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IMAGE AND VIDEO COMPRESSION

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Abstract:-

Image and Video compression has stayed the entity of strenuous research in the last few decades. Image and Video compression routine is currently established as is supported by the large quantity of presentations that make use of this technology. Compression consequently, is a dynamic apparatus that not only shrinks the data size thereby prominent to more rapidly data transmission but also defends it to some extent from transmission errors. This article deals the indication almost altered techniques accessible for image and video compression.

Keywords: - Lossy compression, lossless compression, Run length, Huffman, LZW.

1. INTRODUCTION

During the three decades, we have countersigned an incredible outburst in research and applications in the visual communications field.

Technologically aspect, the information society will be focused by audio and visual application that agree to instant admittance to multimedia information. This technological realization would not be potential without image and video compression.

Image and video has converted very significant system of information technology and is currently recycled in many different fields, for illustration Broad casting, Teleconferencing, Mobile telephone, Surveillance, and Entertainment. Folks today presume to be capable of accessing video and image through a wide choice of miscellaneous devices and over innumerable systems. To give these types of services we need to recognize what is image and video compression aimed at storage and transmission. Compression of video and image has turned out to be inevitability and precise vital for the reason that transmission and storage of uncompressed video and would be tremendously costly and impractical.

Compression is a decline in the amount of bits needed to denote data. Compression is achieved by a program that practices a formula or procedure to regulate in what way to shrink the size of the data. Compressing data be able to protect or save storage capacity, speed file transfer, and decrease costs for storage hardware and network bandwidth.

The production of the compression is called compressed or zipped data (or file). Decompression is the inverse of compression to get the source data (or file) back by applying some deciphering algorithm. The production of decompression is called decompressed or unzipped data (or file).We used to segment data from one computer to another (over LAN, WAN, etc), one device to another. In maximum cases data being transferred covers redundancy.

The Compression and Decompression algorithms practice these redundancy attributes. In one fashion we can say - more redundancy in data would result more compressed (i.e. less size) data. In compressed data communication, sender and receiver must have mutual understanding of encoding and decoding schemes or they must have based on same standard. The determination of compression technique is to optimize the disk space while storing data in computer and to use less bandwidth while data is to be transferred over network. There are security benefits as well.

2. COMPRESSION STEPS

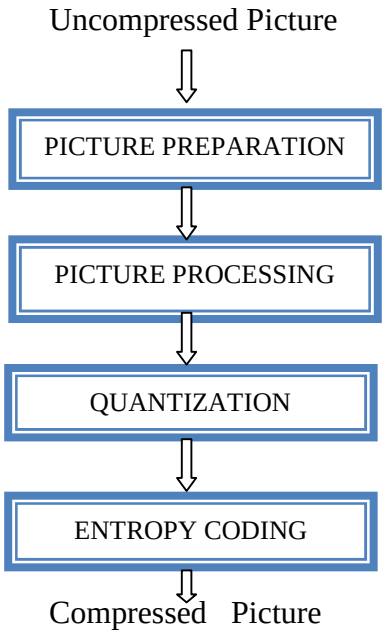

Figure 1: Steps in Compression

3. COMPRESSION THEORY

Figure 2 : Original picture 1.37 MB

Figure 3: Decoded picture (low losses) 85 KB

Figure 4: Decoded picture (high losses) 16 KB

4. IMAGE COMPRESSION

Image compression is a technique of encoding an image to store it or send it using as fewer bits as possible. The objective of image compression is to reduce irrelevance and redundancy of the image data in order to be able to store or transmit data in an well-organized form. Graphics image compression can be lossy or lossless. Graphic image file formats are naturally designed to compress information since the files tend to be large. JPEG is an image file format that ropes lossy image compression. Formats such as GIF and PNG use lossless compression.

Lossless and lossy compression are expressions that describe whether or not, in the compression of a file, Lossless compression enables the restoration of a file to its original state, without the loss of a single bit of data, when the file is uncompressed. With lossless compression, every single bit of data that was originally in the file remains after the file is uncompressed. All of the information is

completely restored. Lossy compression permanently eliminates bits of data that are redundant, unimportant or imperceptible, where a certain amount of information loss will not be detected by most users. Lossy compression is useful with graphics, audio, video and images, where the removal of some data bits has little or no discernible effect on the representation of the content.

