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Analysis of Speech Signal Compression at various levels and wavelets using DWT

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Abstract

As the multimedia technology progresses, so does the need of speech compression for efficient and cheaper transmission. Discrete Wavelet Transform technique aims at providing effective compression in this field. This paper focuses on the analysis of compression ratios for various wavelets at different levels for a speech sample. In our observation, we determined the best results for the symlet2 wavelet type in terms of the compression ratio and overall audio quality.
This analysis was performed on MATLAB 7.1 R2009 on an Intel i-5 processor based system.

Keywords: DWT, Speech Compression, Compression Ratio, Wavelet

Introduction

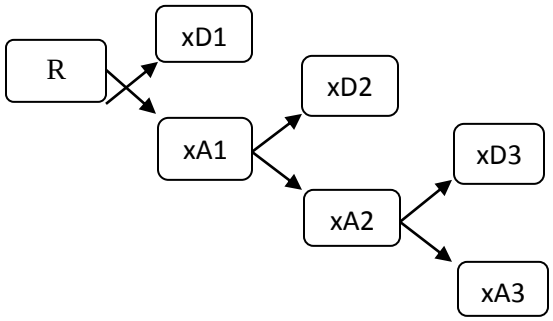
Audio Compression is a method to represent the audio signal in lesser number of bits. This can be achieved by either old ways of using DCT and DFT, or by using the advanced, effective and efficient technique of Discrete Wavelet Transform. DWT is based on sub band coding and is observed to yield faster computation. DWT has an advantage over traditional DCT and DFT in terms of adjustable window size and ability to extract coefficients at the frequency of interest.

Speech

Speech is a very basic way for humans to convey information to one another. With a bandwidth of only 4kHz, speech can convey information with the emotion of a human voice.[1,5,6] People want to be able to hear someone's voice from anywhere in the world-as if the person would be in the same room. Speech can be defined such as the response of the vocal tract to one or more excitation signals.[4]

Discrete Wavelet Transform

DWT is a wavelet transform in which the discretely sampled wavelets decompose the signal into mutually orthogonal set of wavelets. In DWT, the energy is concentrated in time for a small wave providing a tool for analysis of non stationary, transient or time varying phenomenon[2,5].
DWT has a basic concept of signal being divided into low frequency and high frequency components. While the low frequency components store the major information of the signal known as Approximations, the high frequency component imparts the quality to the signal and are known as Details. The original signal is filtered through two complimentary filters and emerges as two signals.[3,6] Concept of down sampling is introduced to avoid doubling of data.



Compression Ratio

Compression Ratio is the ratio of the number of bits in the original signal to the number of bits in the compressed signal[7]

$$CR = \left(\frac{\text{No. of bits in the original signal}}{\text{No. of bits in the compressed signal}} \right)$$

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Results and discussion

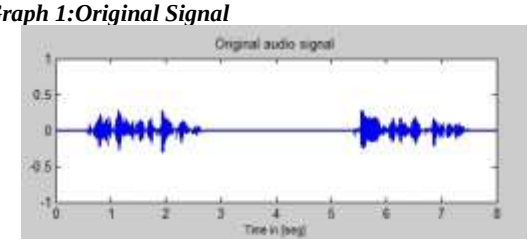
Tables:

Table: Compression Ratios at various levels for different wavelets.

Wavelet	Level 3	Level 4	Level 5
Haar	7.5169	14.4355	28.0313
Coif2	7.7007	14.4054	25.6190
Coif5	7.2484	12.5055	19.4500
Sym2	7.9154	15.6212	30.3824
Sym5	7.7630	14.6806	26.6250

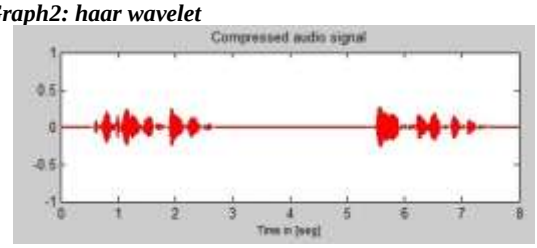
Graphs:

