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PERFORMANCE ANALYSIS OF IMAGE COMPRESSION USING DIFFERENT MODULATION WITH HAAR-WAVELET TRANSFORM

Anjali Nigam[1], Neha Namdev [2], Prof. A. C. Tiwari[3]
M. Tech. Scholar[1], Asst. Prof.[2], Prof. & HOD[3]
Department of Electronics and Communication Engineering
Lakshmi Narain College of Technology, Indore (M.P.) India
nigamanjali14@gmail.com

ABSTRACT

Image compression is now essential for applications such as transmission and storage in data bases. Image processing for wireless transmission is a challenging task, because of the amount of image data that need to be processed in real time, the restriction of transmission bandwidth, and other limited resources of the wireless network. Wireless face recognition is a particular interesting application of image processing for communications, where face recognition is implemented at the application layer, and a customized processing on face images helps correct or tolerate the transmission errors at the lower layers, namely the network layer, the MAC layer, and the physical layer.

In this paper we compression techniques and wireless transmission, some type of noise is also induced in compressed image. So we need improving image quality measured by such parameter. These are done by using de-noising filter such as Wiener filter and Median filter at receiving end. The accuracy of compression methods is measured by CR and PSNR, with QPSK and 8-PSK modulation on AWGN Channel. Performance of these systems is measured by BER plot with respect to SNR. The experimental result shows that the proposed scheme maintains the accuracy of compression, transmission and decompression of image.

Keyword: Haar-wavelet, Wiener filter, Median filter, Image compression, PSK, AWGN.

I. INTRODUCTION OF WAVELET

Discrete Wavelet Transform (DWT) is broadly considered as an efficient approach to replace FFT in the conventional OFDM systems due to its better time-frequency localization, bit error rate improvement, interference minimization, improvement in bandwidth efficiency and many more advantages. Moreover, Convolution codes are used in DWT based OFDM system which improves the bit error rate performance of the system. In communication systems, when the signal is transmitted over the channel, noise and unwanted interferences are introduced which leads to the distortion of transmitted signal. Hence, error control coding techniques are used to mitigate the effect of such channel distortions. Wavelet means a wavelet is a waveform of effectively limited duration that has an average value of zero shown in figure 3.2. Comparison of wavelets with sinusoids waves, which are the main basis of Fourier transforms. Sine wave extend from minus to plus infinity in place of limited duration. And where sine waves are smooth and predictable, wavelets transform to be irregular and symmetric.

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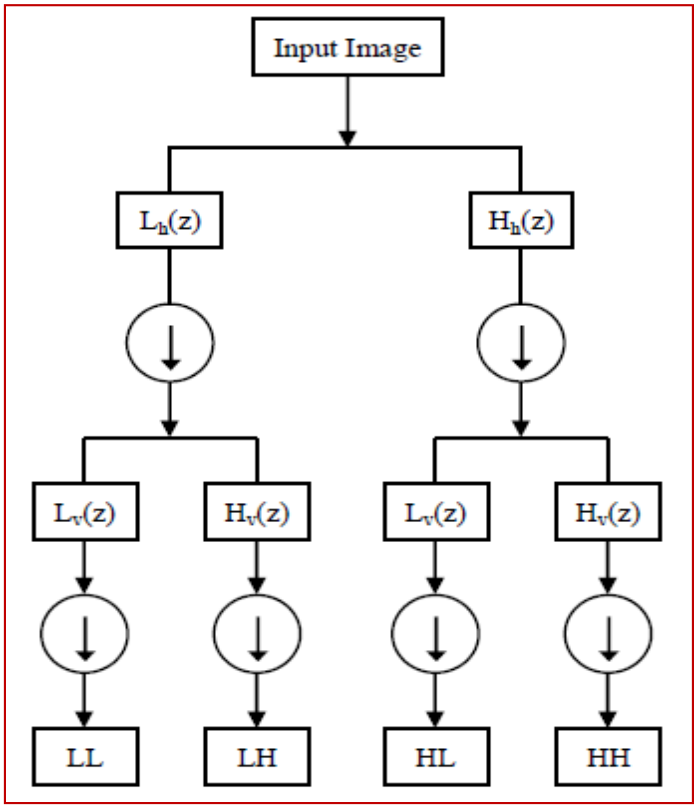

Fig. 1: Image bands LL, LH, HL and HH of the first scale

A. HAAR WAVELET

The Haar sequence was proposed in 1909 by Alfred Haar [3]. Haar used these functions to give an example of a countable other normal system for the space of square integral functions on the real line. The study of wavelets, and even the term "wavelet", did not come until much later. As a special case of the Daubechies wavelet, it is also known as D2. The Haar wavelet is also the simplest possible wavelet. The technical disadvantage of the Haar wavelet is that it is not continuous, and therefore not differentiable. This property can, however, be an advantage for the analysis of signals with sudden transitions, such as monitoring of tool failure in machines.

