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Analysis of Picture Compression Algorithms for Next Generation Networks

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Abstract: *Improvements in information-focused digital sound, image, and video-based (sight and sound) online applications have made more effective approaches necessary. With the advent of the digital age and the growth of innovation, a massive amount of data has surfaced. Managing this amount of data can often result in problems. Computerized data needs to be stored and recovered with efficiency and a clear goal in mind in order to be used practically. Techniques for image compression are essential to achieving this goal. The goal of picture information compression techniques is to transfer or store an image with fewer bits while maintaining a detectable level of data loss.*
Keywords— *Image, Compression, DCT, Wavelet, NGN*

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I.INTRODUCTION

A very high capacity limit would be required to store the large amount of information connected with visual data. The entrance speeds of storage medium are generally inversely proportional to their capacity, despite the fact that some have significant limitations. The goal of picture information compression techniques is to minimize the amount of data lost during the transit or storage of photographs.

1.1 COMPRESSION TECHNIQUES

There are various methods for characterizing compression strategies

The primary layout is based upon the data in the duplicate image. There are two types of compression techniques: lossy and lossless. Pixel for pixel, the image that is recreated following lossless compression is a numerically precise reproduction of the original image.

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The space where a compression method is connected determines the second order of various coding schemes. Predictive and transform are the two kinds of coding. Predictive coding estimates future values and codes the variations using data that has already been provided or is currently available. Since this is done inside the picture or region, it may be easily applied and altered to suit the particular qualities of the picture. Predictive coding has specific applications, such as Differential Pulse Code Modulation (DPCM).

1.2 AN INTRODUCTION TO IMAGE

Sampling is the process of regularly examining the values of a continuous function. In the digital realm, a function can be represented by a finite number of bits by quantizing it at any general value to one of a predetermined set of allowed values.

1.3 QUALITY MEASURES IN IMAGE CODING

When n2 = n1, then C_R= 1 and hence R_D=0

1.3 A TYPICAL IMAGE CODER

How does a classic picture coder look like? A usual lossy image compression system exposed in figure, which consist of three closely associated components:

(a) Source Encoder or Linear Transforms
(b) Quantizer
(c) Entropy Encoder

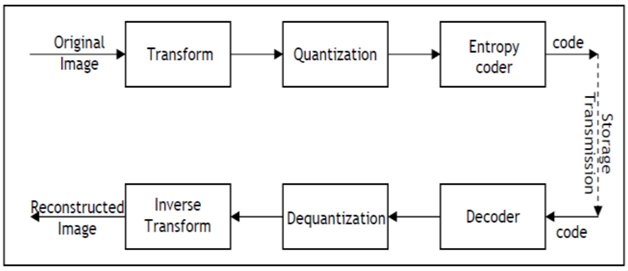

Fig 1: A Typical Image Coder

One of the several transformations that converts the data into a linear combination of weighted premise capacity is the Discrete Cosine Transform.

II. LITERATURE REVIEW

LITERATURE REVIEW This section involves the Literature survey of various techniques available for Data compression and analyzing their results and conclusions. R. S. Brar and B. Singh, et.al, (2013), "A survey on different compression techniques and bit reduction algorithm for compression of text data". International Journal of Advanced Research in Computer Science and Software Engineering (IJARCSSE) Volume 3, Issue 3, March 2013.This paper provides a survey of different basic lossless and lossy data compression techniques. On the basis of these techniques a bit reduction algorithm for compression of text data has been proposed by the authors based on number theory system and file differential technique which is a simple compression and decompression technique free from time complexity. Future work can be done on coding of special characters which are not specified on key-board to revise better results. S. Porwal, Y. Chaudhary, J. Joshi, M. Jain, et. al, (2013), "Data Compression Methodologies for Lossless Data and Comparison between Algorithms". International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 2, March 2013. This research paper provides lossless data compression methodologies and compares their performance. Huffman and arithmetic coding are compared according to their performances. In this paper the author has found that arithmetic encoding methodology is powerful as compared to Huffman encoding methodology. By comparing the two techniques the author has concluded that the compression ratio of arithmetic encoding is better and furthermore arithmetic encoding reduces channel bandwidth and transmission time also. Amandeep Singh Sidhu et al, International Journal of Computer Science and Mobile Computing, Vol.3 Issue.12, December- 2014, pg. 01-10 © 2014, IJCSMC All Rights Reserved 5 S.Shanmugasundaram and R. Lourdusamy, et. al, (2011), "A Comparative Study of Text Compression Algorithms". International Journal of Wisdom Based Computing, Vol.1 (3), Dec 2011. There are lot of data compression algorithms which are available to compress files of different formats. This paper provides a survey of different basic lossless data compression algorithms. Experimental results and comparisons of the lossless compression algorithms using Statistical compression techniques and Dictionary based compression techniques were performed on text data. Among the statistical coding techniques the algorithms such as Shannon-Fano Coding, Huffman coding, Adaptive Huffman coding, Run Length Encoding and Arithmetic coding are considered. A set of interesting conclusions are derived on their basis. Lossy algorithms achieve better compression effectiveness than lossless algorithms, but lossy compression is limited to audio, images, and video, where some loss is acceptable. The question of the better technique of the two, "lossless" or "lossy" is pointless as each has its own uses with lossless techniques better in some cases and lossy technique better in others.

