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A Review on Image Compression & Steganogaphy

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Abstract: The increasing demand for multimedia content such as digital images and video has led to great interest in research into compression techniques. Image compression is process to remove the redundant data from the image so that only essential information can be stored to reduce the storage size, transmission bandwidth and transmission time. The essential information is extracted by various transforms techniques such that it can be reconstructed without losing quality and information of the image.

Keywords Image compression, DCT, DWT, Vector Quantization, Fractal encoding, Steganography, Run length encoding, Huffman encoding.

I. INTRODUCTION

Image compression plays an important role in application like televideo- conferencing, remote sensing, and documents. The increasing demand for multimedia content such as digital images and video has led to great interest in research into compression techniques like medical imaging, fax transmission which depend on the efficient manipulation, storage and transmission. Image compression is the application of data compression on digital images. In effect, the objective is to reduce redundancy of digital images for storing and transmitting the data in a efficient manner. Uncompressed multimedia (graphics, video and audio) data require more space and time for transmitting and storing the data over the network. Digital image requires large amount of space for storage and large bandwidth for transmission. The main aim is to minimize the memory space of data so that transmission times are minimized.

1.1. Image compression

Image compression refers to reduction of size of data that images contain in it or we can say to remove the redundancies. Image compression techniques can be classified into two categories lossless and lossy. In lossless method, the exact original data can be recovered while in lossy technique only close approximations of original data can be obtained. The data reduction, or compression, is performed by a device is known as encoder. The encoder reduces the data size of original image X. The compressed image Y is the output which passes through a channel to the decoder. The decoder reconstructs or decompresses the image Z from compressed data. The ratio of the size of original size to the size of compressed image is known as compression ratio or compression rate .The compression rate can be expressed in bpp (bits per pixel).

1.2. Need for image compression:

The needs for image compression becomes apparent when number of bits per image are computed resulting from typical sampling rates and quantization methods. For example of the need for image compression, consider the transmission of low resolution 512 x 512 x 8 bits/pixel x 3-color video image over telephone lines. Using a 96000 bauds (bits/sec) modem, the transmission would take approximately 11 minutes for just a single image, which is unacceptable for most applications.

II. VARIOUS COMPRESSED ALGORITHMS

2.1 DCT (Discrete Cosine Transformation)

DCT is an orthogonal transform, the Discrete Cosine Transform (DCT) attempts to decorrelate the image data. After de correlation each transform coefficient can be encoded independently without losing compression efficiency.

The DCT transforms a signal from a spatial representation into a frequency representation. The DCT represent an image as a sum of sinusoids of varying magnitudes and frequencies. DCT has the property that, for a typical image most of the visually significant information about an image is concentrated in just few coefficients of DCT. After the computation of DCT coefficients, they are normalized according to a quantization table with different scales provided by the JPEG standard computed by psycho visual evidence. Selection of quantization table affects the entropy and compression ratio. The value of quantization is inversely proportional to quality of reconstructed image, better mean square error and better compression ratio . In a lossy compression technique, during a step called Quantization less important frequencies are discarded, and then the most important frequencies that remain are used to retrieve the image in decomposition process. After quantization, quantized coefficients are rearranged in a zigzag order for further compressed by an efficient lossy coding algorithm. DCT has many advantages:

(1) It has the ability to pack most information in fewest coefficients.
(2) It minimizes the block like appearance called blocking artifact that results when boundaries between sub-images become visible

2.2. Vector Quantization

The main idea is to develop a dictionary of fixed-size vectors, called code vectors. Normally vector is a block of pixel values. An image vector means given image is then partitioned into non-overlapping blocks (vectors). Each in the dictionary is determined and its index in the dictionary is used as the encoding of the original image vector. Thus, each image is represented by a sequence of indices that can be further entropy coded.