II. COMPRESSION RATIO (CR)

The ratio of the size of original data set to the size of the compressed data set, compression ratio is find out, defined in equation 1. Compression ratio is defined as the ratio between the original image size and compressed image size.

$$\text{Comprassion ratio} = \frac{X}{Y} \times 100 \qquad (1)$$

Where X = Number of Bytes in the original data set, Y = Number of Bytes in the Compressed data set. It is clearer by this example. Example: An image, 1024 pixel×1024 pixel×24 bit, without compression, would require 3 MB of storage. If after compression storage requirement is reduced to 300 KB, so by using formula we find the compression ratio as 10:1.

III. BIT-ERROR-RATE (BER)

When number of bits error occurs within one second in transmitted signal then we called Bit Error Rate (BER). In another sentence Bit Error rate is one type of parameter which used to access the system that can transmit digital signal from one end to other end. We can define BER as follows:

$$\text{BER} = \frac{\text{Error Nimber}}{\text{Total Number of bit sent}} \qquad (2)$$

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If transmitter and receiver's medium are good in a particular time and Signal-to-Noise Ratio is high, then Bit Error rate is very low. In our thesis simulation we generated random signal when noise occurs after that we got the value of Bit error rate.

IV. PEAK SIGNAL-TO-NOISE RATIO (PSNR)

The peak signal-to-noise ratio, often abbreviated PSNR, is an term used for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. So by the ratio of signal variance and reconstruction error variance, PSNR can be defined[14].It is also explained as the ratio between the maximum possible power of a signal and the power of corrupting noise. Because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibel scale. So it is most used as a measure of quality of reproduction of image compression etc. PSNR is easily defined which for two $m \times n$ monochrome images I and K where one of the images is considered noisy.
The PSNR is defined in equation 3 as:

$$\mathrm{PSNR} = 10.\log_{10}\frac{\mathrm{MAX_i^2}}{\mathrm{MSE}} = 20.\log_{10}\frac{\mathrm{MAX_i}}{\sqrt{\mathrm{MSE}}} \qquad (3)$$

V. RESULT

During our simulation we used Wavelet Transform (Haar and Daubechies) wavelet algorithms and different filters (Winar and Median) also used modulation in QPSK and 8-PSK techniques through MATLAB R2013a simulation toll used, with the help of above modulation techniques we got the analysis parameters like the SNR versus BER, with different communication channel (AWGN and multipath fading channel). The different methods were discussed to improve the compression ratio (CR), Bit error performance and result is obtained by their individual and combined performance such as CR and BER. The parameter involved in this thesis was PSNR, CR, MSE, BER and SNR. BER is applicable of radio data links as well as fiber optics data systems. It should be minimum for good communication system. Improved BER performance also improves quality of system in another word BER is reduced and SNR is increased.

A. AWGN CHANNEL ON QPSK AND 8-PSK MODULATION WITH HARR TRANSFORM

The simulation result presented in the thesis focuses mainly on Compression ratio and PSNR which typically affects the picture quality. In this performance we consider AWGN channel on different modulation techniques with Harr wavelet transform. Most of the times as researchers go on increasing the compression ratio the quality of the resulting image use to go down for the proposed technique, test image "Cameraman.tif" size 256 × 256.

