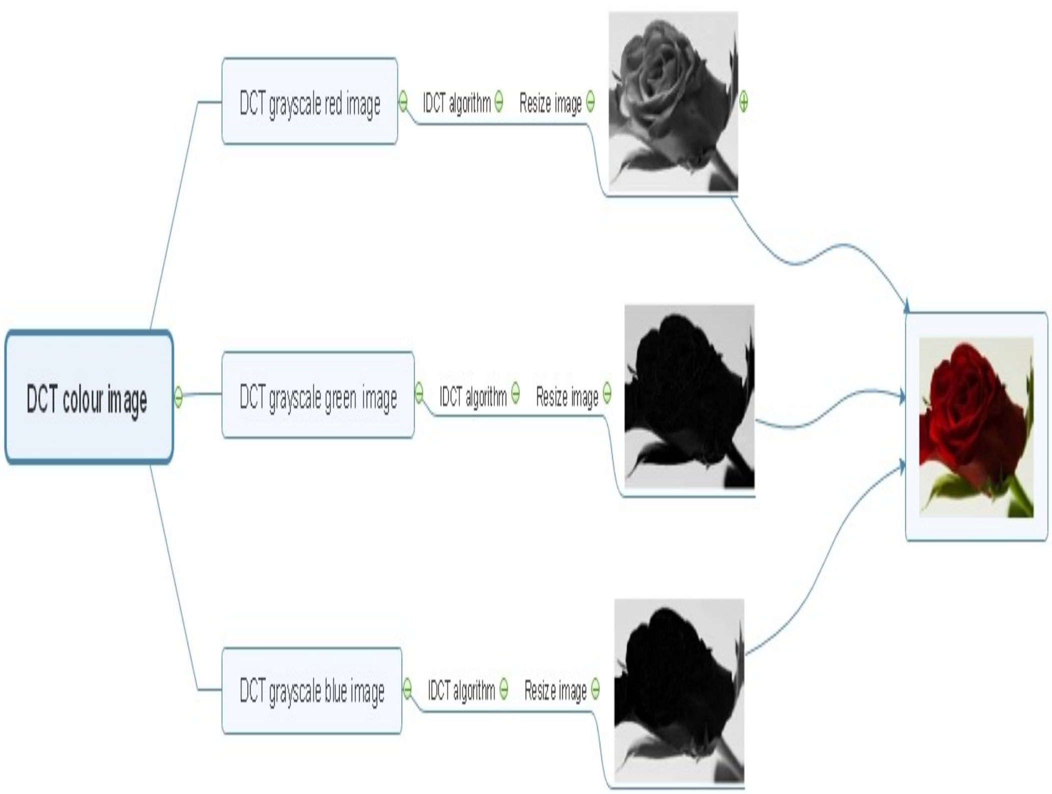


Figure.9: Decoding the new algorithm

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

5. THE RESULTS OF EXPERIMENT AND DATA ANALYSES.

In order to be able to measure the efficiency of the new algorithm in the image compression, we chose a dataset composed of ten colour images of different sizes. The ten self-collected images are used for the algorithm performance evaluation, the collected image contains different flower colours Table 1 shows Dimensions and Sizes of these images. The object for selected different size is to make the algorithm Applicable by any size of the images.

Discrete cosine transforms (DCT) can be used at feature extraction, filtering, image compression and signal processing

Comparing the results of the new algorithm with the (DCT) algorithm in image compression, we applied an (DCT) algorithm on the ten-colour dataset, calculating dimensions and sizes of images, Table 4 shows the new dimensions and size of them, before compression, after compression, and after decompression, the results are in bit unit because the dimension of the images are nearly small in comparison with the other images in the internet.

The results of (DCT) algorithm on the dataset, which presented at the Table 4, showing the difference in image dimensions after processing, that difference is due to requiring of the DCT algorithm, which requires the dimensions of images must be reduplication by eight.

Calculated the efficiency of the DCT algorithm on dataset images, we used the Compression Ratio coefficient (Cr), results are shown in the Table 2. These results show that the mean of (DCT) is (1.02).

The new algorithm was applied to the same dataset, the results are shown in a Table 5 representing the dataset before applying the new algorithm. after applying the new algorithm and even after the image is returned to normal (decompression images).

Calculated the efficiency of the new algorithm that shown in the Table 3, these results show that the arithmetic means of a compression ratio for the new algorithm is approximately (4.2).

Table 1: Dimensions and Size of ten colour images.

