iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** I **Month of publication:** January 2017

DOI:

www.ijraset.com
IC Value: 13.98
Volume 5 Issue I, January 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Denoising Of Speech Signals Using Wavelets

Prashant Arora[1], Kulwinder Singh[2]
[1,2]Bhai Maha Singh College of Engineering, Sri Muktsar Sahib

Abstract: In this paper, we introduced two wavelet i.e. daubechies and symlet techniques for denoising purpose based upon rigrsure, heursure, minimaxi and sqtwolog threshold rules for speech signals.
Keywords: DWT (Discrete wavelet transform), SWT (Stationary wavelet transform), MSE (Mean square error).

I. INTRODUCTION

Present communication system becomes vast due to the advancements in technology. During transmission and processing, these signals are corrupted by noise. Therefore it has been necessary to remove the unwanted noise from the speech signal. Linear methods and non linear methods are used to denoise the signal. In linear method, Fourier transform is used to denoise signal, as compared to non linear method in which wavelet transform is used to denoising signal because of their ability of multi resolution capability [1]. In transmission communication, the signal is corrupted by noise. Therefore it is necessary to remove the unwanted noise from signal. Various denoising techniques are used to remove noise from the signal. DWT and SWT are analyzed with the help of threshold selection rule to denoise signal [2]. Analysis of speech signal is done with wavelet thresholding technique and compared the results with Fourier transform in terms of SNR, MSE, spectrogram and PRD. Results showed that the advanced thresholding method is better for denoising the speech signal as compared to conventional methods [3]. The DWT is computed by passing a signal through a high-pass and a low pass filter. For each decomposition level, the high-pass filter produces the approximations coefficients and the complementary low-pass filter produces the details coefficients. After decomposition, the signal can be reconstructed back using Inverse Wavelet Transform [4]. A universal thresholding rule is developed which can effectively remove the Gaussian random noise. In denoising signal, thresholding selection is important [5]. Minmax and universal thresholding schemes are discussed for both hard and soft thresholds. Universal threshold selection rule gives fix value [6]. Squtlog thresholding technique is used to denoise the speech signal for soft thresholding along with different levels of decomposition. The quality of speech signal is expressed in terms of peak signal to noise ratio [7]. The variance of noise signal changes due to time so threshold should be different for these different time intervals. Interval thresholding selection rule is used for denoising signal with SWT and compared the results with DWT [8]. Hard thresholding can be described as the process of setting to zero the elements whose absolute values are lower than the threshold [9]. Soft thresholding is called shrink or kill which is an extension of hard thresholding. It is based on first setting the elements with the absolute values lower than the threshold to zero, and then shrinking the other coefficients with different threshold selection rules [10]. When the wavelet transformation of the noisy signal has been performed the resultant coefficients not only contains the coefficients of original signal but also contain the wavelet coefficients of noise [10]. Therefore it is necessary to remove these small coefficients which are responsible for the noise in the signal. Denoising algorithm is proposed for speech signal with wavelet transform in which the implementation of two wavelets i.e. haar and daudechies is evaluated [11].

II. DENOISING

We upload Speech signal having SNR 5db .Denoising of speech signal is done with different thresholding rules after adding white gaussion noise in signal. SNR of reconstructed speech signal is also calculated.

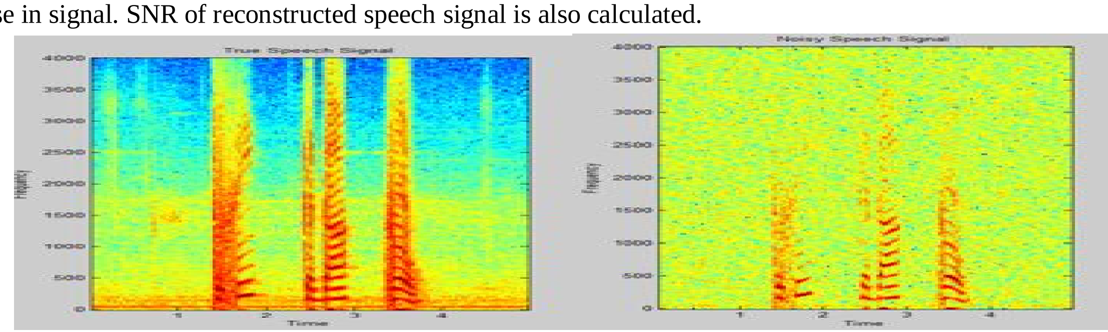


Fig: 1(a) Fig: 1(b)

Fig. 1(a): Input as true speech signal; and 1(b): Speech signal after adding noise

Volume 5 Issue I, January 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Fig 1(a) shows the input which is true speech signal of amplitude 20db. For denoising we added white Gaussian noise in signal that is shown in fig 1(b).