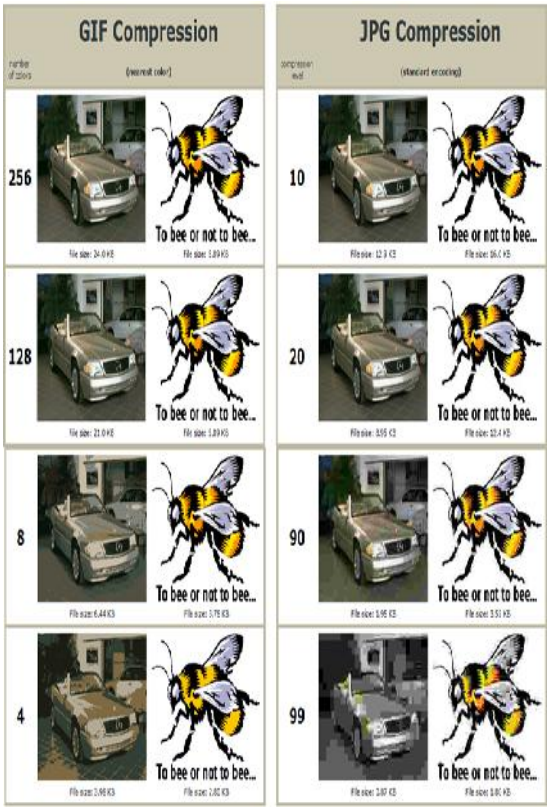

Figure 5: Difference between GIF and JPG compression.

5. VIDEO COMPRESSION

Video compression uses modern coding techniques to reduce redundancy in video data. Video compression is a practical implementation of source coding in information theory. In practice, most video codecs also use audio compression techniques in parallel to compress the separate, but combined data streams as one package. The majority of video compression algorithms use lossy compression. Uncompressed video requires a very high data rate. Although lossless video compression codecs perform an average compression of factor 3, a typical MPEG-4 lossy compression video has a compression factor between 20 and 200. As in all lossy compression, there is a trade-off between video quality, cost of processing the compression and decompression, and system requirements.

Figure 6: Compressed

Figure 7: Uncompressed

The Decoded window shows the compressed video stream. You can see that the compressed video is not as clear as the original video, shown in the Original window, but it still contains many of its features.

6. COMPRESSION TYPES

In general we divide compression algorithms in two types:

- Lossless Compression
- Lossy Compression

- **LOSSLESS IMAGE COMPRESSION**

In lossless compression, the algorithm does not lose any part of data. It means exact source data should be generated after decompression. Lossless compression should be used to compress executable

programs. The major purpose, as well as challenge, for lossless algorithms is to compress data as much as possible and get back the original data by taking minimum time.

When hearing that image data are reduced, one could expect that automatically also the image quality will be reduced. A loss of information is, however, totally avoided in lossless compression, where image data are reduced while image information is totally preserved.

A simple example demonstrates one of the strategies applied. Let us assume that in one horizontal line of an image the following sequence of gray levels is encountered when starting from the leftmost pixel of that line and going to the right:

212 214 220 222 216 212 212 214 ...

These gray levels are usually stored as 8-bit-numbers (1Byte). Obviously much smaller numbers or 'codes' are involved if one transfers only the first value directly, followed by the differences to the preceding gray levels:

+212 +2 +6 +2 -6 -4 0 +2 ....

This strategy of data reduction is called 'predictive encoding', since we use the gray level of each pixel to predict the gray value of its right neighbor. Only the small deviation from this prediction is stored. This is a first step of lossless data reduction. Its effect is to change the statistics of the image signal drastically: typically 80% of the pixels in the resulting 'difference image' will now require just 8 graylevels (3 bits plus sign). Of course, we can still reproduce the original gray level values from these reduced data without any error if we only know the rule that was applied when generating the sequence.

