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An Effective Analysis of Image Based Compression in Digital Image

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ABSTRACT: The digital image processing is an innovative current research trends are more vital in the area of image compression for various imaging applications. These compression applications require good visual quality in processing. In general the substitution between memory efficient, compression efficiency and picture quality is the most important parameter to the newly proposed work. All type of images require to large amounts of space seems to be a big disadvantage during transmission and storage. There are many numbers of image compression technique already developed. These proposed applications involve digital image compression processing approaches for reduce the image volume. The Discrete Cosine Transform is commonly used in image compression technique. Redundant information in an image needs to be eliminated by adopting intellectual method. In the recent research attempts better quality of compression is observed with the use of Discrete Wavelet Transform (DWT) and Quantization. The objective of this proposed method is Effective Discrete Wavelet Transform (EDWT). The compression algorithm is concerned with compressing image with low level of data loss in the process. The compression algorithm is used to calculate the Compression Ratio (CR) in an image. The newly proposed compression image shows the table in various different sample tested images. The experimentation has been carried out on various sample test images successfully. The newly proposed system is an effective compression method is achieved and considerable test application for the quality of process in an image.

KEYWORDS:image, compression, DWT, quantization, EDWT.

I.INTRODUCTION

The digital image processing is a quality image representation. The image is representing function of two dimensional methods. The amplitude values of f at any pair of coordinates f(x,y) is intensity value or gray level of the image point[2]. The image f(x,y) is represented image pixel values. The image compression is to reduce irrelevance and redundancy of the image data in order to be able to store or transmit the data. The image compression is achieved by the removal of redundancy as sample technique like coding redundancy, which is present when less than optimal code words are used, interpixel redundancy, which results from correlations between the pixels of an image and psycho visual redundancy, which is due to data that is ignored by the human visual system. [3] The proposed system to implement the correlations between pixels of an image.

Image compression is very important for efficient transmission and storage of images. Demand for communication of multimedia data through the telecommunications network and accessing the multimedia data through Internet is growing explosively. With the use of digital cameras, requirements for storage, manipulation, and transfer of digital images, has grown explosively. These image files can be very large and can occupy a lot of memory. A gray scale image that is 256 x 256 pixels have 65, 536 elements to store and a typical 640 x 480 color image have nearly a million. Downloading of these files from internet can be very time consuming task. Image data comprise of a significant portion of the multimedia data and they occupy the major portion of the communication bandwidth for multimedia communication. Therefore development of efficient techniques for image compression has become quite necessary. A common characteristic of most images is that the neighbouring pixels are highly correlated and therefore contain highly redundant information. The basic objective of image compression is to find an image representation in which pixels are less correlated. The two fundamental principles used in image compression are redundancy and irrelevancy.

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Redundancy removes redundancy from the signal source and irrelevancy omits pixel values which are not noticeable by human eye. Image compression model shown here consists of a transformer, quantizing and encoder.

II. RELATED ANALYSIS

A. Compression

An ordinary characteristic of most images is that the neighboring pixels are correlated and hold redundant information. The primary task then is to find out less correlated representation of image. Two elementary components of compression are redundancy and irrelevancy reduction. Redundancy reduction is aims to removing duplication from the input image. [3]

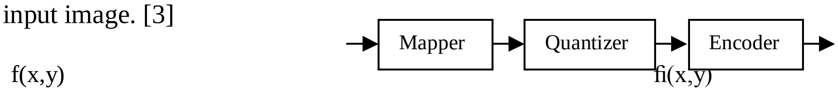

Fig. 1: Encoding Structure

B. Compression Technique

Image compression is the application of data compression on digital images. The main objective of image compression is to reduce redundancy of the image pixels in the suitable form of storage media or transmit data (e-mail) in a competent form. The basic two types of image compression Lossy and Lossless. The lossy compression is a data compression method which loses some of the data from original data which is result being a smaller file size. Most common files type like JPG and BMP. The lossless compression is a data compression method there are no loss of compressed data that is it allows for a smaller file size, but also decompressed back to the original size and qualities. Most common image types are like TIFF, PSD, PNG, GIF, and RAW.