III. RESULTS AND DISCUSSIONS

Spectrograms of denoised speech signals are shown for two different wavelets i.e. Db13 wavelet and Sym13 wavelet by applying for different threshold rules for both soft and hard threshold.

A. Heusure

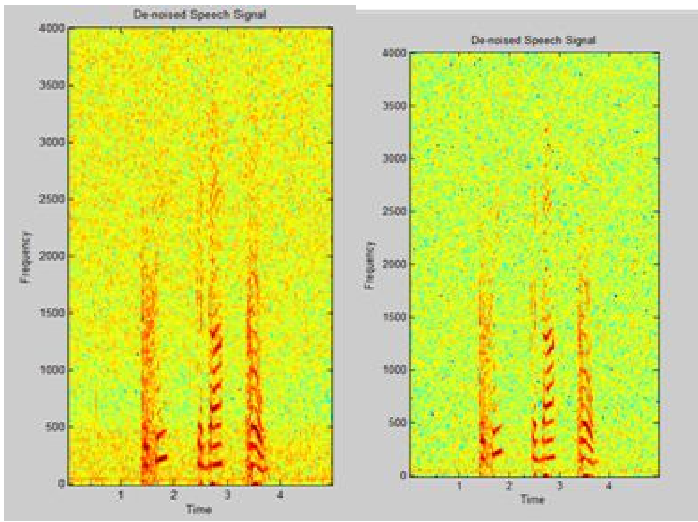


Fig: 2(a) Fig: 2(b)

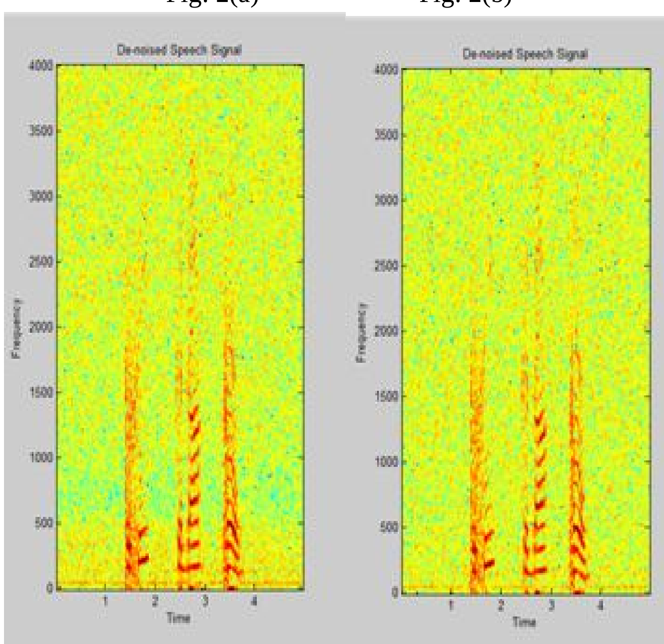


Fig: 2(c) Fig: 2(d)

Fig. 2 (a): Denoised speech signal Spectrogram of Db13 (Soft) wavelet.
Fig 2(b): Denoised speech signal Spectrogram of db13 (hard) wavelet to determine the quality of voice signal.
Fig 2(c): Denoised speech signal Spectrogram of Sym (13) wavelet (Soft).
Fig 2(d): Denoised signal Spectrogram of Sym (13) wavelet (Hard).

In this section Heusure threshold selection rule is used for selecting threshold limit of the signal by applying both soft and hard threshold for further calculating the value of SNR for Db13 (a, b) and Sym (13) (c, d).

