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# A Review on image compression technique

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## Abstract

The demand for images video sequences and computer animation has increased drastically over the years. This has resulted in image and video compression on becoming an important issue in reducing the cost of data storage and transmission.JPEG is currently the accepted standard for still image compression. , but alternative methods are also being explored. Storing images in less memory leads to a direct reduction in storage cost and faster data Hence image compression has proved to be a valuable technique as one solution. In this paper we purpose the lossless method of image compression and decompression using a simple method called Huffman coding.

Keywords: Image, Digital Image, Image compression Techniques.

## 1. Introduction

Image compression has an important application in the areas of image transmission and image storage despite the large capacity storage devices that are currently available. Therefore, an efficient method for storing and transmitting an image to reduce execution time and memory size is needed. The general principle of image compression algorithms is to transform binary digits into a new one that contains the same information but with fewer digits, so the file can be as small as possible. The efficient image compression algorithm or any data compression is chosen according to scales, such as compression size, compression ratio, and entropy. *Compression size* is the size of the new file in bits after compression is complete. *Compression ratio* is a percentage that results from dividing the original file size in bits by the compression size in bits. *Entropy* is the number that results from dividing the compression size in bits by the number of symbols in the original file and scales as bits/symbol [1].

The general idea for achieving error detection and correction is to add some redundancy (i.e., some extra bits) to a message. The receiver then uses these extra bits to the check consistency of the delivered message and to recover data that is determined to be erroneous. These detecting/correcting codes are also used in data compression. Hamming codes, BCH code, and

Huffman code are all codes for detecting/correcting errors. Hamming and BCH codes are block codes that have fixed lengths, whereas Huffman code is a variable-length code [2,3 4]. Typically, a block code takes *k* bit information and transforms this into an *n* bit codeword by adding *m* redundant bits to the original data bits. The block length of this type of code would be an *n* bit and, so, there are $2^k$possiblecodewords.

Data compression is divided into two major categories, lossless compression techniques and lossy compression techniques. In lossless compression, data can be compressed and restored without any loss of information. In lossy compression, the decompressed data may be an acceptable approximation of the original uncompressed data [5]. The codeword of length *n* and *k* data bits: (*there are* $2^k$ *possible* code words) are compressed into a *k* bit in the compressed file using (n, k) BCH code. For a non-codeword*(there are* $2^n - 2^k$ *possible non*-code words*)* the same *n* bits are written in the compressed file. We use an indicator to determine whether or not the *n* bits in the original file are compressed into a *k* bit.

## 2. What is Digital Image Processing?

Pictures are the most common and convenient means of conveying or transmitting information. A picture is worth a thousand words. Pictures concisely convey information about positions, sizes and inter-relationships between objects. They portray spatial information that we can recognize as objects. Human beings are good at deriving information from such images, because of our innate visual and mental abilities. About 75% of the information received by human is in pictorial form.

An image may be defined as a two-dimensional function, *f(x, y),* where x and y are spatial(plane) coordinates, and the amplitude of *f*at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When (x, y) and the intensity values of *f* are all finite, discrete quantities, then we call the image a digital image.

A digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are called *picture elements, image elements, pels , and pixels* .In spatial domain methods we directly process the pixels of an input image. An expression for spatial domain processing is given by the equation shown below:

$$g(x, y) = T[f(x, y)] \quad (1.1\text{-}1)$$

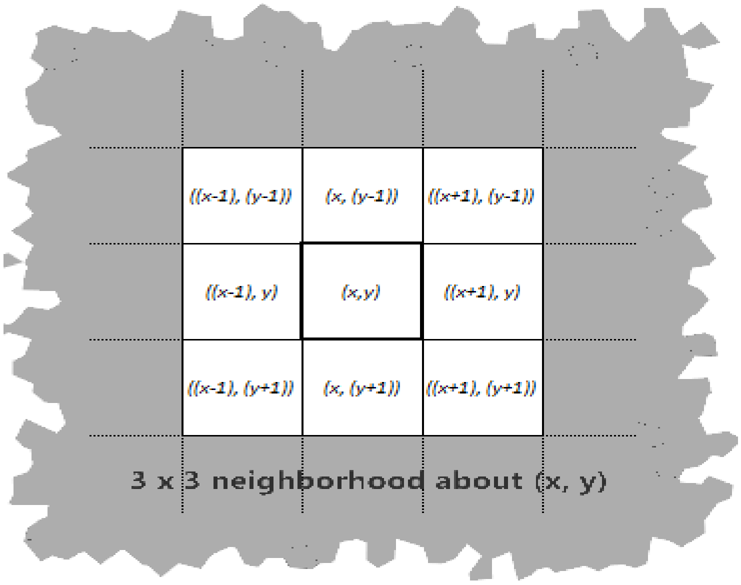



**Figure 1.1**Neighborhood of pixel at point (x, y).

Here, *f(x, y)* is the original image, *g(x, y)* is the processed image and *T*is an operator over neighborhood of *(x, y).*

The principal approach in defining a neighborhood about a point *(x, y)*is to use a square or rectangular sub image area centered at *(x, y).* The center of the sub image is moved from pixel to pixel. The operator $T$ is applied at each location to yield the output at that location. The process utilizes only the pixels in the area spanned by the neighborhood.

