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A HIGH PERFORMANCE NOVEL IMAGE COMPRESSION TECHNIQUE USING HUFFMAN CODING WITH EDGE DECTION

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ABSTRACT

Image compression can improve the performance of the digital systems by reducing time, cost in image storage and transmission without significant reduction of the image quality. This paper proposes a technique for image compression which uses Huffman coding is used to compress image then using Edge detection to identifying and locating sharp discontinuities in an image. There are large number of edge detection among them. The Canny edge detection is applied after Huffman coding. This technique is simple in implementation and utilizes less memory.

Keywords: Edge Detection, Huffman coding, Canny edge detection.

1. INTRODUCTION

The image compression has become a necessity due to the demand of manipulation, storage and transmission of digital images, great efforts are made to seek image compression technique that are of modest complexity, exhibit efficient compression. Performance and provide scalability. A digital image is an array of real or complex numbers represented by a finite number of bits. It involves with the removal of redundant data. Compression is done by reducing video transmission bandwidth. It is referred as Bandwidth compression. Image compression is key technology in the field of video conferencing, remote sensing, Medical imaging, Facsimile Transmission, Military applications and space applications. Image compression is a mapping from a higher dimensional space to a lower dimensional space.

2. FUNDAMENTAL OF COMPRESSION

2.1 Types

Lossless compression means no loss of image when compressing and also decompressing. The reconstructed image after compression is same as the original one.

Lossy compression means some image is lost when it is decompressed. In this compression, a higher compression ratio can be achieved when compared to lossless compression.

2.2 File compression

The File compression is commonly used when sending a file from one computer to another over a connection that has limited bandwidth. File compression makes the file smaller and sending the file fast. When compressing a file and sending it to another computer that computer has to have a program that will decompress the file. So it can be returned to normal file.

2.3 Disk compression

Disk compression software utility increases the amount of information that can be stored on a hard disk drive of given size. Unlike a file compression utility which compresses only specified files which requires the user designate the files to be compressed. When information needs to be stored to the hard disk the utility will compress the information. When information needs to be read, the utility will decompress the information.

3. EDGE DETECTION

Edge detection is used in image analysis. There are so many techniques in the edge detection. Edge detection is the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterise boundaries of objects in it. Edge detection significantly reduces the amount of data and filters out unwanted information, while preserving the structural properties in an image.

4. CODING TECHNIQUES

4.1 LZW

LZW replaces strings of characters with single codes. These code that the LZW algorithm outputs can be of any arbitrary length, but it must have more bits in it than a single character.

Advantages

- It is easy to implement.
- Fast compression
- Lossless technique.
- Dictionary based technique.

Disadvantages

- Management of string table is difficult.
- Amount of storage needed is indeterminate.

Application

- It is used in TIFF and GIF files.

4.2 ARITHMETIC CODING

The principles of arithmetic coding describe an arithmetic coding engine that will produce a compliant bit stream when used in conjunction with the correct methods for binarization and context selection [2].

Advantages

- Efficiently represents more frequently occurring sequences of pixels values with fewer bits.
- Reduce file size dramatically.
- Lossless compression.

Disadvantages

- It is a paid algorithm.
- Statistical technique.

Application

- It is used mostly for frequently occurring sequences of pixels.

4.3 RUN LENGTH CODING

Run Length coding (RLE) is a simple technique to compress digital data by reducing the physical size of a repeating string of characters. It also called as recurrence coding.

Example

AAABBCC
3A2B2C

Advantage

- Simple to implement.
- Fast to execute.
- Lossless compression.

Disadvantage

- Compression ratio is low as compared to other algorithms.

Application

- It is used mostly for TIFF, BMP and PCX files.

4.4 HUFFMAN CODING

Huffman code procedure is based on the two observations [5].

(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.

Table 1. Huffman source Reduction

Original source		Source reduction			
Symbol	Probability	1	2	3	4
a_2	0.4	0.4	0.4	0.4	0.6
a_6	0.3	0.3	0.3	0.3	0.4
a_1	0.1	0.1	0.2	0.3	
a_4	0.1	0.1	0.1		
a_3	0.06	0.1			
a_5	0.04				

Table 2. Huffman Code Assignment procedure

Original source			source reduction							
Symbol	Probability	Code	1		2		3		4	
a_2	0.4	1	0.4	1	0.4	1	0.4	1	0.6	0
a_6	0.3	00	0.3	00	0.3	00	0.3	00	0.4	1
a_1	0.1	011	0.1	011	0.2	010	0.3	01		
a_4	0.1	0100	0.1	0100	0.1	011				
a_3	0.06	01010	0.1	0101						
a_5	0.04	01011								

In the above table 1 the symbols are listed and corresponding symbol probabilities are arranged in decreasing order. To form the first source reductions, the bottom two probabilities, 0.06 and 0.04 are combined to form a compound symbol with probability 0.1. This compound symbol and its associated probability are placed in the first source reduction column so that the probabilities of the reduced source are also ordered from the most to the least probable. This process is then repeated until a reduced source with two symbols is reached. The second step if Huffman's procedure is a code each reduced source, starting with the smallest source and working back to its original source. The minimal length binary code for a two symbol source, of course, is the symbols 0 and 1.

In the above table 2 these symbols are assigned to the two symbols on the right. As the reduced source symbol with probabilities 0.6 was generated by combining two symbols in the reduced source to its left, the 0 used to code it is now assigned to both of these symbols 0 and 1 are arbitrary appended to each to distinguish them from each other. This operation is then repeated for each reduced source until the original course is reached. The final code appears at the far left in the table 2. The average length of the code is given by the average of the product of probability of the symbol and number of bits used to encode it. This is calculated below.

Lavg= (0.4) (1) + (0.3) (2) + (0.1) (3) + (0.1) (4) + (0.06) (5) + (0.04) (5) =2.2 bits/symbol and the entropy of the source is 2.14 bits/symbol, the resulting Huffman code efficiency is 2.14/2.2=0.973

Huffman's procedure creates the optimal code for a set of symbols and probabilities subject to the constraint that the symbols be coded one at a time.

5. CANNY EDGE DETECTOR

The current standard edge detection scheme widely used around the world is the canny edge detector. This edge detector works in a multi-stage process. These processes are smoothing, finding gradients, non-maximum suppression, double thresholding and Edge tracking by hysterias. It using probability for finding error rate and also Improving signal ratio.

6. THE PROPOSED ALGORITHM

The proposed scheme combines Huffman coding with Edge detection. The steps given below.

Step 1: Read the image on to the workspace of the mat lab.
Step 2: Convert the given colour image into grey level image.
Step 3: Call a function which will find the symbol whose pixel value does not repeated.
Step 4: Call a function which will calculate the probability of each symbol.
Step 5: Probability of symbols are arranged in decreasing order then lower probabilities are merged till two probabilities are left.
Step 6: Codes are assigned according to rule that the highest probable symbol will have a shorter
Length probable will have a shorter length code then Huffman encoding is performed.
Step 7: Smooth the image with a Gaussian filter.
Step 8: Compute the gradient magnitude and angle image.
Step 9: Apply non-maxima suppression to the gradient magnitude image.
Step 10: Use double thresholding and connectivity analysis to detect and link edges.

7. RESULT

INPUT IMAGE

OUTPUT IMAGE

8. CONCLUSION

We have presented new method of compression by applying Huffman Coding with Edge detection. From the output, it is concluded that this method is more efficient than the traditional method. This method gives identifying and locating sharp discontinuities in this compressed image. As a future work more shall be on improvement of new technique in Edge detection.

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