Graph 1:Original Signal

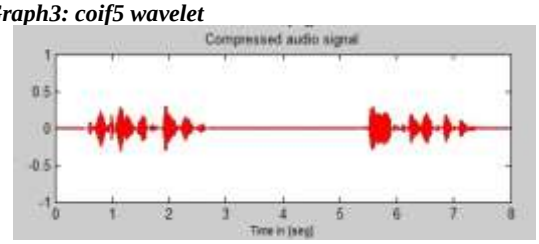


Compressed Signal for Level 3

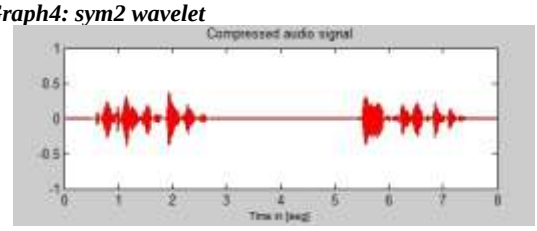
Graph2: haar wavelet



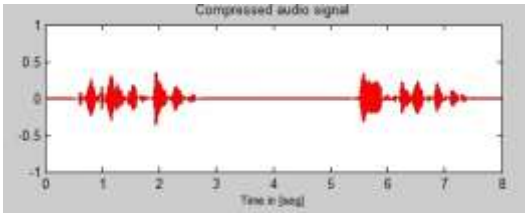
Graph3: coif5 wavelet



Graph4: sym2 wavelet

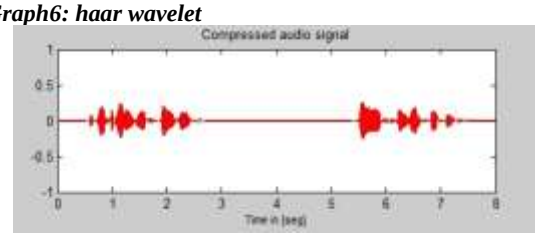


Graph5: sym5 wavelet

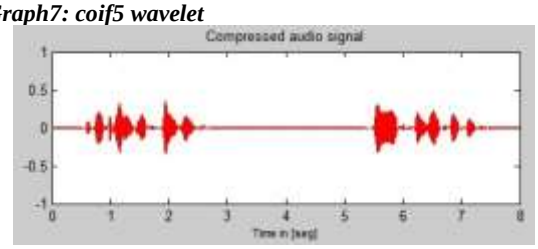


Compressed Signal for Level 4

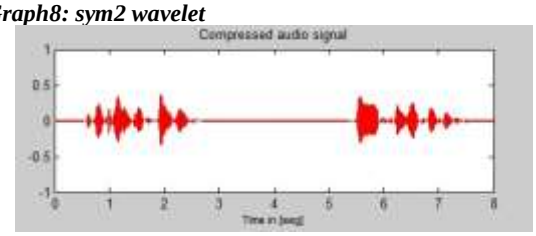
Graph6: haar wavelet



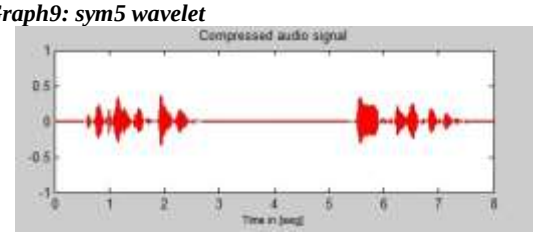
Graph7: coif5 wavelet



Graph8: sym2 wavelet

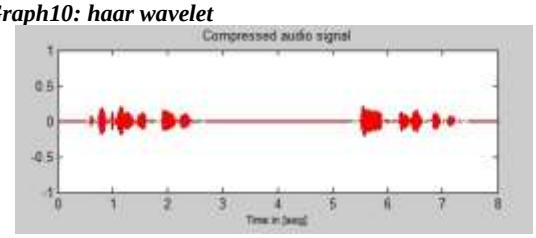


Graph9: sym5 wavelet



Compressed Signal for Level 5

Graph10: haar wavelet



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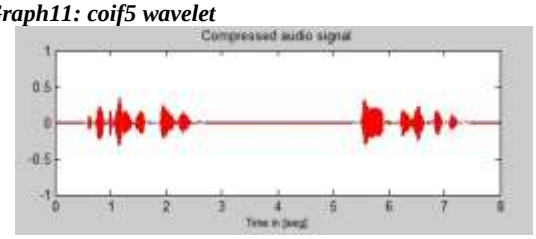
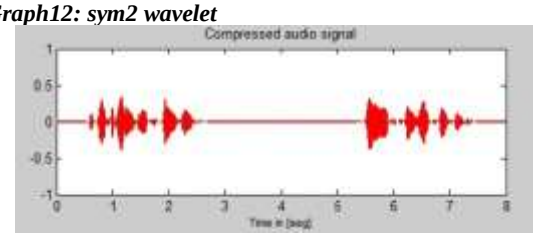
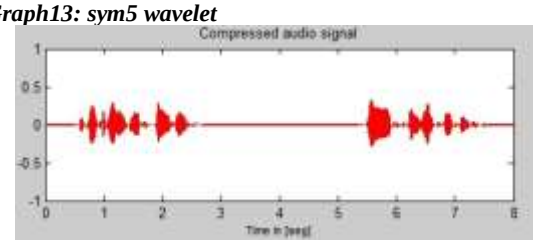
Graph11: coif5 wavelet



Graph12: sym2 wavelet



Graph13: sym5 wavelet



Conclusion

In our analysis, we compared different wavelet types for level 3, 4 and 5 for a male speech sample. The sample was of the duration of 7 seconds. We observed the best compression ratio for Symlet 2 wavelet type at level 5 for speech sample. The sound quality was considerably good and the distortion was minimum.It wa observed that with increase in levels, the compression ratio increased significantly.

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References

1. Chakresh Kumar: *Implementation of Audio signal by using wavelet transform,* IJEST, ISSN:4792-4977, Vol 2(10), 2010
2. Victor Giurgiutiu, Lingyu Yu: *Comparison of Short-time Fourier Transform and Wavelet Transform of Transient and Tone Burst Wave Propagation Signals For Structural Health Monitoring*
3. Prof. Dr. Ir. M. Steinbuch, Dr. Ir. M.J.G. van de Molengraft: *Wavelet Theory and Applications, A literature study*
4. Z. Dan and M. S. Qian, *"Speech compression with best wavelet package transform and SPIHT algorithm,"* 2nd International conference on computer modeling and simulation, PP. 360-363, 2010.
5. Nitin Trivedi, Sachin Ahuja, Dr. Vikesh Kumar, Raman Chadha, Saurabh Singh. *Speech Recognition by Wavelet analysis*. IJCA: Volume 15– No.8, February 2011.
6. S. M. Subhra Debdas, Vaishali Jagrit, Chinmay Chandrashekhar, M.F.Qureshi. *Application of Wavelet Transform for Speech processing* .IJEST: Vol. 3 No. 8 August 2011, ISSN: 0975-5462.
7. Samar Krimi, Kaïs Ouni, Noureddine Ellouze: *An Improved Psychoacoustic Model for Audio Coding based on Wavelet Packet*