New Technology to improve an Image Compression using the LZW Algorithm

Suad Abed Alwahab
Ministry of Education, Iraq
Email: bsmt.jnaen@gmail.com
https://orcid.org/0009-0000-9534-3214

Abstract

Image compression is a process applied to reduce the size of an image file, byte by byte, without reducing its quality acceptability levels. By reducing the file size, more images can be stored dona given amount of disk or memory space. Thus, bandwidth is required when images are transmitted over the Internet or downloaded from a web page, reducing network congestion and speeding contented delivery . The proposed system adopted the LZW algorithm to compress images without loss. This algorithm was named after the names of the scientists who developed this algorithm in recognition of their efforts, namely Abraham Lempel ،Jakob Ziv and Terry Welch, which is based on a dynamic dictionary, where this dictionary checks the file for duplicate data and then stores it in the dictionary, where this algorithm replaces strings of characters with individual symbols, as this proposed system performs 12-bit codes, and it was applied to many images and we got impressive results. The importance of this system lies in the benefit it provides by reducing the size of the image file without losing data, and thus reducing the space needed to store and send it easily over the Internet and high quality. The Python language has been used to implement this system.

Keywords- Dictionary, Image compression, Lossless Compression, LZW algorithm, photographs.

I . INTRODUCTION

In the social networking community in, there is an urgent need to deal with colorful pictures and videos that we need to circulate among ourselves in order to benefit from them in various fields. Therefore, we find that there is a problem, which is that these images and videos require large storage spaces and may be difficult to transfer over the Internet. Therefore, this problem must be avoided by creating a program to compress images and provide storage spaces without compromising the quality of the image and making it available to the general public. One of the types of data compression is image compression, which is used with digital images in order to reduce transportation costs and reduce storage space. This algorithm can rely on statistical data and visual perception to reduce error results compared to other common types. It is a data compression method that is used with numeric data. [1]
There are two types of compression: lossy compression and lossless compression:
Lossless compression is often used for archival purposes such as graphic art, medical images, comics, or clip art. Lossless compression systems often provide combined compression, Particularly when used at low bit rates. Lossless compression is often used in applications where loss of resolution is acceptable, such as in natural images, including photographs, i.e. imperceptible, and thus there is a significant drop in bit rate. Lossy compression may be referred to as results in which discrepancies are not visible as lossy notes. [2] Transformation encoding - This method is considered one of the most common methods. The DCT, which is the Discrete Cosine Transform is a method of the Fourier transform form which was updated by T. Natarajan, K. R. Rao and Nasir Ahmed in 1974. In general, the best and most efficient image compression method is the use of the DCT in JPEG, and sometimes this method is called "DCT". -II". It is the newer and more lossy HEIF format. The newly developed ripples are often used on a large scale, and then the hologram is quantized and encoded, and this will lead to a reduction of the color space in relation to the colors most present in the image. Here, the required color is placed at the beginning of the compressed image, where each pixel symbolizes the color index in the color palette. Thus, this method can be combined with vibration to prevent sticking. Croma Sub, which is sampling, which relies on a scientific act that The human eye distinguishes and perceives spatial changes in color more specifically than changes that occur in color. And averages and may display some image saturation information that represents partial pressure. [3]

II. Related work

[A]Smitha Rao et al. [4] Many lossy compression techniques have been addressed in this research, and many challenges for different types of compression in many applications have been discussed. The statistical method has been adopted in text compression, and a comparison has been made between LZ77 and LZ78, and this algorithm has provided the best result compared to the Huffman and the RUN algorithm from statistical methods. DWT has also been discussed.

