Contrast of Wavelets Order Behavior for Sine Signal

Roopali Goel, Javed Ahmed

Abstract— Degradation of signals by noise is a very common problem in today's world .As we know that noise is the main factor that affect the accuracy of results in the signals. It is due to the rapid growth of latest technologies .Noise is added by various factors like heavy machines, loud music, heavy vehicles and noisy engines .Noise is basically unwanted signals which cause disruption of original signals. There are various ways by which we can restore original signals from the distorted signals. Lots of research is conducted for the improvement of results .The best motivational factor to be consider is wavelet. Wavelet denoising attempts to remove the noise present in the signal while preserving the signal characteristics, regardless of its frequency content. . In this paper, the author compares the performances of Haar, Coiflet and BIORSPLINE Wavelets for different values of their order for a sine signal. The variation of correlation value with the wavelets order has been investigated.

Index Terms—About four key words or phrases in alphabetical order, separated by commas.

I. INTRODUCTION

In solving engineering problems the use of wavelets in signal and image processing has been found to be very useful tool. As we know that Wavelets are superior to STFT and Fourier Transform because they simultaneously process time and frequency. In Wavelet we could vary the scale of the basic functions instead of their frequency. The basic idea behind wavelets is to analyze according to scale, instead of representing a function as a sum of weighted delta functions (as in the time domain), or as a sum of weighted sinusoids (as in the frequency domain), it represents the function as a sum of time-shifted (translated) and scaled (dilated) representations of some arbitrary function, which is called a wavelet. There are many denoising methods which can be used with different Wavelets. Choosing the correct denoising method and Wavelets are the important consideration in improving the quality of sine signal. Also, wavelets can easily represent functions for discontinuities and sharp peaks and can work without using complex numbers.

II. STEPS FOR DENOISING

The general procedure for denoising requires basic three steps described below:

1. Decompose - Choose a wavelet, choose a level N. Compute the wavelet decomposition of the signal s at level N.
2. Thresholding: Threshold detail coefficients - For each level from 1 to N, select a threshold and apply soft or hard thresholding method to the detail coefficients.
3. Reconstruct - Compute wavelet reconstruction using the original approximation coefficients of level N and the modified detail coefficients of levels from 1 to N.

The number of vanishing points is an important criterion in choosing a Wavelet. If there are 'n' vanishing points, it means the Wavelet coefficients for nth order polynomial will be zero. This implies that any scale up to (n-1)th order can be drawn completely in scaling space. More vanishing points mean that the signal can be represented more accurately.

III. BLOCK DIAGRAM

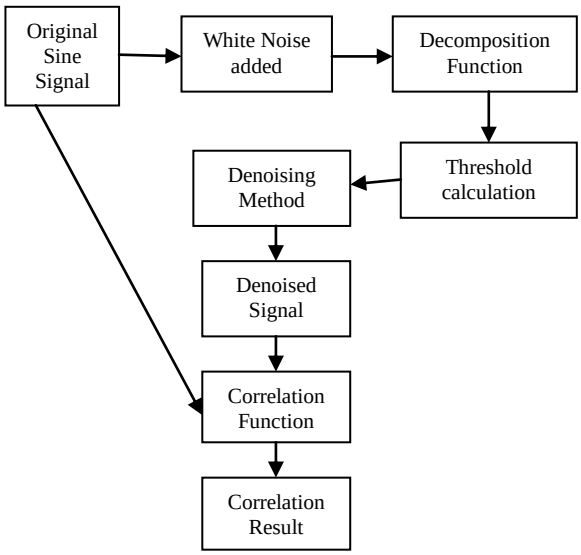

Figure 1:Block Diagram Representing Denoising Process

IV. RESULTS

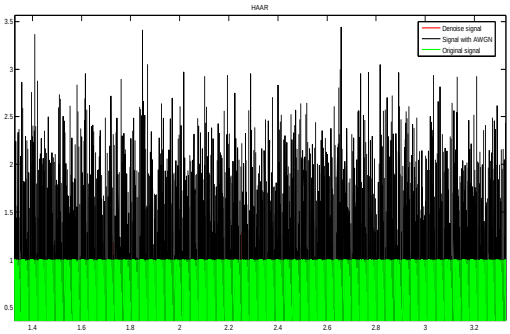

Figure 2:Haar wavelet sine signal

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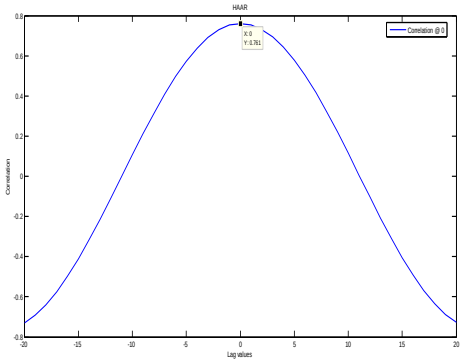