Statistical encoding is another important approach to lossless data reduction. A frequently occurring letter such as 'e' is transmitted as a single dot ' · ', while an infrequent 'x' requires four Morse symbols ' - · · - '. In this way the mean data rate required to transmit an English text is decreased as compared to a solution where each letter of the alphabet is coded with the same number of basic symbols. Accordingly in image transmission, short code words or bit sequences (one to four bits) will be used for frequently occurring small gray level differences (0, +1, -1, +2, -2 etc.), while long code words are used for the large differences (for instance the 212 in above example) with their very infrequent occurrence. Statistical encoding can be especially successful if the gray level statistics of the images has already been changed by predictive coding. The overall result is redundancy reduction, that is reduction of the reiteration of the same bit patterns in the data. Of course, when reading the reduced image data, these processes can be performed in reverse order without any error and thus the original image is recovered. Lossless compression is therefore also called reversible compression.

Following techniques are included in lossless compression:

- Run-length Coding
- Huffman Coding
- LZW (Lempel-Ziv-Welch) Coding

Run Length Coding

Run length coding is the modest method of compression. It can be used to compress data made of any combination of symbols. It does not need to know the frequency of occurrence of symbols and can be very efficient if data is represented as 0s and 1s.The general idea behind this method is to replace consecutive repeating occurrences of a symbol by one occurrence of the symbol followed by the number of occurrences. The method can be even more efficient if the data uses only two symbols (for example 0 and 1) in its bit pattern and one symbol is more frequent than the other.

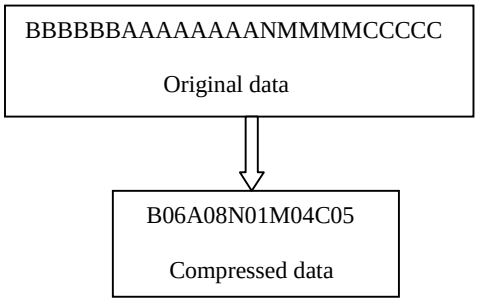

Figure 8: Run length coding.

Huffman coding

This is a general technique for coding symbols built on their statistical occurrence frequencies (probabilities). The pixels in the image are treated as symbols. The symbols that occur more frequently are assigned a smaller number of bits, while the symbols that occur less frequently are assigned a relatively larger number of bits. Huffman code is a prefix code. This means that the (binary) code of any symbol is not the prefix of the code of any other symbol. Most image coding standards use lossy techniques in the prefix of the code of any other symbol and in the earlier stages of compression and use Huffman coding as the final step.

LZW coding

LZW (Lempel-Ziv-Welch) is a dictionary based coding. The idea is to create a dictionary (a table) of strings used during the communication session. If both the sender and the receiver have a copy of the dictionary, then previously-encountered strings can be substituted by their index in the dictionary to reduce the amount of information transmitted. Dictionary based coding can be static or dynamic. In static dictionary coding, dictionary is fixed during the encoding and decoding processes. In dynamic dictionary coding, the dictionary is updated on fly. LZW is widely used in computer industry and is implemented as compress command on UNIX.