[B] Gaurav Gupta et al [5] This research dealt with compressing images using lossless data compression, which means that there is no loss in the original image data. This paper also discussed the compression factors such as compression size, compression speed, and image quality.
[c] Hao Zhang et al.[6] This research includes a new lossless image encryption method, as this method depends on making the encryption within the image compression process, where encryption is performed for a small part of the data, with emphasis on the required encryption properties, and this is done in three stages of mixing, where chaotic systems are used to generate text related to With the original text to be at a high level of security and resistance to attackers, and the length of the image channel is not fixed, which leads to difficulties for attackers in decoding the encryption algorithm. The results indicate a compression ratio of 50% of the original image. This system has passed the entropy analysis and lossless recovery test.

III. LZW algorithm

This algorithm is a commonly used compression technique, usually used with GIFsnad and optionally used with PDF, JPG files, and also used in UNIX compression, which is a lossless compression, that is, without losing data during compression.And this algorithm is easy to implement and has very high productivity, as it is used in the GIF image format, as it relies on repeated patterns to reduce storage space, and the LZW algorithm is considered the first technology for data compression, which is used for general purposes because of its simplicity and diversity. LZW compression works with a yreadiga string of symbols, compiling symbols into a thread, compressing conversion on LZW by reading a string of symbols and then making the symbols into a string and then converting that string into a symbol so the symbols take up less space than the string they are replaced with and this is achieved Compression. The compression of this algorithm, LZW, is unique in that it uses the code table. The number of entries in the table is 4096 typically, and symbols from 0-255 are often set on the table to represent one byte of the input file, and that is at the beginning of the encoding. The symbol table also contains 256 entries only, while the rest of the entries are empty. When starting the encryption process, the code table includes only the first entries, which are empty, and then compression is done using symbols from 256 to 4045 to represent the tasequence of bytes. As the encryption process continues, the LZW algorithm will identify repeated sequences and add them to the code table. [7],[8] The decoding is done by taking each symbol from the compressed files and translating it via the code table to find the letter or characters it represents.[9]

Lossless compression method

- Runtime encodes - this type is used by default in (p, c x) and is one of the possible properties in TIFF, BMP and TGA.
- Range image compression.
- Predictive coding - which is implemented in DPCM.
- Entropy Coding - One of the most widely used coding techniques in the universe is Huffman notation and computer notation.
- Adaptive dictionary algorithms such as LZW - used in TIFF, GIF and JPEG.
- DEFLATE - Use in TIFF, PNG and MNG formats.
- Code string [10].

Advantages of LZW

1 - This algorithm is characterized by its simplicity and speed of implementation.
2- It has a high compression ratio, especially for text-based data, which reduces storage requirements and greatly reduces file size.
3- You do not need prior information about the input data flow.
4- This algorithm can compress the input data in one pass.
5- This algorithm is characterized by fast decompression, as it decompresses faster than other compression algorithms, which makes it the ideal choice for applications where the speed of decompression is important.
6- Internationally approved: It is widely used and supports a variety of operating systems and software applications, which makes it the ideal choice for compression and decompression.
7 - Dynamic compression: This algorithm uses dynamic compression of the data being compressed, so it achieves high compression ratios even for data with repetitive patterns [11].

Disadvantages of LZW

1- Patent problems: This algorithm was patented in the eighties, and this required licensing fee for many years, which led to its adoption in some applications being limited.
2- Memory requirements: This algorithm requires a lot of memory in order to store the compressed dictionary, and this represents a problem for applications that need limited memory.
3- Compression speed: This algorithm is slower than other compression algorithms because it needs to update the dictionary continuously and is not suitable for large files.
4- Limited applicability: This algorithm is very effective with text-based data, but is less effective with images and video with data with different compression requirements. [12],[13].