Image compression focuses on the problem of reducing the amount of data required to represent a digital image. The process of image compression is reducing the image size for storage requirements of representation in an image. Compression is obtained by the removal of one or more of the three basic data redundancies: When less than Coding redundancy is optimal code words are used. Inter pixel redundancy results from correlations between the pixels of an image. Psycho visual redundancy is due to data that is ignored by the human visual system. An image compression technique is used to reduce the number of bits required by representing an image and taking advantage of these redundancies. [16]

C. Discrete Cosine Transform [DCT]

Compression is the technique of reducing the number of bits required to store or transmits digital image data without losing the quality of the input image. The Discrete Cosine Transform widely used compression methods. The DCT image is divided into n*m number of blocks.The Discrete Cosine Transform converts the spatial image representation. The average value in the image block is represent by the low-order term, strength and more rapid changes across the width or height of the block represented by high order terms. [4]

It is a mathematical transformation which is related to the Fourier transformation which is similar to the Discrete Fourier transformation but it uses only real numbers. DCTs are equivalent to DFTs roughly it is twice the length and operating on real data with even symmetry, where by half a sample. Discrete Cosine Transformation technique is often used in signal and image processing, mainly for lossy data compression, because it has a strong "energy compaction" property. DCTs are also widely employed in solving partial differential equations. Transform coding constitutes an integral component of contemporary image processing applications. It involves expression of data points in sequence in terms of cosine function's sum oscillating at different frequencies. The use of cosine rather than sine functions is critical in these applications, for compression it turns out that cosine functions are much more efficient. Transform coding relies on the premise that pixels in an image exhibit a certain level of correlation with their neighbouring pixels. Consequently, these correlations can be exploited to predict the value of a pixel from its respective neighbours. The transform coding comprises an important component of image processing applications. A transform coding involves subdividing an N×N image into smaller non-overlapping n×n sub-images blocks and performing a unitary transform on each block. Transform coding relies on the fact that pixels in an image exhibit a certain level of correlation with their

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neighbouring pixels. These correlations can be exploited to predict the value of a pixel from its respective neighbours. Therefore, transformation maps the spatial (correlated) data into transformed (uncorrelated) coefficients.

D. *Discrete Wavelet Transform(DWT)*

Discrete Wavelet Transform provides the time representation in digital image processing. The original image decomposes into four subparts passing the image into high and low pass filtering mechanism. The four subparts are low and high pixel value of the horizontal and vertical details of the image. [5]

The DWT represents an image as a sum of wavelet functions, known as wavelets, with different location and scale. The discrete wavelet transform usually is implemented by using a hierarchical filter structure. It is applied to image blocks generated by the pre-processor. Two-dimension DWT leads to a decomposition of approximation coefficients at level j in four components: the approximation at level j+1, and the details in three orientations. [10]

E. Fine Discrete Cosine Transform [FDCT]and Fine Inverse DCT[FIDCT]

FDCT is digital image compression technique the image divided into 8*8 block of pixels. Every block of pixel used to image compression standards. The block of pixel dividing system is using to produce quality of image visual system. Every block shows the information about the picture. The Fine Inverse Discrete Cosine Transform is image reconstruct through digital image decompression. FDICT produce the same quality level of output image as given input image. [7] In general, information can be compressed if it is redundant. It has been mentioned several times that data compression amounts to reducing or removing redundancy in the data. With lossy compression, however, we have a new concept, namely compressing by removing irrelevancy. An image can be lossy-compressed by removing irrelevant information even if the original image does not have any redundancy.

III. PROPOSED METHOD

The newly proposed system is Effective Discrete Wavelet Transform (EDWT) used to digital image compression. The proposed system initial requirement process is quantization, EDWT, encoding.

A. System Design

The proposed overall system designs show the following fig no.3. The input image is implementing to EDWT process. The image is divided into non overlapping blocks of data n*m pixels. The n*m pixel value is 8*8 division procedure. The second step is quantization process. The image quantization block of pixel to reduce the inter pixel redundancy. The quantization process is reduces the redundancy of input image to display high visualization. The encoding process is creates a fixed or variable length code to represent the quantizer output and maps the output in accordance with the code. It produces the compressed output image.