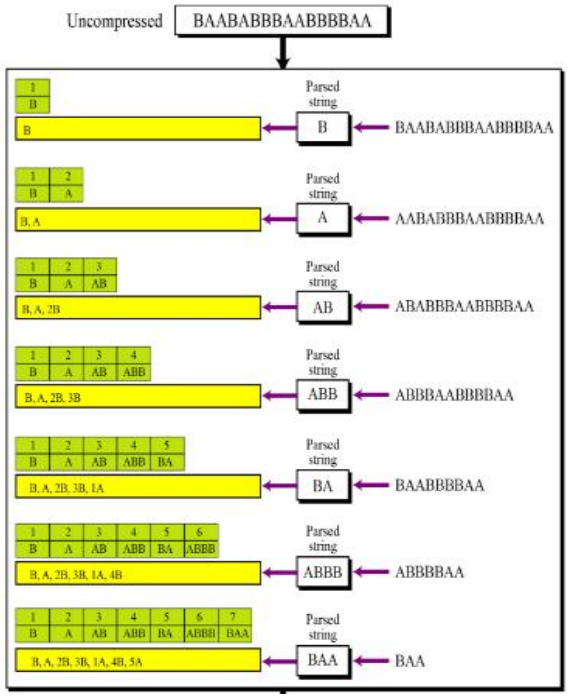

Figure 9: An example of Lempel Ziv encoding

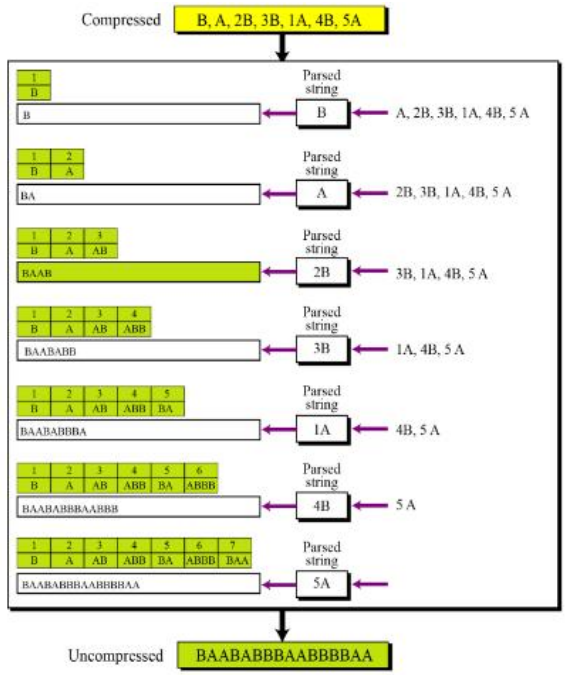

Figure 10: An example of Lempel Ziv decoding

- **LOSSY IMAGE COMPRESSION**

Lossy data compression has of course a strong negative connotation and it is at all

applicable in medical imaging. A trivial example for lossy compression of image data is selecting only 4 to 10 of the most relevant images for exposing them to a multi format film that is to be sent to a referring physician. This is an interactive strategy of irrelevancy reduction. For instance, in transform encoding one performs for each image of the cine run a mathematical transformation that is similar to the Fourier transform thus separating image information on gradual spatial variation of brightness (regions of essentially constant brightness) from information with faster variation of brightness at edges of the image. In the next step, the information on slower changes is transmitted essentially lossless ,but information on faster local changes is communicated with lower accuracy. In image data reduction, this second step is called quantization. Since this quantization step cannot be reversed when decompressing the data, the overall compression is 'lossy' or 'irreversible'.

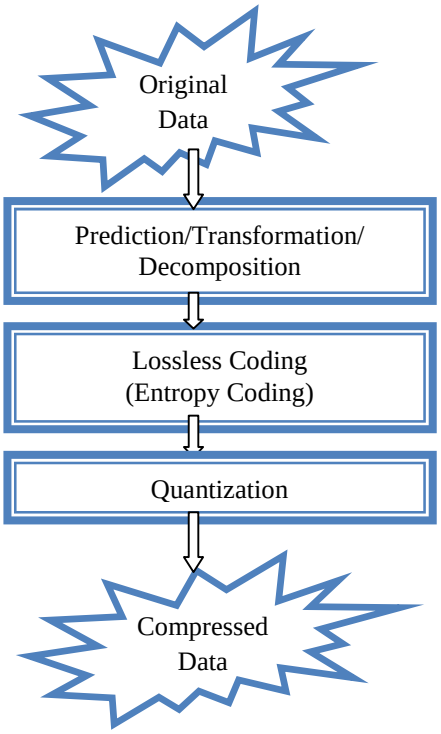

Figure 11: Outline of lossy image compression

Data Compression strategy	Lossless /Reversible	Lossy/Irreversible
Based On	Statistics of Data	Meaning Of Information
Result In	Redundancy reduction	Irrelevancy Reduction
Key methods	Predictive encoding plus statistical encoding	Transform Encoding plus Quantization
Examples of Implementation	Lossless JPEG Mode	Lossy JPEG Mode
Compression Factor	2-3	6-12

Table 1: Summarizes some of the characteristics of lossless and lossy image compression techniques.

CONCLUSION

This article boons several types of image and video compression and its compression techniques. There are ultimately two types of compression procedures. One is Lossless Compression and other is Lossy Compression Technique. Paralleling the performance of compression technique is problematic unless identical data sets and performance trials are used. A number of these procedures are obtained well for certain applications like security technologies though the compression techniques debated overhead can aid image

and video compression to a prodigious extent. Accordingly from security perspective it is not unobjectionable because the true message and its integrity are lost. Consequently multimedia compression is static in its developing stage and has a proportion to be researched.

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