VI. the propose system

1-This algorithm relies on the dictionary in the process of checking the file in order to search for the sequence of data that occurs many times.
2- Then a dictionary is used to store these sequences and references are placed in the ZIP file where the repeated data occurred. Where this algorithm (L ZW compression) replaces these strings with individual characters. The code output by the lzw algorithm can be of any length, but must contain at least one character bit. The code output by the LZW algorithm can be of any length, but must contain at least one bit.
3- The first 256 characters (when using 8-bit characters) are first assigned to the standard character set. There meaning symbols are assigned to the string as the algorithm progresses. A typical program works as shown for a12-bit code.
4-LZW is an adaptive technique variable dictionary is maintained for (some of) the strings that have appeared in the text so far while the compression algorithm is running. This dictionary is pre-populated with 256 different symbols that may appear in a single byte, so the entire input source can almost certainly be a convert edit string at the dictionary index. If"A" and "B" are the two character strings held in the dictionary.
5-string converts"AB" index "A", which converts to index "E". Bar"then"Ax"cannot be an element of the dictionary. The adaptive nature of the algorithm is due to the fact that if 'A' matches, but 'A"x' does not, it is automatically dictionary. This indicates that codes 0-255 refer to individual byte sand codes 256-4095 refer to substrings. Thus LZWcompresions has advantages and disadvantages has advantages and disadvantages. Files are usually increased in size significantly when they contain a lot of redundant data or monochrome images. Lzw compression is a great technique for reducing the size of files that continent of redundant data. Lzw compression is fast and easy to apply. It can be used for files that contain a lot of redundant data. It can be used for files that contain a lot of redundant data. It can be used for files that contain a lot of redundant data. Since this is a lossless compression technique, no file content is lost during or after compression. The decompression algorithm always follows the compression algorithm; the LZW algorithm I snore efficient because it does not need to purse-string table in the decompression code. The input stream can be used as data, and the tables can be recreated exactly as they were during compression. This eliminates then edition shirt large string conversion tables during data compression.
6-PlaneSlicing:Emphasizesthe contribute ion that a particular bit makes to the overall appearance of the image. Assuming that each pixel is represented by 8 bits, the image has8one-bit levels. As shown in Figure(1), level (0) contains the least significant bit and level (7) contains the most significant bit. Only the most significant bits (the first four bits) contain most of the visually significant data. The other bit levels contribute finer detail. This is useful for analyzing the relative importance that each part of the image plays.

Implement and results for the propose system

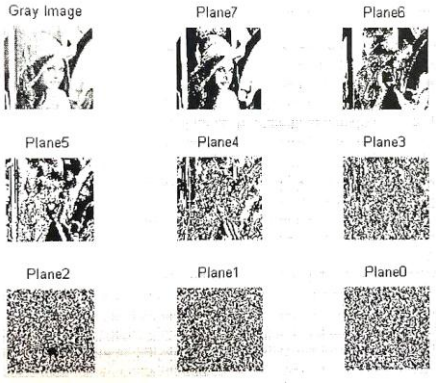

Figure (1) An 8-bit grayscale line image of size256 x256pixels Each bit plane is a binary image.

We are now implementing the program to obtain the results as shown Below:

BEFORE AFTER

Original Image Name	Original Size	Image Name	Size
Pic-0	4.5 MB	Pic-0 LZW	760 KB
Pic-1	1.40 MB	LZW	B
Pic-2	1.40 MB	LZW	B
Pic-3	2.30 MB	LZW	B
Pic-4	1.40 MB	LZW	B

1-Reducing the size of image files while maintaining the same quality and accuracy.
2- Reducing the space needed to store it, and thus the ease of sending it via the internet.
3-The LZW algorithm provides impressive results compared to other compression algorithms in terms of compression ratio and image quality.

V. **Conclusions**

In this paper, a new technique was adopted to compress images using the lzw algorithm, which is based on a dynamic dictionary, by storing duplicate data, and also adopts 12-bit codes. When applying this system, we got great results in terms of :
Enables the user to compress images for faster data backup and storage.-
Easy to send by multimedia such as e-mail.-
Provide storage space for the hard disk.-
The LZW algorithm provides results that are superior to other algorithms.

IV. Recommendations

-Developing the system to include video files.
-Make the program available in all social media so that people can use it easily and quickly.
-Add encryption to video files.

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