1.3 PRINCIPLES OF COMPRESSION

The amount of information associated with visual data is so vast that storing it would take up a very huge amount of storage. Their entrance speeds are typically the opposite of the limit, even though some accumulating medium have large limits.

Information rates for a typical TV picture exceed 10 million bytes per second. Alternative image sources yield significantly greater information rates. Such information requires a large amount of limit and data transport capacity, which can be very expensive.

Picture information compression systems are concerned about a decrease in the number of bits needed to transfer or store images without causing noticeable data loss. The elimination of redundant information—that is, information that either provides no significant new information or essentially restates what is already known—is the fundamental tenet of the reduction process. The main problem with computerized photo compression is data redundancy. The compression ratio is defined as follows if n1 and n2 denote the number of information carrying units in two information sets that contain the same information:

$$C_R = n_1 / n_2$$

In this scenario, relative data redundancy (RD) of the first data set can be defined as follows:

$$R_D = 1 - 1/ C_R$$

When n2=n1 hen CR=1 and thus RD=0. It shows that the first representation of the data information include no redundant data.
When n2<<n1 then CR->∞ and thus RD->1. It shows important compression and extremely redundant data.
In the final case when n1<<n2 then CR->0 and hence RD->-∞, indicating that the next data set contains much more information than the original representation.
The image that contains redundant information can be compressed using a variety of methods. Here, we obtain a compressed image of an original image by applying the Discrete Cosine Transform (DCT) technique.

III. THE DISCRETE COSINE TRANSFORM

A quick transform that turns data into a linear collection of weighted premise functions—typically frequencies, much as sine waves—is the discrete cosine transform. It is a cozy and popular method of image compression that offers better energy compaction for highly linked data than DFT and WHT.

Either creating a stylistic theme that unites the pixels in each subpicture or compressing as much information as is reasonably possible into the fewer number of transform coefficients are the two main objectives of the transformation process.

3.1 COMPRESSION PROCEDURE

We essentially reconstruct each line of the original image using the inverse DCT, padding each column with as many zeroes as the number of discarded coefficients, in order to recreate the original image. After examining the image at several frequency bands, we may reconstruct the original image by utilizing solely the coefficients of that particular band. The compression techniques are as follows

Step 1: Convert the raw image into a signal (a string of integers).

Step 2: Process the signal into a series of transform coefficients w
.
Step 3: Modify transform coefficients from w to another sequence w´ by using a threshold.

Step 4: Convert w' to a sequence q by using quantization.

Step 5: Pack q into a sequence e using entropy coding.

IV. EXPERIMENTAL RESULTS

4.1 WT COMPRESSION RESULT

The wavelet is shaped by means of averaging and differencing in the WT photo compression technique. Next, we reduce the number of coefficients by using the threshold system. The condensed mage is then obtained by connecting the inverse transform.