Volume 5 Issue I, January 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

B. Rigrsure

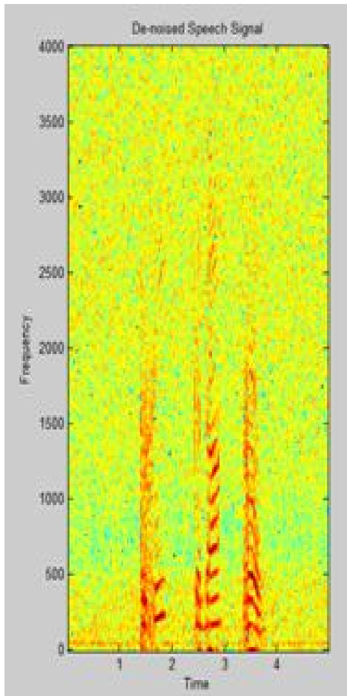


Fig: 3(a)

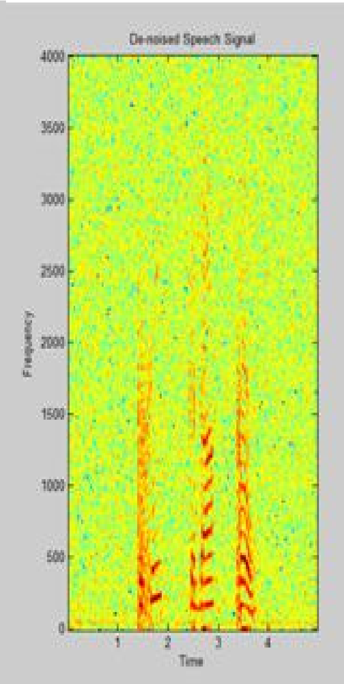


Fig: 3(b)

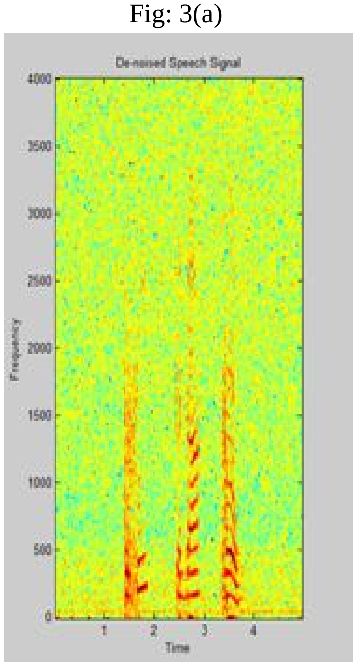


Fig: 3(c)

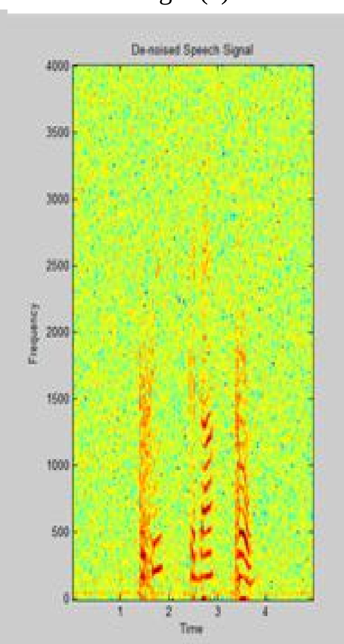


Fig: 3(d)

Fig 3(a): Denoised speech signal Spectrogram of Db (13) wavelet (Soft).
Fig 3(b): Denoised signal Spectrogram of Db (13) wavelet (Hard).
Fig 3(c): Denoised speech signal Spectrogram of Sym (13) wavelet (Soft).
Fig 3(d): Denoised signal Spectrogram of Sym (13) wavelet (Hard).

In this section Rigrsure threshold selection rule is used for selecting threshold limit of the signal by applying both soft and hard threshold for further calculating the value of SNR for Db13 (a, b) and Sym (13) (c, d).