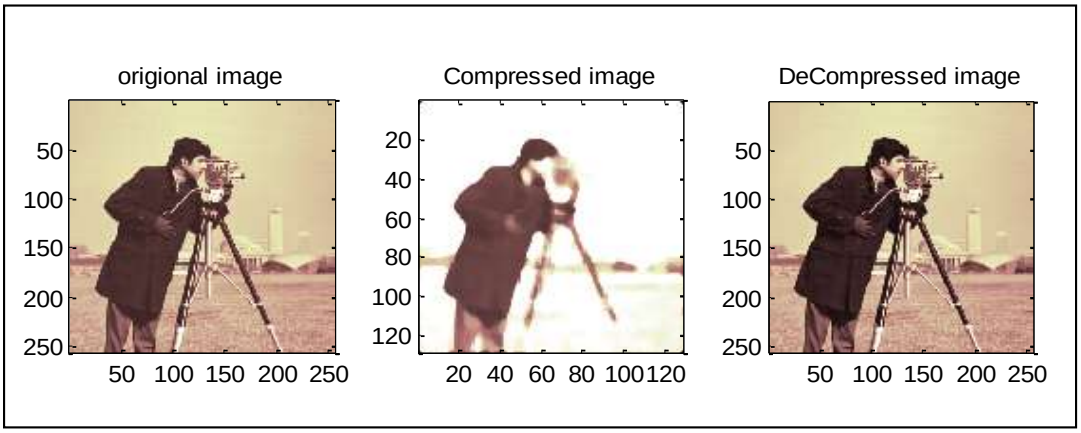

Fig. 2(a) Original image, (b) Compressed image and (c) De-compressed image

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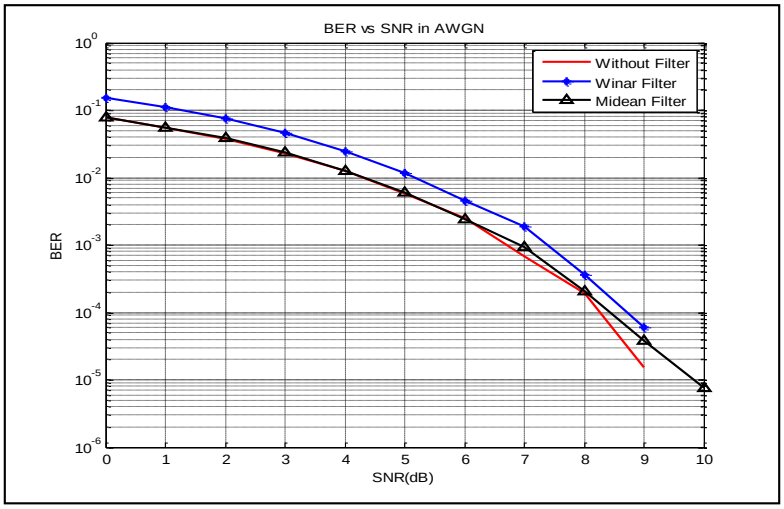

Fig 3: Performance of Harr Wavelet Transformer QPSK Modulation with AWGN Channel

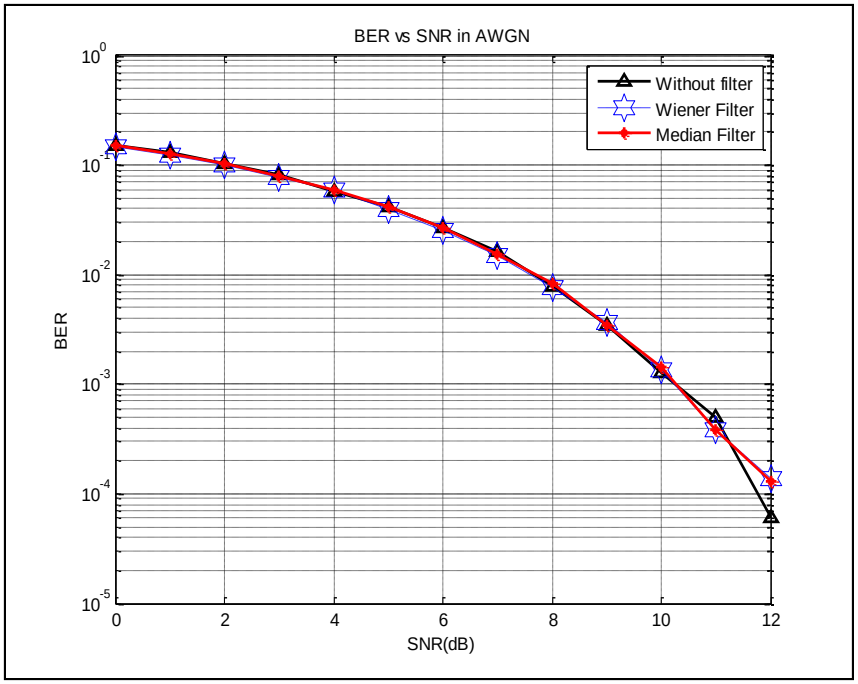

Fig 4: Performance of Harr Wavelet Transformer on 8-PSK Modulation with AWGN Channel

Table 1: Image Compression ratio with different filter

S. No.	Wavelet	Modulation	Channel	CR		
				Without filter	Wiener filter	Median filter
1	Haar	QPSK	AWGN	7.4237	6.2214	8.0736
2	Haar	8-PSK	AWGN	7.4237	6.2214	8.1746

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Table 2: PAPR Calculation ratio with different filter

S. No.	Channel model	PSK modulation order	Wavelet technique	PSNR		
				Without filter	Wiener filter	Median filter
1	AWGN	QPSK	Haar	16.5144	16.7301	17.1295
2	AWGN	8-PSK	Haar	16.1539	15.7582	15.5734

VI. CONCLUSION

We get results of different wavelet image compression techniques Haar wavelet are presented and compared their effect. We also compare the result of de-noising filter (Wiener filter and Median filter). Our focus on increase Compression Ratio (CR) and Pick to signal ratio (PSNR) and decrease BER also get simulated result of wireless channels model (AWGN channel and Flat fading channel) with QPSK and 8-PSK modulation techniques and compared their effect, focus on decrease Bit Error Rate (BER).We find that that if we increase SNR value, BER performance is improved. We have notice that wiener filter with Haar wavelet compression ratio 8.1746 and with PSNR is 15.5734 by using AWGN Channel of 8-PSK.

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