Image before compression		
Name	Dimensions	Size (bytes)
1	231x218x3	151074
2	241x209x3	151107
3	208x242x3	151008
4	281x180x3	151740
5	169x225x3	114075
6	194x259x3	150738
7	226x223x3	151194
8	591x591x3	1047843
9	259x194x3	150738
10	195x259x3	151515

Table 2: DCT compression ratio.

Name	compression ratio
1	1.040798611
2	1.008994391
3	1.008333333
4	1.02637987
5	1.01044324
6	1.022257487
7	1.041625331
8	1.024116274
9	1.022257487
10	1.027526855
Mean	1.023273288

Table 3. Compression ratio for the new algorithm

Name	compression ratio
1	4.32331731
2	4.03597756
3	4.03333333
4	4.22627005
5	4.24386161
6	4.08902995
7	4.32675137
8	4.21104601
9	4.08902995
10	4.11010742
Mean	4.16887246

Table 4: Using only (DCT) on the templet images.

Name	Image before compression			Image compression		DCT Matrix	
	Dimensions	Size (bytes)		Dimensions	Size (bytes)	Dimensions	Size (bytes)
1	231x218x3	151074		224x216x3	145152	224x216x3	145152
2	241x209x3	151107		240x208x3	149760	240x208x3	149760
3	208x242x3	151008		208x240x3	149760	208x240x3	149760
4	281x180x3	151740		280x176x3	147840	280x176x3	147840
5	169x225x3	114075		168x224x3	112896	168x224x3	112896
6	194x259x3	150738		192x256x3	147456	192x256x3	147456
7	226x223x3	151194		224x216x3	145152	224x216x3	145152
8	591x591x3	1047843		584x584x3	1023168	584x584x3	1023168
9	259x194x3	150738		256x192x3	147456	256x192x3	147456
10	195x259x3	151515		192x256x3	147456	192x256x3	147456

Table 5: Using a new algorithm on the data templet

	Image before compression		Image compression		DCT Matrix	
Name	Dimensions	Size (bytes)	Dimensions	Size (bytes)	Dimensions	Size (bytes)
1	231x218x3	151074	112x104x3	34944	231x218x3	151074
2	241x209x3	151107	120x104x3	37440	241x209x3	151107
3	208x242x3	151008	104x120x3	37440	208x242x3	151008
4	281x180x3	151740	136x88x3	35904	281x180x3	151740
5	169x225x3	114075	80x112x3	26880	169x225x3	114075
6	194x259x3	150738	96x128x3	36864	194x259x3	150738
7	226x223x3	151194	112x104x3	34944	226x223x3	151194
8	591x591x3	1047843	288x288x3	248832	591x591x3	1047843
9	259x194x3	150738	128x96x3	36864	259x194x3	150738
10	195x259x3	151515	96x128x3	36864	195x259x3	151515

Journal of Theoretical and Applied Information Technology
31st March 2019. Vol.97. No 6

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Comparing the compression ratio with an anther algorithm who used the same approach. Miao Zhang and Xiaojun Tong [30] present an algorithm to a compression colour image, they use six algorithms to reach a good result. The six algorithms are a random sequence, divide the image into 8×8 blocks, adopt NDCT Transform, apply run-length encoding, apply Huffman encoding and. Discrete Cosine Transform (DCT). They applied their algorithms on six images as a dataset Table shows 6 the size of the image and its compression ratio. With the reasonableness of the results due to the large difference in a compression ratio, in spite of the images have the same size. The arithmetic mean between our algorithm and their algorithm is convergent, that indicated our algorithm is efficient

Table 6: The performance of Miao and Xiaojun algorithm.

Name	Size	Cr
Image1	512×512	4.8
Image2	512×512	4.8
Image3	512×512	4.2
Image4	512×512	4
Image5	512×512	4t
Image6	512×512	4
Mean	512×512	4.3

Trees and Chen [31] presented a new algorithm for lossless still image compression. They used a spatial domain method for lossless still image compression, such that a partitioned image into non-overlapping fixed-size sub-images, hierarchical technique, international standard algorithms known as JBIG and Lossless JPEG the average compression ratio is (2.04). Based on this comparison, it is apparent that the algorithm provided High-efficient in image compression.