Volume 5 Issue I, January 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

C. Minimaxi

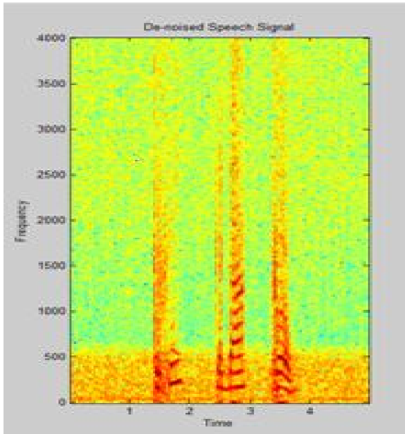


Fig: 4(a)

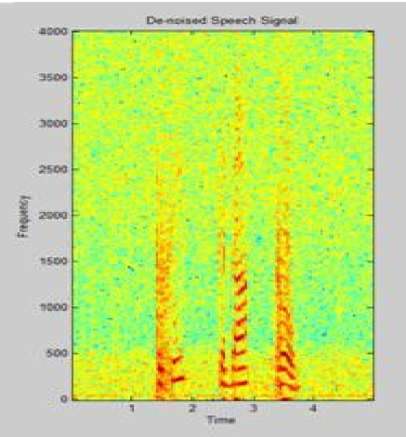


Fig: 4(b)

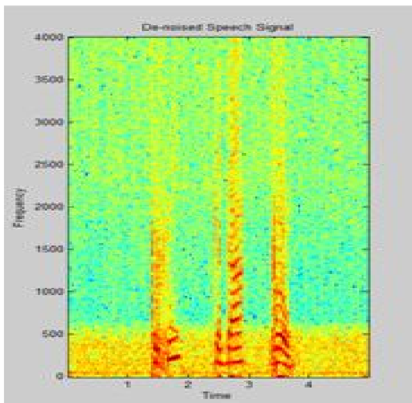


Fig: 4(c)

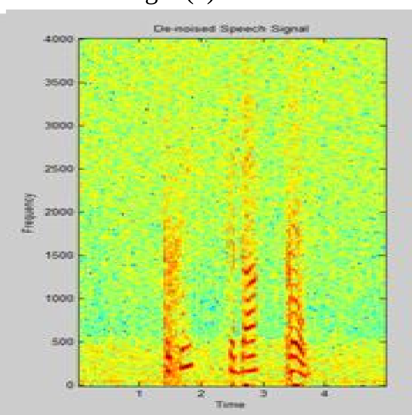


Fig: 4(d)

Fig 4(a): Denoised speech signal Spectrogram of Db (13) wavelet (Soft).
Fig 4(b): Denoised signal Spectrogram of Db (13) wavelet (Hard).
Fig 4(c): Denoised speech signal Spectrogram of Sym (13) wavelet (Soft).
Fig 4(d): Denoised signal Spectrogram of Sym (13) wavelet (Hard).

In this section Minimaxi threshold selection rule is used for selecting threshold limit of the signal by applying both soft and hard threshold for further calculating the value of SNR for Db13 (a, b) and Sym (13) (c, d).

D. Sqtwolog

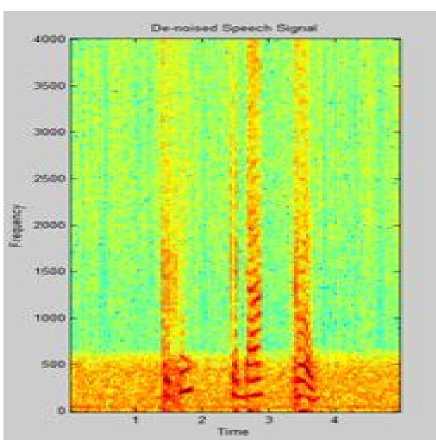


Fig: 5(a)

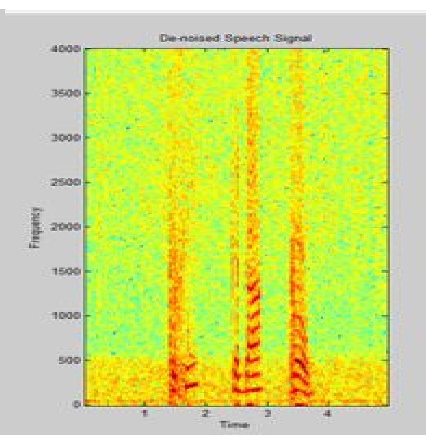


Fig: 5(b)