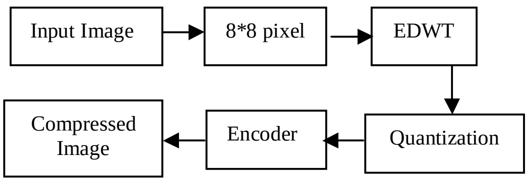

Fig.3: Overall Proposed System Process

The 8*8 pixels that transformed by Effective Discrete Wavelet Transform (EDWT) procedure it progress producing quantized image matrix value. The Effective Discrete Wavelet Transform (EDWT) producing is high quantized and low quantized image matrix value. The low quantized image matrix contains the low level quantized is coded by the max-min matrix value algorithm. The high quantized is transformed image by another mechanism to be followed. The Effective Discrete Wavelet Transform (EDWT) exploits the spatial correlation of data by dilation method. The frequency correlation as followed by same dilation method. The Effective Discrete Wavelet Transform (EDWT)

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supports normal image resolution analysis of data. The Effective Discrete Wavelet Transform (EDWT) allows the process of transmission and enlarges the image without the extra volume of storage because it is supports to multi-resolution process. One of the best features is fast compression process. Another important feature is high compression ratio in the proposed system.

$$f(x) = \sum_k C j_0 (k)\varphi j_{0,k}(x) + \sum_{j=j_0}^{\infty} \quad \sum_k d_j (k)\psi_{j,k} (x) \text{ ---------Eq-1}$$

f(x) = Wavelet Series
j_0 =arbitrary scaling function
Cj_0 =Scaling Coefficient
Ψ(x) =Relative to Wavelet
Φ(x)= Scaling function
dj(k)=Wavelet Coefficient

The image is broken in to n*m block of pixels. Each and every block of pixels is used to image compression process. The block of pixel hides image information. The splitting standard to implement in input image. The EDWT image coefficient values become zero. The EDWT coefficient are compressed through the quantization and encoding standard. The pixel identification or scanning mechanism from left to right.

$$W_\varphi(j_{0,}k) = 2 * \left(\frac{\frac{1}{\sqrt{M}}\sum_x f(x)\varphi j_{0,k}(x)}{2}\right) \qquad \text{---------Eq-2}$$

$$W_\Psi(j_,k) = 2 * \left(\frac{\frac{1}{\sqrt{M}}\sum_x f(x)\Psi j_{,k}(x)}{2}\right) \qquad \text{---------Eq-3}$$

for $j>=j_0$ and

Effective wavelet f(x)= equ 2+equ 3
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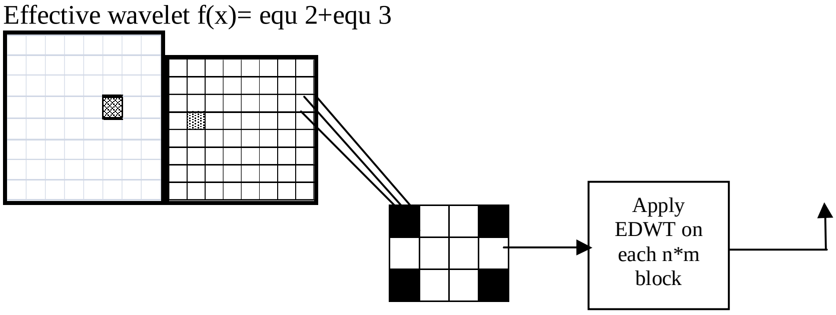

Fig 4: EDCT Code Form

EDWT Method

Input: Read original image I=Read_Image(file)
Load the input image
Decomposition from I into value of x and y
To construct I is cropped CI=I(200:(cropped size[0]-1]+200))
CI constructed block of pixel=n*m
EDWT=WTN(image,20)
PS=ABS(EDWT)^2
SPS=ALOG10(PS)
Output: Received compressed image i

The proposed implement system of Effective Wavelet Compression method is effective coding mechanism. The image is decomposed used filtering process. The output of the filtered image is dividing block, quantized and encoded.

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Effective Discrete Wavelet Transform (EDWT) divides the information of an image into the value code. The divided information shows the image value of pixel in given digital image. The pixel value is used to identify the given image. The image is compressed with the help of frequency mechanism. The proposed system is used to low frequency image compressed into reduce the original image bytes. The compression with Discrete Wavelet Transform (DWT) using compression frequency is high. The Discrete Wavelet Transform (DWT) used to high frequency coefficient into multiple regions. The proposed system is measure in low frequency coefficient into single region. The progress is reduce the image size is half of the original image. The image size is reduced with high compression ratio.