Fig.2 Image compression using WT

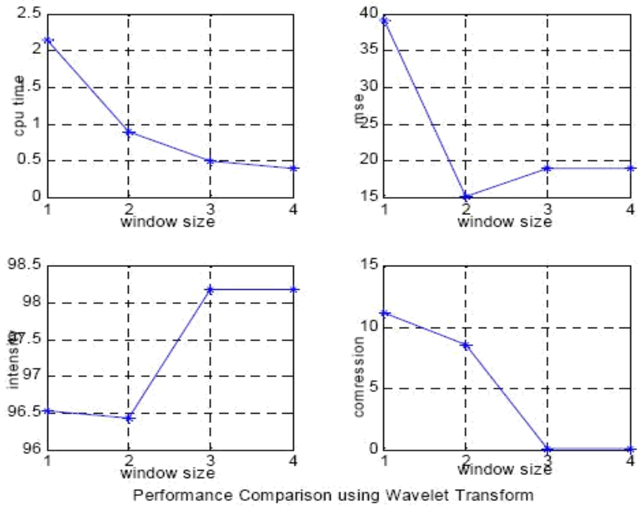

Fig 3. The Intensity, CPU Time, Compression Ratio and Mean Square Error for WT.

4.2 DCT COMPRESSION RESULT

We have taken, photo, for the sake of our inquiry. Three 3 x 3 sub images have been created from the original image. The pixels of each sub picture are associated with the forward 2D-DCT transformation. Next, the pixels with the least quantity of information are eliminated. Because the pixels' values are below the threshold, the estimations of the pixels are set to zero. For our trial, the threshold esteem equivalents of 20 have been chosen. All pixels with an estimated value of less than 20 are therefore presumed to have an estimated value of zero. Next, each altered pixel in the sub image is linked to the inverse discrete cosine transformation equation.

It has been discovered that 98.16% of the original life remains in the compressed image. The Wavelet Transform compression yielded better results than the 2D DCT. The image intensity was around 96.4%, and the MSE was 12 dB. The duration of the programme execution was lowered to roughly 0.9 seconds. Additionally, the compression was 8.5. The figure illustrates the comparison of CPU time, mean square error (MSE), compression, and intensity for various window estimates when a 2D DCT picture compression is being performed.

Fig 4. Image compression using DCT

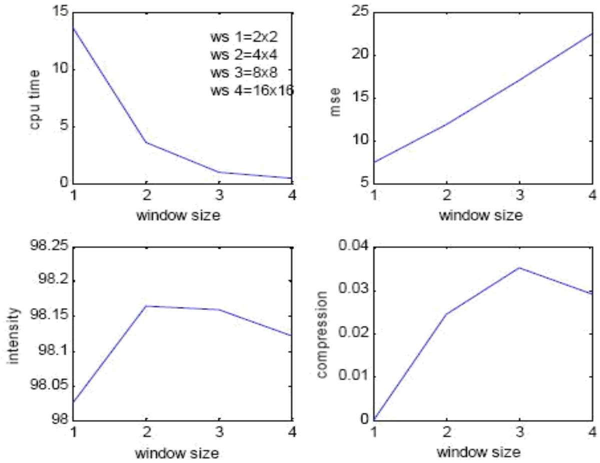

Fig 5. The intensity, CPU Time, Compression Ratio and Mean Square Error for DCT

4.3 PERFORMANCE COMPARISON: DCT VS WT

Table 4.1: Result comparison for window size (4 x 4)

S.No.	Parameter	2D DCT	Wavelet Transform
1.	Image Intensity	98.16%	96.4%
2.	MSE in dB	8	12
3.	CPU Time / Exec. Time	3.8	0.9
4.	Compression	0.025	8.5

Table 4.1 shows a comparison between Wavelet Transform and 2D DCT.

V. CONCLUSION

The Discrete Cosine Transform is still a popular and useful method for digital image compression as compared to Wavelet-based Transform As a widely used and efficient method for digital image compression, the Discrete Cosine Transform can convey most of the data in the fewest number of pixels, even though the Wavelet-based Transform produced better results in terms of properties like RMS error, image intensity, and execution time. Therefore, wavelet-based transformations are frequently employed.

The photo compression methods employed were DWT and DCT. For transformation, DCT is used in the JPEG standard.DCT performs well when operating at medium bit rates. One drawback of DCT is that it ignores the correlation between the pixels in neighbouring blocks and only considers the spatial relationship between the pixels inside a single 2-D block. Blocks cannot be decorrelated at their boundaries using DCT. DWT provides excellent compression at low bit rates. Near-edge blurring in photos is caused by the employment of wavelet filters or increased DWT premise capabilities. DWT performs better than DCT in preventing blocking artefacts that impair reconstructed images. However, DWT provides lower quality than JPEG at low compression rates.Data compression in DWT requires more time.

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