2.3. Discrete Wavelte Transformation

A **discrete wavelet transform** (DWT) is any wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution: it captures both frequency *and* location information (location in time).it is a way to represent a signal in time frequency form. Wavelets transform are based on small waves called wavelets, of varying frequency. A transform can be thought of as a remapping of a signal that provides more information than the original .The Fourier transforms fits this definition quite Wavelets are useful for compressing signals. They can be used to process and improve signals, in fields such as medical imaging where image degradation is not tolerated. Wavelets can be used to remove noise in a image. Wavelets are mathematical functions that can be used to transform one function representation into another. Wavelet transform performs multi resolution image analysis. Multi resolution means simultaneous representation of image on different resolution levels. Wavelet transform represent an image as a sum of wavelets functions, with different location and scales. The 2D wavelet analysis uses the same 'mother wavelets' but requires an extra step at every level of decomposition. In 2D, the images are considered to be matrices with N rows and M columns. Any decomposition of an image into wavelets involves a pair of waveforms One to represent the high frequency corresponding to the detailed part of the image (wavelet function) One for low frequency or smooth parts of an image (scaling function) At every level of decomposition the horizontal data is filtered, and then the approximation and details produced from this are filtered on columns. At every level, four sub-images are obtained; the approximation, the vertical detail, the horizontal detail and the diagonal detail. Wavelet function for 2-D DWT can be obtained by multiplying wavelet functions (ψ (x, y)) and scaling function (φ(x, y)). After first level decomposition we get four details of image those are, Approximate details –$\psi (x, y) = \varphi(x)\,\varphi(y)$
Horizontal details –$\psi (x, y) = \varphi(x)\,\psi (y)$
Vertical details – $\psi (x, y) = \psi (x)\,\varphi(y)$
Diagonal details – $\psi (x, y) = \psi (x)\,\psi (y)$.

The approximation details can then be put through a filter bank, and this is repeated until the required level of decomposition has been reached. The filtering step is followed by a sub-sampling operation that decreases the resolution from one transformation level to the other. After applying the 2-D filler bank at a given level n, the detail coefficients are output, while the whole filter bank is applied again upon the approximation image until the desired maximum resolution is achieved. The sub-bands are labeled by using the following notations. LLn represents the approximation image nth level of decomposition, resulting from low pass filtering in the vertical and horizontal both directions. LHn represents the Horizontal details at nth level of decomposition and obtained from horizontal low-pass filtering and vertical high-pass filtering. HLn represents the extracted vertical details/edges, at nth level of decomposition and obtained from vertical low-pass filtering and horizontal high-pass filtering. HHn represents the diagonal details at nth level of decomposition and obtained from high-pass filtering in both directions.

2.4. Fractal encoding

Fractal image coding is based on partition iterated function system (PIFS),in which an original input image is partitioned into a set of non-overlapping sub-blocks, called range block (R) that cover up the whole image. The size of every range block is N X N. At the same time, the original image is also partitioned into a set of other overlapping sub-blocks, called domain blocks (D), which size is always twice the size of range blocks. The domain blocks are allowed to be overlapping and need not cover the whole image. Secondly, each of the domain blocks is contracted by pixel averaging or down sampling to match the size of the range block. Next, eight symmetrical transformations (rotations and flips) are applied to all contracted domain blocks to bring out an extended domain pool, which denoted as d For each range block, we search the domain pool to get the best matched domain block D with a contractive affine transformation. The problem with fractal coding is the highly computational complexity in the encoding process Most of the encoding time is spent on the best matching search between range blocks and numerous domain blocks (d) so that the fractal encoding is a time consuming process, which limits the algorithm to practical application greatly. In order to solve this problem, lots of researches were done earlier to speed up the block matching process.

2.5. Run length encoding

Run-length encoding is simplest method of compression used for sequential. It is very useful in repetitive data. This technique replaces sequences of identical pixels, called runs by shorter symbols. A data made of any combination of symbols can be compressed by using this encoding. The data contain only 0 and 1.so it is very effective and need not to know the frequency of occurrence of symbols. To replace consecutive repeating occurrences of a symbol by one occurrence of the symbol followed by the number of occurrences is a basic idea for Run-length encoding. When compared to other method this method is even more efficient because the data use only two symbols (0 and 1).

2.6. Huffman coding

Huffman coding is a popular technique for removing coding redundancy. It produces the smallest possible number of code symbols per source symbol. A coding symbol based on their statistical occurrence frequencies. The image of the pixel is treated as symbols, in this Huffman coding the symbols that occur more frequently are assigned a smaller number of bits. Huffman coding is a prefix code [binary code]. Huffman coding was introduced by David Huffman. A most used method for data compression is Huffman coding. It is a basic for several popular programs. Huffman construct code tree from bottom up to top down (build the codes from right to left). Huffman code procedure is based on the two observations.

a. More frequently occurred symbols will have shorter code words than symbol that occur less frequently.

b. The two symbols that occur least frequently will have the same length.