B. Quantization

The quantization is the process it simply reduces the number of bits needed to store the transformed coefficients by reducing the precision of those value. The quantization is performed on a group of coefficient values. An entropy encoder further compresses the quantized values losslessly to give better overall compression. It uses a model to accurately determine the probabilities for each quantized value and produces an appropriate code based on these probabilities so that the resultant output code stream will be smaller than the input stream. The newly proposed system is implementing the quantization process. The image is divided into block of pixels. The block of pixels reducing the transmission bit rate in an image.

Based on the two techniques, quantizing the image's DCT coefficients and entropy coding the quantized coefficients, DCT-based image compression minimizes the data required to represent an image. Quantization process minimizes the number of bits required to represent a quantity by minimizing the number of possible values of the quantity. A range of values are compressed to a single quantum value to achieve quantization. The stream becomes more compressible as the number of discrete symbols in a specified stream is reduced. Transformation is performed by using a quantization matrix in combination with a DCT coefficient matrix. According to the quantization matrix, the DCT coefficients are normalized by different scales, for high compression [6]. The transformed image matrix is divided by the employed quantization matrix to achieve quantization. Then the values of the resultant matrix are rounded off. The coefficients located near the upper left corner in the resultant matrix have lower frequencies.

The image divided 8*8 by a quantization factor value Effective Quantization (EQ) using matrix dot division value. The quantization removes insignificant coefficient value and increasing the zero value block by block. The factor effective quantization EQ is computed as

$$LQ = quality \times \max(block1)$$

$$EQ = \begin{cases} 10, & i,j=1 \\ LQ+i+j, & i>j \end{cases} \quad \text{---------Eq-4}$$

LQ= Level of Quantization
i=1,2,3,4 and j=1,2,3,4

The level of quantization is computer from the maximum value of block1. The block1 quality value is calculated value>=0.01. The image quality value is identified as a ratio for the maximum value. This ratio is increased the image coefficient number is large. The coefficient value forced to assign the value is zero. The assigned zero value to produce low image quality. In this kind of problem the proposed system to overcome to produce same level of input image quality in compression and decompression process.

C. Encoder

The encoder is removes the redundancy in the form of repeated bit pattern in the output of the quantization. An entropy encoder is compresses the quantized values of lossless to give better the compression. It uses a model to accuracy determine the probabilities for each quantization value and produce an appropriate code based on these probabilities. The resultant output code stream is smaller than the input stream. The various encoders are available in the digital image processing. The newly proposed system arithmetic encoder is implemented.

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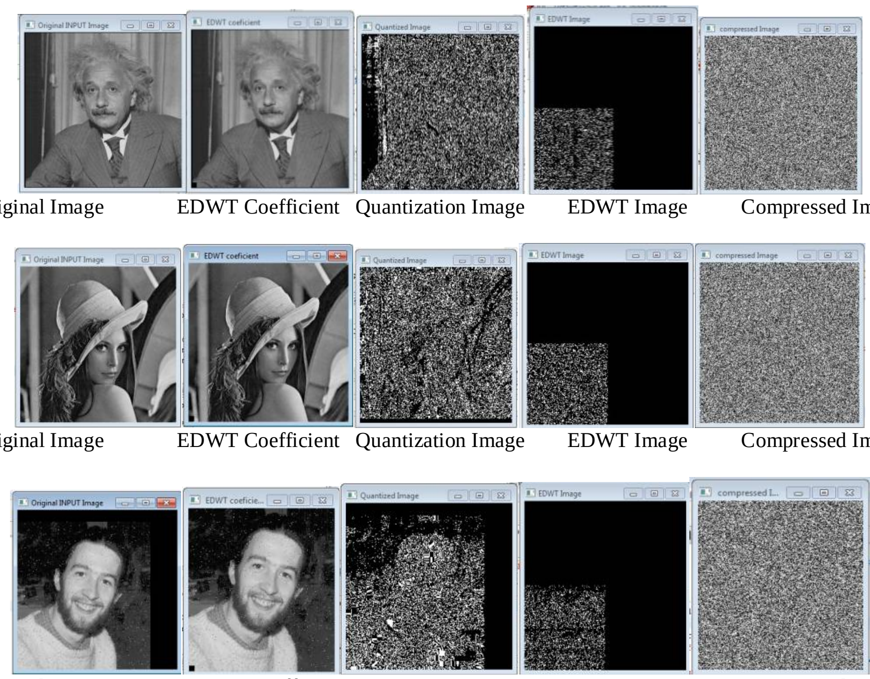
The proposed system to finalize the compression algorithm stage is arithmetic coding. The arithmetic coding takes the value a stream of data. The image compression is data stream is to apply the conversion procedure. The compression progress is stream of data converted in to decimal point values. The decimal point value is one dimensional value. In this one dimensional value range between one and zero. The arithmetic coding needed to compute the probability of all image data. The range is assign to level of low and high values which is limited one. The image value range limitation between low and high values in an image.

