AUDIO NOISE REDUCTION USING WAVELET TYPES WITH THRESHOLDING TECNIQUES

*Manjeet Singh
GZS-PTU Campus, Bathinda
Manjeetg9@gmail.com

**Er.Naresh Kumar Garg
GZS-PTU Campus, Bathinda
naresh2834@rediffmail.com

Abstract:
The paper the speech enhancement is using DWT with thresholding and types of wavelet are used to denoised the audio signals and enhance speech and audio signal quality. Our main objective is to reduce noise from system which is heavily dependent on the specific context and application. As, we want to increase the intelligibility or improve the overall speech perception quality. After studying and analyzing, we have concluded that Noise reduction technology is aimed at reducing unwanted ambient sound, and is implemented with parameters such as SNR, PSNR, MSE and the Time to reduce the noise for noisy signals for removing noise. In the DWT Coif wavelet with soft threshold is best as compared to coif hard threshold, in DWT soft threshold results are has been best as compared to hard threshold.

Keywords: *MSE,SNR, PSNR, DWT denoisng, Coif.*

I. INTRODUCTION

Wavelet transform consists of a set of basis functions that can be used to analyze signals in both time and frequency domains simultaneously. This analysis is accomplished by the use of a scalable window to cover the time-frequency plane, providing a convenient means for the analyzing of non-stationary signal that is often found in most application [8]. Wavelet analysis adopts a wavelet prototype function known as the mother wavelet given as:

$$\psi(\tau, s) = \frac{1}{\sqrt{s}}\psi\left(\frac{t-\tau}{s}\right)$$

This mother wavelet in turns generates a set of basis functions known as child wavelets through recursive scaling and translation.

Where, s reflects the scale or width of a basis function, τ is the translation that specifies its translated position on the time axis,

$\psi\left(\frac{t-\tau}{s}\right)$ is the mother wavelet, $\frac{1}{\sqrt{s}}$ is the normalized factor used to ensure energy across different scale remains the same[10].

II. APPLİCATİONS OF WAVELET TRANSFORM

The standard applications of wavelet transform are:

1) Signal Processing
2) Data Compression
3) Computer Graphics
4) Denoising

III. WHY WE USE WAVELET TRANSFORM

The advantages of wavelet transform are as follows:

1) Space and Time Efficiency.
- Low Complexity of DWT.

2) Multiresolution Properties.
- Hierarchical Representation and Manipulation.

➢ Generality and Adaptability.

➢ Different Basis and Wavelet Functions.

IV. DWT ALGORİTHM FOR SİGNAL ENHANCEMENT

© 2014 Vidya Publications. Authors are responsible for any plagiarism issues.

Step 1: Load an original wave signal.

Step 2: Noise is added to the original wave signal read in above step using the Gaussian noise and produces the noisy wave signal.

Step 3: The Gaussian original wave signal on which logarithmic transform is performed firstly.

$$\text{Log } J(x, y) = \log I(x, y) + \log \eta(x, y)$$

Step 4: A multilevel decomposition is performed on the log transformed signal using wavelet transform.

Step 5: Apply the wavelet types.

Step 6: Apply thresholding to the noisy coefficients using bayes shrinkage method.

Step 7: After the decomposed signal coefficients are thresholded using the thresholding technique, denoised image is reconstructed as IR(x,y) using inverse wavelet transforms-IDWT.

Now apply the filter based on statistics estimated from a local neighborhood around each pixel. Filter reconstructed image IR(x,y) according to following formula:

$$I(x,y) = \mu + \frac{(\sigma^2 - v^2)(I_g(x,y) - \mu)}{\sigma^2}$$

Where, μ is the local mean, σ2 the variance in 3x3 neighborhoods around each pixel and v2 is the average of all estimated variances of each pixel in the neighborhood.

Step 8: Take exponent of the signal obtained in above step and obtained the denoised signal.

Step 9: Now we get the denoised signal and different parameters.

V. RESULTS

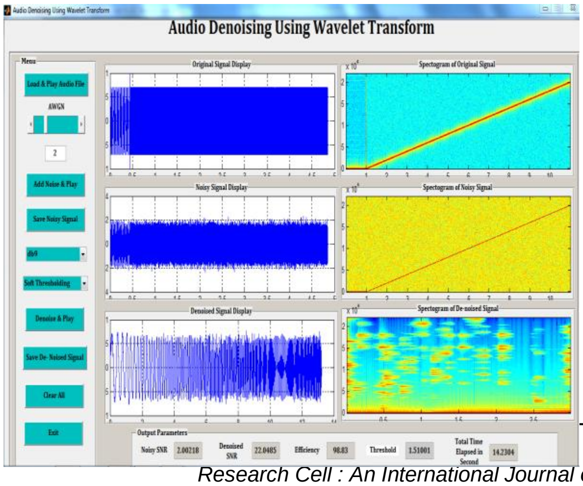

Figure: DWT GUI starting window

Using Coif5 wavelet type with Soft Thresholding

Name of Signal	Nosiy SNR value	Denoised SNR value	Total Time Elapsed value(in sec.)
1N.wav	1.00144	12.1227	31.354
2N.wav	1.01068	21.2134	8.87863
3N.wav	0.985718	19.4941	8.86212

