International Journal of Scientific and Technical Advancements
IJSTA
ISSN: 2454-1532

Image Compression and Decompression using Huffman Coding

Ajeet Kaur[1], Randhir Singh[2], Bhanu Gupta[3]
[1,2]Department of ECE, SSCET, Punjab Technical University, Pathankot, Punjab, India-145001
[3]Department of AE&IE, MBSCET, Jammu University, Jammu, J&K, India-180004
Email address: [1]unique23ajeet@gmail.com, [2]er_randhir@rediffmail.com, [3]bhanugupta.mbs@gmail.com

***Abstract*—**Advances in digital image processing techniques have given way to image compression technology. Image compression becomes an immediate requirement for storage of digital images and image data transmission. In the present scenario when data has become digital and its transmission, reception and storage has become online, faster sending and receiving textual data or images has become top priority for every information system and thus image compression becomes a basic necessity as small size images become the basic requirement. In this paper, discussion on code redundancy algorithm using Huffman coding which chooses less number of bits for frequently occurring data for image compression is provided. The image compression and decompression models are provided with algorithms for easy implementation.

***Keywords*—**Image; compression; decompression; huffman coding.

I. INTRODUCTION

The key application areas for image compression are image database and archival systems, image communication systems, digital motion picture creation, tele-video conferencing, remote sensing, documentation, medical imaging, satellite imaging, digital cameras, photography etc. Image processing finds its need in the mentioned areas of application as theses applications need higher rates of data processing and image compression provides this facility as it obtains reduced size images with no or low information or data losses. The web space storage applications and image transmission methods readily use image compression and decompression techniques to enhance storage capacities of the system and achieve reduction in transmission and reception time. The time required to transmit a small image is about 0.03 to 7 seconds. The image compression techniques if applied effectively can easily reduce this time by a factor of 2 to 10 or more. A large number of image compression techniques have been used. One of the most common is using DCT (Discrete Cosine Transforms) to achieve image compression [1]. Other than image compression data compression techniques are also available [2]. Huffman coding is one of the techniques which can also be used for lossless image compression and decompression.

II. METHODOLOGY

The removal of redundant data from an image is the most natural and easy way to achieve image compression. The compression ratio C, is the ratio of representations which hold same number of bits with same information. The Relative data redundancy in a system represented by R=1-1/C, shows how much percent data is redundant. The different types of redundancies present in an image are code redundancy, spatial redundancy, and irrelevant information. A code is a system of symbols used to represent a body of information or a set of events. In coding redundancy, symbols which are used many times in an image are set as less number of symbols, thus reducing the size of image. Spatial redundancy id also called inter-pixel redundancy which means the neighbouring pixels in an image are correlated and these pixels are deleted to compress the image. The irrelevant information redundancy data points to those areas in the 2D image which are ignored or non-interpretable by human visual cortex.

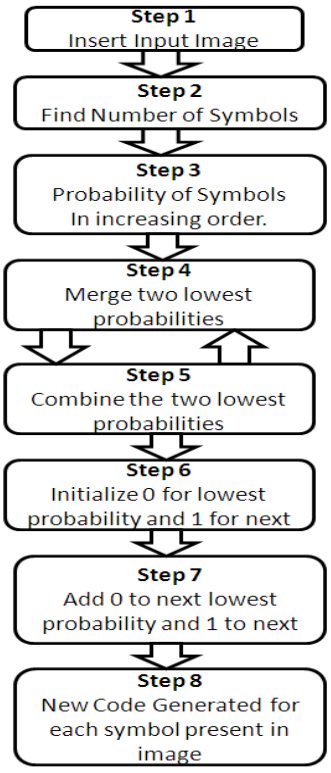

Fig. 1. Huffman coding encoder model.