6. CONCLUSION.

In this study, resizing treatment and frequency treatment were used, in compression of digital images. A new method has been introduced to redistribute the intensity value within the digital image. The resize digital image was compressed by applying the Discrete Cosine Transform (DCT) algorithm. The digital image was also decompressed by using Inverse Discrete Cosine Transform (IDCT). The experiment results of the algorithm presented by the study showed the robust effect of the algorithm, depending on the values given by a compression ratio for the resulting compressed images. No distortion was calculated to compare the original images with the compressed images after decompression, for different sizes of original images and compressed images. It may give incorrect information for the pixel position after resizing the image, and there are difficulties in comparing images when its sizes are varying. Keeping the original colours of the image, we have created a highly efficient algorithm using a resize image and Discrete Cosine Transform (DCT), frequency domain processing.

ACKNOWLEDGMENT.

I would like to thank the Department of Management Information Systems at the Faculty of Applied Studies and Community Service, and to the Imam Abdulrahman Bin Faisal University represented by the Deanship of Scientific Research for their supports of scientific research at the university and providing all necessary means for research and innovation.

Conflict of Interest: The author declares that he has no conflict of interest.

The Dataset

The ten self-collected images are used for the algorithm performance evaluation, the collected image contains different flower colours.

	
Image 1	Image 2
	
Image 3	Image 4
	
Image 5	Image 6

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195


Image 7


Image 8


Image 9


Image 10

REFERENCES

[1] Samir, K.B., Tuhin, U.P., Avishek, R.: Image Compression Using Approximate Matching And Run Length. International Journal Of Advanced Computer Science And Applications, 2(6),2011. Http://Dx.Doi.Org/10.14569/Ijacsa.2011.020617

[2] Huffman, D.: A Method For The Construction Of Minimum-Redundancy Codes. Proceedings Of The Ire.40(9): 1098–1101, (1952). Doi:10.1109/Jrproc.1952.273898

[3] Akil, M., Perroton, L. & Grandpierre, T.: Fpga-Based Architecture For Hardware Compression Decompression Of Wide Format Images. J Real-Time Image Proc (2006) 1: 163. Https://Doi.Org/10.1007/S11554-006-0005-X

[4] Duan, X., Liu, J. & Zhang, E.: Efficient Image Encryption And Compression Based On A Vae Generative Model. J Real-Time Image Proc (2018). Https://Doi.Org/10.1007/S11554-018-0826-4

[5] Fridrich, J., Goljan, M., Du, R.: Lossless Data Embedding New Paradigm In Digital Watermarking. Eurasip J. Adv. Signal Process. 2002(2), 185–196 (2002).

[6] Silveira, D., Zatt, B., Agostini, L.: Reference Frame Context-Adaptive Variable-Length Coder: A Real-Time Hardware-Friendly Approach For Lossless External Memory Bandwidth Reduction In Current Video-Coding Systems. J Real-Time Image Proc (2018) 14: 249. Https://Doi.Org/10.1007/S11554-014-0443-9

[7] I. Baroud, Y., Mariños Velarde, J.M., Wang, Z.: Architecture For Parallel Marker-Free Variable Length Streams Decoding. J Real-Time Image Proc (2017). Https://Doi.Org/10.1007/S11554-017-0715-2

[8] Kim, C., Shin, D., Leng, L.: Lossless Data Hiding For Absolute Moment Block Truncation Coding Using Histogram Modification. J Real-Time Image Proc (2018) 14: 101. Https://Doi.Org/10.1007/S11554-016-0641-8

[9] II. Akoushideh, A.R., Shahbahrami, A. Maybodi, B.Mn.: High Performance Implementation Of Texture Features Extraction Algorithms Using Fpga Architecture. J Real-Time Image Proc (2014) 9: 141

III. .Https://Doi.Org/10.1007/S11554-012-0283-4

[10] Yong, Z., Donald A.: Prediction By Partial Approximate Matching For Lossless Image Compression. Ieee Transactions On Image Processing, 17(6), Pp 924-935 2008. Https://Ieeexplore.Ieee.Org/Stamp/Stamp.Jsp?Arnumber=4483679

[11] Schürmann, T.; Grassberger, P., "Entropy Estimation Of Symbol Sequences". Chaos.6(3): 414–427, (1996). Doi:10.1063/1.166191.Pmid12780271

[12] Seward, J., Bzip2. Retrieved 9 29, 2018, From Wikipedia: Https://En.Wikipedia.Org/Wiki/Bzip2

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[13] Ziv, J., Lempel, A. "A Universal Algorithm For Sequential Data Compression". Ieee Transactions On Information Theory. 23 (3), 337–343. Citeseerx 10.1.1.118.8921 . Doi:10.1109/Tit.1977.1055714.