## 2.1 Image Compression

Image compression addresses the problem of reducing amount of data needed to represent an image or data without degrading the quality of the image to an unacceptable level. This is done by the removal of redundant data contained in the image. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from Web pages.

This removal of data may be reversible (i.e. the removed data can be fully reconstructed from compressed data) or irreversible (i.e. the removed data can be only partially reconstructed from compressed data). The former kind of compression is called *lossless compression*, while the latter kind of compression is called *lossy compression.*

**Lossy image compression**

**Lossless image compression**

A text file or program can be compressed without the introduction of errors, but only up to a certain extent. This is called lossless *compression*. Beyond this point, errors are introduced. In text and program files, it is crucial that compression be lossless because a single error can seriously damage the meaning of a text file, or cause a program not to run. In image compression, a small loss in quality is usually not noticeable. There is no "critical point" up to which compression works perfectly, but beyond which it becomes impossible. When there is some tolerance for loss, the compression factor can be greater than it can when there is no loss tolerance. For this reason, graphic images can be compressed more than text files or programs.

The lossless image compression is used in fields where full restoration of original image from compressed one is crucial[6]

- business documents, where lossy compression is prohibited for legal reasons.
- satellite images, where the data loss is undesirable because of image collecting cost.

medical images, where difference in original image and uncompressed one can compromise diagnostic accuracy

## 3. Trade Off Quality Against Compression

Lossless compression(information preserving):-

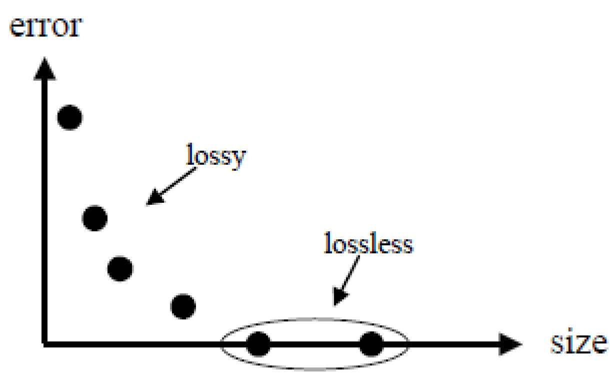
- original can be recovered exactly.

*Higher quality, bigger.*

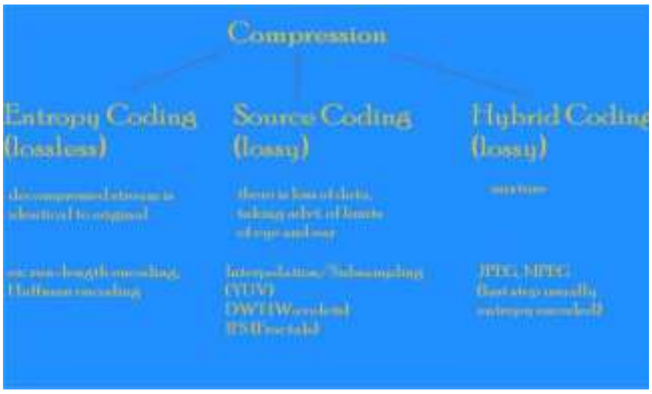
Lossy compression:-

- only an approximation of the original can be recovered.

*Lower quality, smaller.*




**What's compression all about?**




Basically there are two types of coding:- *Entropy coding* and *Source coding.*

***Entropy Coding***

In entropy coding, a characteristic called redundancy is used to decrease the size of the file. There are usually many repeating characters in a file, and in entropy coding, these repeated symbols are just noted down and instead of repeating them at every pixel, the positions of these pixels are recorded and they are all noted to have the same symbol (this is only an example of entropy coding, called run-length encoding, RLE). Thus, there is no loss of information in entropy coding. This kind of coding is also called *non-* lossy coding. Two examples of entropy coding are given below.

***4.Run-Length Encoding***

Run Length Encoding is one of the oldest compression methods. It is characterized by the following properties:

- Simple implementation of each RLE algorithm
- Compression efficiency restricted to a particular type of contents
- Mainly utilized for encoding of monochrome graphic data

In Run-Length Encoding, which is a special kind of entropy coding, repetitive symbols/characters are collected and the pixels/positions where they are repeated are written down into the coded file. In the case of video files, repeatedly unchanging scenes can be encoded together. We can use *differential encoding*, as shown below.[7] [8]

**5.Differential Encoding**

This is a very smart non-lossy technique. To illustrate this procedure, consider a sequence of frames. For example, if in a sequence of images, Homer Simpson is walking through Springfield on a very quiet day, the rest of Springfield (the pixels) can be coded into the file with the information that those pixels do not change for a few frames, while Homer's position is changing from pixel to pixel. In differential encoding, as the name suggests, this is done by noting down the change between frames, instead of the actual values of, for example, the colours. This means, for example, that we could just have a lot of zeroes in the coded images, and this can now be further compressed by using RLE.

## 6.Conclusion

Based on the review of images and its compression algorithms we conclude that the compression normally chosen for compressing the images needs to be experimented with the various compression methods on various types of images, the following general guidelines can be applied as a starting point to compress image.

For true images that do not require perfect reconstruction when decompressed JPEG can be used.

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