IV. SAMPLE OUTPUT



Original Image EDWT Coefficient Quantization Image EDWT Image Compressed Image

Original Image EDWT Coefficient Quantization Image EDWT Image Compressed Image

Original Image EDWT Coefficient Quantization Image EDWT Image Compressed Image

Fig 5: Image Compression

The sample output is displaying image compression with various images. The input image is original image. The original image is applying EDWT coefficient methodology. The coefficient image is converting to standardized quantization image. The quantized image is applying to the EDWT system. The conclusion of image compression is produced quality of compressed image. The compressed image size is reduced without loss of quality.

IV. EXPERIMENTAL RESULT AND DISCUSSION

The experimental result about the proposed system has been done. The newly proposed EDWT system to apply the sample test images. The proposed system is checking quality of output in an image. The evaluation is process comparison between original image and compressed image. Image compression techniques reduce the number of bits required to represent an image. In this paper, image compression technique using a new method of pixel correlation with EDWT is implemented. New technique is used all kind of images. The following table and graph shows the compression ratio of the images. It achieves more than 10% from existing system in compression ratio without any effect to quality of given images.

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Table 1:

Type of Image	Original Image Size in Byte	Existing Compressed Image Size in Byte	Proposed Compressed Image Size in Byte
.jpg	131072	75536	65536
.bmp	92160	56080	46080
.tif	100962	60481	50481

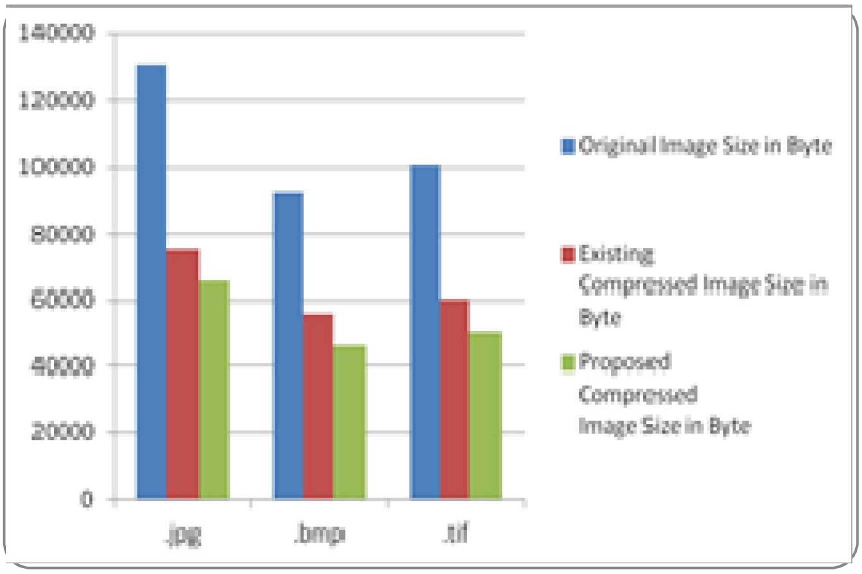

Fig.6: Image Compression

In graphical representation is displayed image compression system is compared with exiting system. The original image size, existing system with compared proposed compressed image size. The image size is represented by bytes. The proposed compression method is producing the compressed image. The image size is reduced with same quality of input image.

V. CONCLUSION AND FUTURE ENHANCEMENT

Image compression techniques reduce the number of bits required to represent an image. This research paper has explained and demonstrated a new method for image compression EDWT The result shows that newly proposed approach introduce the better image quality at equal to the input image. The most important aspects of the compression methods are providing without loss of data in the process.

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BIOGRAPHY

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