Using Coif5 wavelet type with Hard Thresholding

Name of Signal	Nosiy SNR value	Denoised SNR value	Total Time Elapsed value(in sec.)
1N.wav	2.00151	3.5589	79.0825
2N.wav	1.96955	4.9958	31.4523
3N.wav	1.97672	20.943	21.1168

Using sym4 wavelet type with soft Thresholding

Name of Signal	Nosiy SNR value	Denoised SNR value	Total Time Elapsed value(in sec.)
1N.wav	2.03813	7.88699	18.1931
2N.wav	1.95963	6.55297	9.95348
3N.wav	1.99192	8.75724	18.282

Using sym4 wavelet type with Hard Thresholding

Name of Signal	Nosiy SNR value	Denoised SNR value	Total Time Elapsed value(in sec.)
1N.wav	2.00151	11.2783	32.7486
2N.wav	1.96955	9.24276	8.0365
3N.wav	1.97672	9.03269	8.02389

© 2014 Vidya Publications. Authors are responsible for any plagiarism issues.

VI. CONCLUSION & FUTURE WORK

In the DWT Coif wavlet with hard threshold and soft threshold and Sym4 hard and soft threshold is implemented and compared with each others. In this Coif wavelet with soft threshold is best as compared to coif hard threshold and Sym4 wavelet with hard and soft threshold.In DWT soft threshold results are has been best as compared to hard threshold.

Future work might involve a real time implementation of the system so that the maximum noise is reduced form the audio signals and videos. In the future anybody can extent the order of the different filters and works on higher amplitude signals. They can calculate the efficiency of the filters that they have to implement. In the DWT we are using coif and sym4 with hard and soft threshold but in the future different types of wavelet is implemented with different types of thresholding techniques or hybrid techniques is designed with the help of filters and wavelets and thresholding techniques. Other things in future the results may be improved in the filters and DWT techniques.

REFERENCES

[1] Roshahliza M. Ramli, Ali O. Abid Noor, and Salina Abdul Samad *"A Review of Adaptive Line Enhancers for Noise Cancellation"* Australian Journal of Basic and Applied Sciences, 6(6): 337-352, 2012 ISSN 1991-8178.

[2] Eric Martin,*" Audio denoising algorithm with block thresholding*" Published in Image Processing On Line on YYYY {MM {DD.ISSN 2105-1232.

[3] B. JaiShankar1 and K. Duraiswamy "audio denoising using wavelet transform" International Journal of Advances in Engineering & Technology, Jan 2012. ISSN: 2231-1963

[4] C Mohan Rao1, Dr. B Stephen Charles "*A Variation of LMS Algorithm for Noise Cancellation"* International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 7, July 2013 ISSN (Print) : 2319-5940 .

[5] B. Jai Shankar, K.Duraiswamy "signal denoiser using wavelets and block matching process "Asian Journal of Computer Science and Information Technology2: 1 (2012) 1 – 3..

[6] J. Jebastine , Dr. B. Sheela Rani "design and implementation of noise free Audio speech signal using fast block least Mean square algorithm" Signal & Image Processing : An International Journal (SIPIJ) Vol.3, No.3, June 2012.

[7] Guoshen Yu, Stéphane Mallat "Audio Denoising by Time-Frequency Block Thresholding "IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 56, NO. 5, MAY 2008.

[8] Raghavendra Sharma, Vuppuluri Prem Pyara" A Robust Denoising Algorithm for Sounds of Musical Instruments Using Wavelet Packet Transform "*Circuits and Systems*, 2013, 4, 459-465 Published Online November 2013.

[9] Matheel E. Abdulmunim, Rabab F. Abass " Novel Video Denoising Using 3-D Transformation Techniques "International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-5, June 2013 .

[10] K.P. OBULESU1 P. UDAY kumar "implementation of time frequency block thresholding algorithm in audio noise reduction "ISSN: 2278 – 7798 International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 7, July 2013 .

[11] S. N. Sampat1*, Dr. C. H. Vithalani" Customized Neighborhood Threshold Speech Denoising Using Wavelet Transform Based On Filter Bank Method "international journal of darshan institute on engineering research & emerging technologies vol. 2, no. 1, 2013 .

[12] Rajeev Aggarwal" Noise Reduction of Speech Signal using Wavelet Transform with Modified Universal Threshold "International Journal of Computer Applications (0975 – 8887) Volume 20– No.5, April 2011.

***© 2014 Vidya Publications.* Authors are responsible for any plagiarism issues.**

***© 2014 Vidya Publications.* Authors are responsible for any plagiarism issues.**