[14] Yang, Cn., Chou, Ys., Liu, Y. Et Al: Exploiting Error Control In Matrix Coding-Based Data Hiding Over Lossy Channel, J Real-Time Image Proc (2018). Https://Doi.Org/10.1007/S11554-018-0829-1

[15] Singh, V., Elamvazuthi, I., "Fingerprint Matching Algorithm For Poor Quality Images,"Journal Of Engineering, Vol. 2015, No. 4, Pp. 149-153, (2015). Doi: 10.1049/Joe.2014.0247

[16] Lin, Y., Amit, A., Marcellin, M., Bilgin, A., "Task-Based Jpeg 2000 Image Compression: An Information-Theoretic Approach," Data Compression Conference, Snowbird, Ut, Pp. 423-423, (2018) Doi: 10.1109/Dcc.2018.00076

[17] Peyman, R.G., " Two Reversible Data Hiding Schemes For Vq-Compressed Imagesbased On Index Coding" : Iet Image Processing, 12(7), 2018 , P. 1195 – 1203 (2018)

[18] Amrutbhai, N., Patel, K., Patel, B. Patel, "Vector Quantization And Lzw Based Lossy Image Compression" International Journal Of Advanced Research In Computer Science, 9(1), 2018

[19] Thalji, Z., Alsmadi, M., " Iris Recognition Using Robust Algorithm For Eyelid, Eyelash And Shadow Avoiding" World Applied Sciences Journal 25 (6), 858-865, (2013).

[20] Neetu, S., Abhinav, G., Roop, C., "Statistical Characterization Of Block Variance And Ac Dct Coefficients For Power Law Enhanced Images" Iet Image Processing, 12(11),Pp.2128–2137, (2018),

[21] Tonny, H., Mohd, H., Ahmad, N., "Lossless Coding Scheme For Data Audio Channel Using Huffman And Shannon-Fano" Journal Of Theoretical And Applied Information Technology .96(11), 2018.

[22] Enas, K., Hassan, E., George, G., Mohammed Colour Image Compression Based On Dct, Differential Pulse Coding Modulation, And Adaptive Shift Coding Journal Of Theoretical And Applied Information Technology,96(11), 2018.

[23] Duan, X., Liu, J., Zhang, E. J., " Efficient Image Encryption And Compression Based On A Vae Generative Model" Real-Time Image Proc (2018). Https://Doi.Org/10.1007/S11554-018-0826-4

[24] Alshehri, S.A., "Neural Network Technique For Image Compression', Iet Image Processing, 6 (3), P. 222-226,2016. Doi: 10.1049/Iet-Ipr.2014.1039iet Digital

[25] Leni, P.E., Fougerolle, Y.D., Truchetet, F.: 'Kolmogorov Superposition Theorem For Image Compression', Iet Image Processing, 6 (8), P.P 1114-1123, 2012. Doi: 10.1049/Iet-Ipr.2011.0459.

[26] Emy, S., Retantyo, W., "Review Of Image Compression And Encryption Techniques" International Journal Of Advanced Computer Science And Applications (Ijacsa), 8(2), 2017. Http://Dx.Doi.Org/10.14569/Ijacsa.2017.080212

[27] Suma, A., Sridhar, V., "Roi-Based Compression On Radiological Image By Urdhva-Tiryagbhyam And Dwt Over Fpga" International Journal Of Advanced Computer Science And Applications (Ijacsa), 8(2), 2017. Http://Dx.Doi.Org/10.14569/Ijacsa.2017.080228

[28] Tamer, R., "Lossless Quality Steganographic Colour Image Compression" International Journal Of Advanced Computer Science And Applications (Ijacsa), 6(4), 2015. Http://Dx.Doi.Org/10.14569/Ijacsa.2015.060416.

[29] Rehna, V., Jeya, K., "Hybrid Approaches To Image Coding: A Review" International Journal Of Advanced Computer Science And Applications (Ijacsa), 2(7), 2011. Http://Dx.Doi.Org/10.14569/Ijacsa.2011.020716

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[30] Miao Z, Xiaojun T" A New Algorithm Of Image Compression And Encryption Based On Spatiotemporal Cross Chaotic System", Springer Science+Business Media New York 74, 2014
Doi 10.1007/S11042-014-2227-4

[31] Trees J, Chen L"A New Algorithm For Lossless Still Image" Elsevier Science, 31(9), Pp. 1343-1352, 1998