Advantages and Disadvantages

METHOD	ADVANTAGES	DISADVANTAGES
Discrete Cosine Transform	Real-valued Better energy Compaction Coefficients are nearly uncorrelated	Undesirable blocking artifacts affect the reconstructed images or video frames. Impossible to completely decorrelate the blocks at their boundaries
Discrete wavelet transform	High compression ratio	Cofficent quantization bit allocation
Fractal	Good mathematical Encoding frame	Slow encoding
Vector Quantization	Simple decoder No coefficient quantization	Slow codebook Generation No Standard Slow decompression
Run length encoding	Easy to implement Does not require much CPU power	High storage Requirements Only for Color image
Huffman encoding	Very Efficient Entropy	Length of the code could be very large

III. STEGANOGRAPHY

Due to rapid development in both computer technologies and Internet, the security of information is regarded as one of the most important factors of Information Technology and communication. Attacks on confidential data, unauthorized access of data have crossed the limits. It is used to share or receive confidential information. Accordingly, we need to take measures which protect the secret information. Steganography has emerged as a powerful and efficient tool which provides high level for security particularly when it is combined with encryption. The general idea of hiding some information in digital content has a wider class of applications that go beyond steganography. Two special cases of information hiding include digital watermarking and Fingerprinting. Watermarking can be used to provide copyright protection by extending the cover source with some extra information which can later be extracted and can be used for variety of purposes like copyright protection and control. Digital watermarking has become an active and important area of research, and development and commercialization of watermarking techniques is being deemed essential to help address some of the challenges faced by the rapid proliferation of digital content. In Fingerprinting, different customers are given different and specific marks embedded in the copies of their work.

The goal of steganography is to avoid drawing suspicion to the transmission of the secret message. On other hand, steganalysis is a way of detecting possible secret communication using against steganography. That is, steganalysis attempts to defeat steganography techniques. It is based on the fact that hiding information in digital media alters the carriers and introduces unusual signatures or some form of degradation that is visible to the human eye. Thus, it is crucial that a steganography system to ascertain that the hidden messages are n message, a steganographic system will be considered detectable. Reasons for rapid growth of interest in Steganography

1.) Restrictions imposed on the availability of encryption service by various governments have encouraged people to take a move towards the methods through which messages can be embedded in cover sources.

2.) Publishing and broadcasting industries have become interested in techniques for hiding encrypted copyright marks and serial numbers in digital films, audio recordings, books and multimedia products When we talk of digital steganography, we mean to say that, digital media's like Image, Audio /Video, Protocol are used as innocent covers for hiding secret confidential messages. Almost all digital file formats can be used for steganography, but the formats that are more suitable are those with a high degree of redundancy.

IV. CONCLUSION

In this paper we review and discuss about the Key issues of image compression, need of compression, its principles, and methods of compression and various compression algorithm of image, steganography, goal of steganography. We review and discuss the advantages and disadvantages of these algorithms for compression images for lossless and lossy Techniques.

REFERENCES

[1] Mehdi hussian and mureed hussain , A survey of image steganography techniques , international journal of advanced science and technology(ijast), vol 54 ,MAY 2013
[2] Sachin dhawan, a review of image compression and comparison of it's of its algorithms, International journal of electronics & communication technology, vol 2, March 2011.
[3] Prabhakar telegram , Vjagan Naveen ,A.Lakshmi prasanthi, G.vijaya santhi ' image compression using DCT and Wavelet Transformations' ,International journal of signal processing ,image processing and pattern recognition , vol 4, September 2011
[4] Amandeep kour, vimal kishore yadav, vikas maheshwari, Deepak prashar 'a review on image processing' international journal of electronics communication and computer engineering, vol 4, 2013
[5] Ms. Pallavi M.sune 'image compression techniques based on wavelet and Huffman coding' international journal of advanced research in computer science, vol 3, April 2013
[6] Rafael C. Gonzalez, Richard e woods "digital image processing", second Edition PAGE 410.
[7] Jain, fundamentals of digital image processing, prentice-hall Inc, 1982.
[8] Springer, digital image processing, Bred jahne, 5th edition.

