Compression of Image with Haar Wavelet and Neural Network A Review

Rajwinder Kaur
Department of Computer Science & Engineering
Sri Guru Granth Sahib World University, Fatehgarh Sahib

Sheenam Malhotra
Department of Computer Science & Engineering
Sri Guru Granth Sahib World University, Fatehgarh Sahib

Abstract- Image Compression is the need of today's world. The compressed image use the lesser space of memory and easy to transmit over the internet. There are so many techniques of image compression which are used to compress the image. The image quality is one of the serious issue when compress the image. Image compression is implemented using the Haar wavelet transformation and Neural Logic Network to compress the image. The PSNR and Compression Ratio are two factors which are used to obtain the quality of the compressed image. The higher the PSNR value higher the quality of an image.

Keywords- Image Compression, Haar Wavelets, Neural Networks

I. INTRODUCTION

The images play very important role in today's world. The image compression is used to save the storage space and network bandwidth which is the need of today's environment. The increasing growth of technology, images comes the serious issue of storing and transferring the image data. The uncompressed images require the more storage space and bandwidth which slow down the speed of processor.

1.1 Image Compression

In simple words image compression is to reduce the image size or to compress the image. The goal of image compression is to reduce the image file size without affecting the quality of an image. The compressed image used lesser space of hard disk and easy to transmit over internet without affecting the speed. The reduction in image size allows more images to be stored in memory.

1.2 Classification of Compression Techniques

There are two ways of considering the classification of compression technique- Lossless vs. Lossy compression: In lossless compression schemes, the reconstructed image, after compression, is same to the original image. In lossy schemes, the reconstructed image, after compression is not same as the original image. It provide higher compression ratio.

II. RELATED WORK

A lot of works were found in literature related to the wavelet based image compression technique using the neural network technique. This section of the paper discusses some of the earlier work proposed on image compression using neural networks and Haar wavelet transform.

2.1 Wavelet

Wavelets are small "waves" and a wave is an oscillating function of time or space. Wavelets are localized waves with limited duration. Wavelets describe the original image into frequency domain and further describe into sub band images with different components and components are studied with a resolution matched to its scale. Wavelets are mathematical tools for hierarchically decomposing functions [3, 5 and 7]

2.2 Haar Wavelet

Haar wavelet computes a wavelet transform to represent image. It is the basic transformation from space to a local frequency domain. The idea of Haar transformation is to divide the signal into two components: one is called averages and other is differences. As a result it produces four sub band LL, HH, LH and HH. The low frequency sub band further subdivided into four sub band at the next coarser scale. The HL, LH and HH are high frequency at vertical, horizontal and diagonal directions [8].

2.3 *Neural Networks*

The neural network is the interconnected network of processing element. The processing element called the neurons and it is inspired from brain. A neural network can be viewed as comprising eight components which are neurons, activation state vector, signal function, pattern of connectivity, activity aggregation rule, activation rule, learning rule and environment [4] [5].

2.4 Artificial Neuron

The human brain is the complex structure highly interconnected network of processing elements called neurons. The behavior of a neuron shown by a simple model a in Figure 1. Here, x1, x2, x3 …xn are the n inputs to the artificial neuron, w1, w2, w3… wn are the weights attached to the input links. A neuron receives all inputs, sums them and produces an output if the sum is greater than a threshold value. The input signals are passed and which may accelerate or retard an arriving signal. It is this acceleration or retardation of the input signals that is modeled by the weights [3].

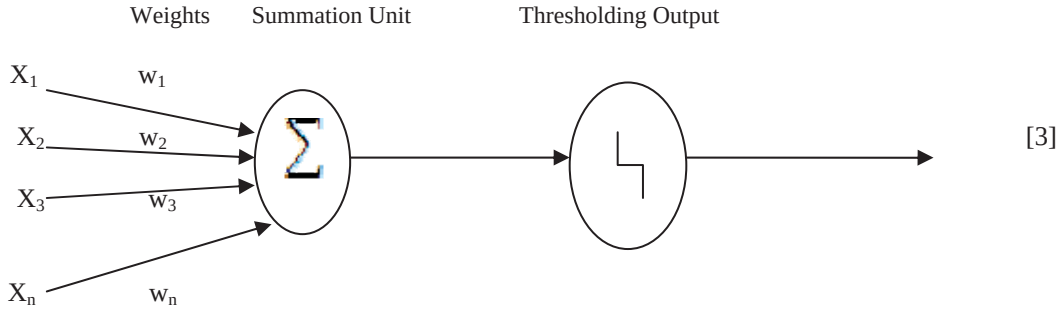

Figure 1 Simple model of an artificial neuron

Hence, the total input (**I**) received by the sums of the artificial neuron is:

$$I = w_1\, x1 + w2\, x2 + \ldots wn\, xn$$

$$I = \sum_{i=1}^{n} w_i\, x_i$$

III. PROPOSED NETHODOLOGY

The usual steps involved in compressing of image are:

Step 1- Select the image.

Step 2-Generate Compressed Image

Step 3- Calculate the Compression Ratio.

Step 4- Calculate the PSNR for original and output image.

Compression Ratio*:* The ratio of original (uncompressed) image to a compressed image is referred to as *Compression Ratio* C_R:

$$C_R = \text{Original image/Compressed image}$$

PSNR: PSNR is most commonly used to measure of quality of image. The signal in this case is the original data, and the noise is the error introduced by compression. PSNR is most easily defined via the mean squared error (*MSE*). Given a noise-free $m \times n$ monochrome image I and its noisy approximation K, *MSE* is defined as:

$$MSE = \frac{1}{m\,n} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i,j) - K(i,j)]^2$$

The PSNR is defined as:

$$\begin{aligned} PSNR &= 10 \cdot \log_{10} \left(\frac{MAX_I^2}{MSE} \right) \\ &= 20 \cdot \log_{10} \left(\frac{MAX_I}{\sqrt{MSE}} \right) \\ &= 20 \cdot \log_{10} (MAX_I) - 10 \cdot \log_{10} (MSE) \end{aligned}$$

Here, MAX_I is the maximum possible pixel value of the image. When the pixels are represented using 8 bits per sample, this is 255.

IV. CONCLUSION

In this paper, a neural network and Haar wavelet technique is used for image compression. From the analysis, it is found that they exhibit significant. The Haar wavelet is used to obtain the quality measurement of the compressed image. To evaluate the comparisons of performance of compression technique is difficult task unless same images and performance measures are used.

REFERENCES

[1] K. H. Talukder, and K. Harada , " Haar Wavelet Based Approach for Image Compression and Quality Assessment of Compressed Image" International Journal of Applied Mathematics, vol.36,pp.1-8, 2007.

[2] C. Ben Amar, and O. Jemai, "Wavelet Networks Approach for Image Compression," ICGST International Journal on Graphics, Vision and Image Processing, pp. 37-45, 2007.

[3] Khashman A. and Dimililer K, "Image Compression using Neural Networks and Haar Wavelet," WSEAS Trans Signal Processing vol.4, pp. 330-339, 2008.

[4] N.Senthilkumaran, and J.Suguna, "Neural Network Techniques for Lossless Image Compression using X-ray Images," International Journal of Computer and Electrical Engineering, vol.3, no.1, 2011.

[5] Abood Kuther, Aboud Hayder, and A.H. Falih, "X-ray image compression using neural network," ISSN 2229-5518,vol.3, Issue 10, 2012.

[6] Sindhu M and Rajkamal R, "Images and Its Compression Techniques," International Journal of Recent Trends in Engineering, vol.2, no. 4, 2009.

[7] Anuj Bhardwaj and Rashid Ali, "Image Compression Using Modified Fast Haar Wavelet Transform," ISSN 1818-4952, vol.7, no.5, 2009.

[8] Ajay K.S, Shamik Tiwari and V.P. Shukla, "Wavelet based Multi Class image classification using Neural Network," International Journal of Computer Applications, vol.37, no.4, 2012.

[9] Baluram Nagaria, Mhd. Farukh Hashmi and Pradeep Dhakad,"Comparative Analysis of Fast Transform for Image Compression for optimal Image Quality and Higher Compression Ratio," International Journal of Engineering Science and Technology (IJEST), vol.3, no.5, 2011.