Figure 3:Haar Wavelet Sine Signal Correlation Graph

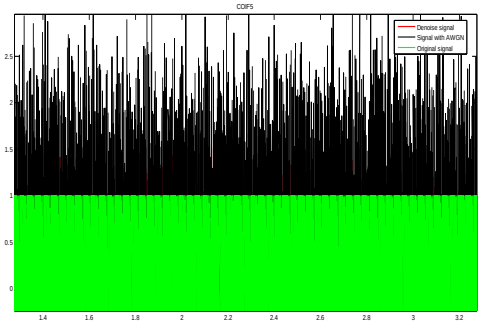

Figure 4: Coiflet5 Wavelet Sine Signal

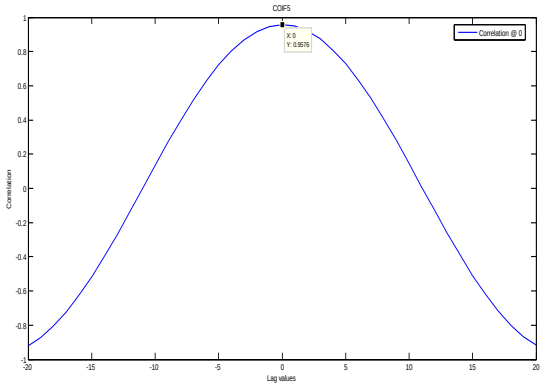

Figure 5: Coiflet5 Wavelet Sine Signal Correlation Graph

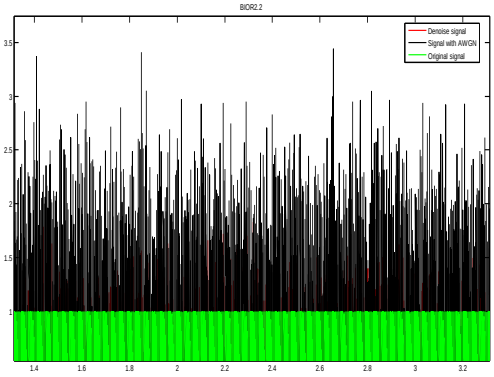

Figure 6:BIOR2.2 Wavelet Sine signal

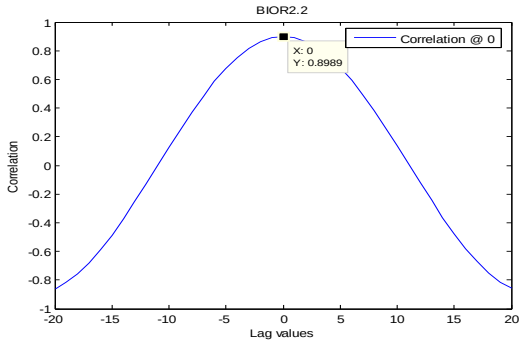

Figure 7:BIOR2.2 Wavelet Sine Signal Correlation Graph

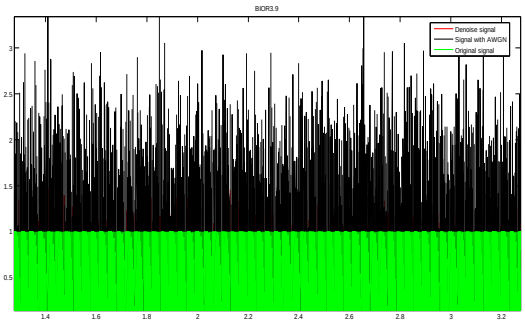

Figure 8: BIOR3.9 Wavelet Sine Signal

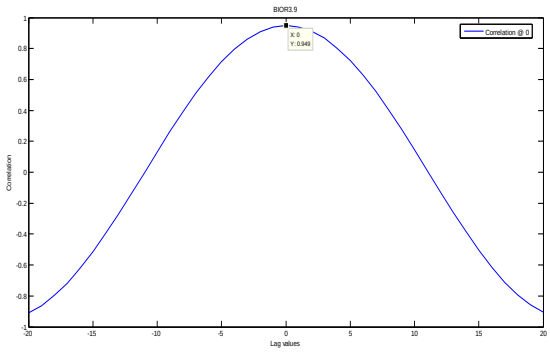

Figure 9:BIOR3.9 Wavelet Sine Signal Correlation Graph

V. COMPARISON TABLE FOR SINE SIGNAL

HAAR WAVELET	CORRELATION VALUE
HAAR	0.7612
COIFLET WAVELET	CORRELATION VALUE
COIF1	0.8523
COIF2	0.9135
COIF3	0.9368
COIF4	0.9501
COIF5	0.9576
BIORSPLINE WAVELET	CORRELATION VALUE
BIOR1.1	0.7602
BIOR1.3	0.7700
BIOR1.5	0.7729
BIOR2.2	0.8989

BIOR2.4	0.9101
BIOR2.6	0.9134
BIOR2.8	0.9157
BIOR3.1	0.7152
BIOR3.3	0.9143
BIOR3.5	0.9413
BIOR3.7	0.9469
BIOR3.9	0.9490
BIOR4.4	0.9279
BIOR5.5	0.9382
BIOR6.8	0.9463

VI. CONCLUSION

In the comparison of three family of wavelets viz. Haar, Bior, Coiflet for the correlation value it has been found that Coiflet wavelets are the best. The maximum value is found at coif5 followed by coif4.In the case of Bior wavelet maximum value is found at Bior 3.9 followed by Bior 3.7.In the terms of Coiflet wavelets a increasing trend in the correlation values has been observed as the order of Coiflet wavelets is increased. In the case of Bior wavelet such trend is observed from Bior1.1 to Bior 2.8, then from Bior 3.3 to Bior 3.9 and from Bior 4.4 to Bior 6.8.In general the value of correlation increases as the order of Coiflet and Bior wavelet is increased. Coiflet 5 and Bior 3.9 are the west wavelets for a sine signal. The performance of Haar wavelet is not comparable to Coiflet and Bior wavelet.

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