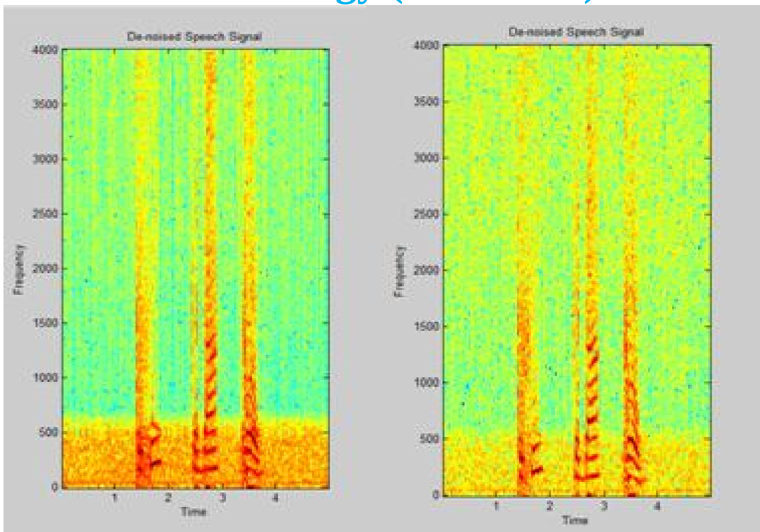


Fig: 5(c) Fig: 5(d)

Fig 5(a): Denoised speech signal Spectrogram of Db (13) wavelet (Soft)
Fig 5(b): Denoised signal Spectrogram of Db (13) wavelet (Hard).
Fig 5(c): Denoised speech signal Spectrogram of Sym (13) wavelet (Soft)
Fig 5(d): Denoised signal Spectrogram of Sym (13) wavelet (Hard).

In this section Squtlog threshold selection rule is used for selecting threshold limit of the signal by applying both soft and hard threshold for further calculating the value of SNR for Db13 (a, b) and Sym (13) (c, d).

Table 1: SNR of denoising speech signal

Type of wavelet		Heursure SNR(db)	Rigrsure SNR(db)	Minimax SNR(db)	Squtlog SNR(db)
db13	SOFT	6.3721	6.1979	8.7477	7.7724
	HARD	5.0430	5.0049	6.8557	7.9546
sym13	SOFT	6.1998	6.1647	8.7201	7.6876
	HARD	5.0348	5.0383	6.8159	8.0116

All the results observed in figure number 2, 3, 4 & 5 are summarized in table 1. Table shows the SNR value of denoising speech signal with two wavelets involving different thresholding rules for both soft and hard thresholding. It is observed that for both (db13 & sym13) types of wavelets techniques soft thresholding gives much better results as compared to hard thresholding technique. Also from comparison of four thresholding rules, Minimaxi thresholding rule achieved the best SNR values.

IV. CONCLUSION

We have concluded from the denoising technique that soft thresholding gives appropriate mathematical values as compare to hard thresholding. Minimaxi (soft) removes better noise as the SNR value is high as compared to other thresholding rules.

REFERENCES

[1] S. Mallat, “A wavelet tour of signal processing” Third Edition, Academic Press, San Diego, USA, 2009.
[2] R. Kumar and P. Patel, “Signal denoising with interval dependent thresholding using DWT and SWT”, International journal of Innovative Technology and Exploring Engineering, Vol. 1, pp. 47-50, 2012.
[3] P. Arora and M. Bansal, “Comparative Analysis of Advanced Thresholding Methods for Speech-Signal Denoising”, International Journal of Computer Analysis, Vol. 59, No. 16, pp. 28-32, December 2012.
[4] I. Daubechies, “Ten Lectures on Wavelets”, CBMS-NSF Regional Conference Series in Applied Mathematics, Philadelphia, 1992.
[5] D. L. Donoho, I. M. Johnstone, “Ideal spatial adaptive via wavelet shrinkage”, Biometrika, Vol. 81, No. 3, pp. 425-455, 1994.
[6] M Ayat, M. B. Shamsollahi, B. Mozaffari, and S. Kharabian, “ECG denoising using modulus maxima of wavelet transform”, Annual Conference on Engineering Medical and Biology Society, IEEE, pp.416-419, 2009.