Removal of these areas also amounts to image compression. By the removal or elimination of one or more

Ajeet Kaur, Randhir Singh, and Bhanu Gupta, "Image compression and decompression using huffman coding," *International Journal of Scientific and Technical Advancements*, Volume 1, Issue 4, pp. 35-36, 2015.

such redundancies the image compression can be achieved. Huffman coding technique is used to remove coding redundancies from an image. Also, the image compression is of two types, lossy image compression and Lossless image compression. Huffman Coding is used for lossless image compression. The Huffman Coding requires encoding and decoding of redundant symbols for achieving image compression and decompression respectively. The process of Huffman coding as an encoder is shown in figure 1. To understand the encoding system let us consider an 8 bit representation of an image in which each image pixel is represented by 8 different bits. By using probabilities the occurrences of redundancies in this case largest occurrences of symbols in the image is calculated. In this way the redundancy is reduced by reducing large number of bits for large occurrences of symbols, in turn reducing the storage capacity for the image. Hence, Image compression is achieved. The image decompression can be achieved by using Huffman decoder system. The compressed image is transmitted to another node or terminal where the decoder software runs to retrieve the compressed data and generates the original image. The decoding procedure is as such that it generates a decimal code for each symbol in the compressed image. The Huffman Coding table is used to decode the decimal code by matching it with symbol. The compressed bits are decompressed if the codes match. The huffman code table is shown in figure 2.

Symbol	Probability	Code	Huffman Code Source Reduction					
a1	0.5	01	0.5 01	0.5 01	0.6 00	0.8 1	1.1	0
a2	0.4	10	0.4 10	0.4 10	0.5 01	0.6 00	0.8	1
a3	0.3	000	0.3 000	0.4 11	0.4 10	0.5 01		
a5	0.3	001	0.3 001	0.3 000	0.4 11			
a8	0.2	110	0.2 110	0.3 001				
a7	0.1	1110	0.2 111					
a6	0.1	1111						

Fig. 2. Huffman source code reduction table.

The complete image compression and decompression using Huffman coding is explained as follows. The process starts with inserting the image to be compressed in the Huffman encoder system. This encoder system compresses the image by reducing the code redundancy and the output is the compressed image as explained above in figure 1. This compressed representation of original image is stored for later use or transmitted to other node or remote location for application purposes or storage. At this stage the compressed image is given to the decoder system which reconstructs the image in its original form and generates the decompressed image output. The whole process is depicted in figure 3.

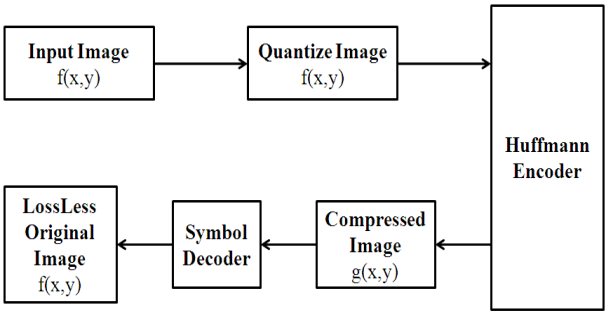

Fig. 3. Huffman code based image compression and decompression.

III. RESULTS

The testing was performed on lena.bmp and the result for the image is shown below in figure 4.

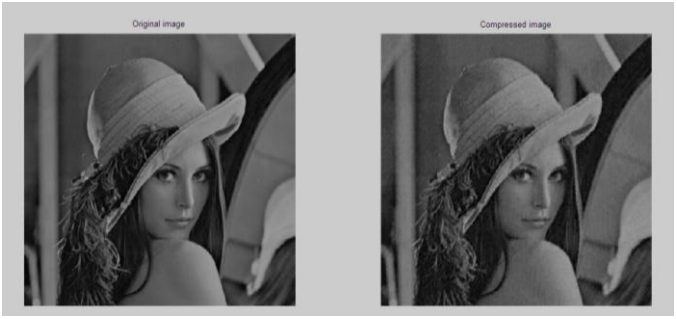

Fig. 4.Original image and compressed image.

IV. CONCLUSION

Image compression technique is used to reduce the size of any image for storing and transmission applications. This paper helps to understand the compression and decompression operations using Huffman coding technique and implements the same using MATLAB on a test image.

REFERENCES

[1] A. B. Watson, "Image compression using the DCT," *Mathematica Journal*, vol. 4, issue 1, pp. 81-88, 1994.

[2] R Singh and J. Singh, "Edge preserving compression technique using feed forward neural network," *International Journal of Computer Science and Technology (IJCST)*, vol. 2, issue 1, pp. 136-137, 2011.

Ajeet Kaur, Randhir Singh, and Bhanu Gupta, "Image compression and decompression using huffman coding," *International Journal of Scientific and Technical Advancements*, Volume 1, Issue 4, pp. 35-36, 2015.