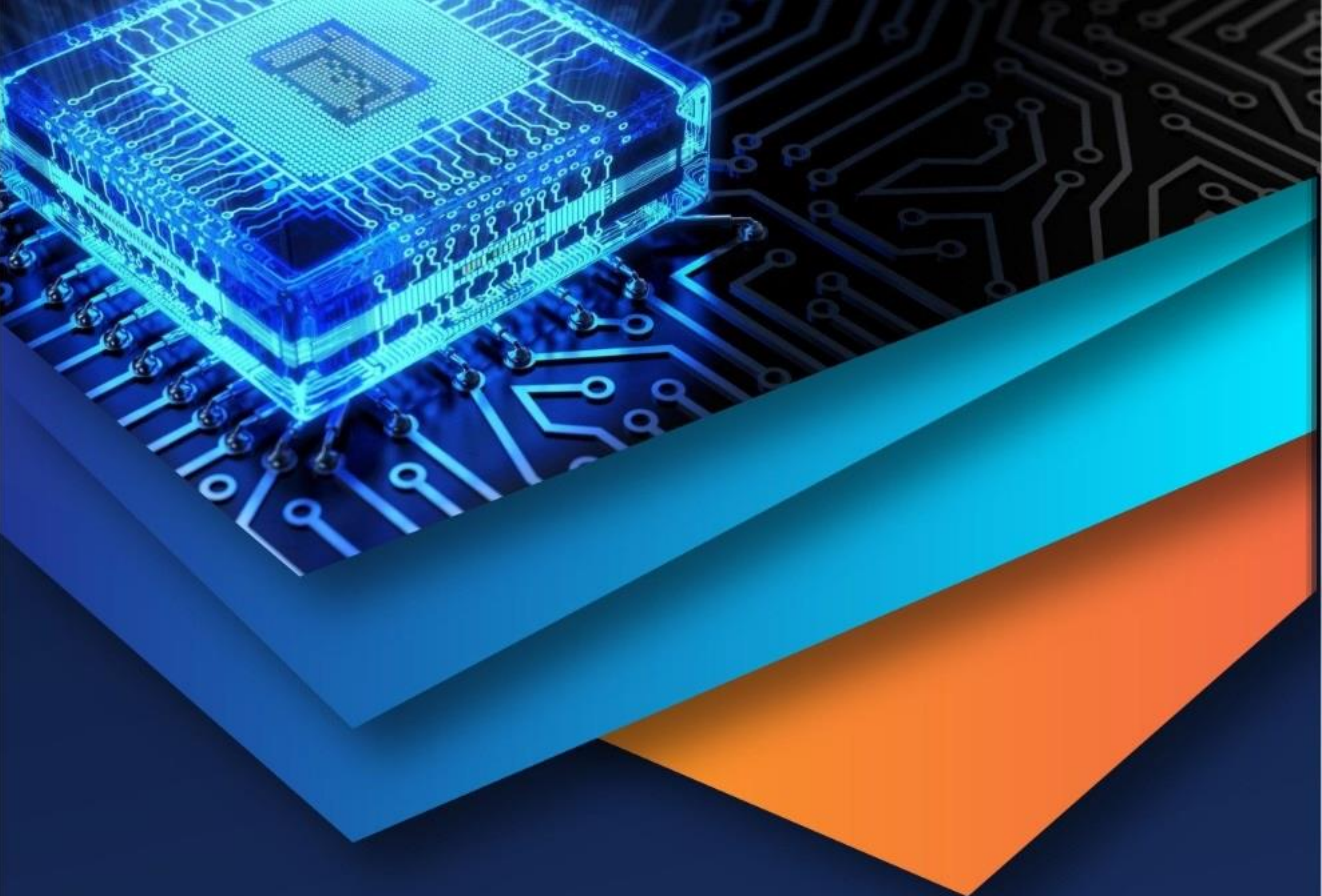
[7] A. K. Verma, “A comparative performance analysis of wavelets in denoising of speech signals”, International journal of computer applications, pp. 29-32, 2012.

[8] Q. Zhang, R. A. Rossel and P. Choi, “Denoising of gamma ray signals by interval –dependent thresholds of wavelet analysis”, Measurement Science and Technology, Vol. 17, No. 4, 2006

[9] D. L. Donoho, “Denoising by soft thresholding”, IEEE Transaction on Information Theory, Vol. 41, No. 3, pp. 613-627, 1995.

[10] D. L. Donoho, “Progress in wavelet analysis and WVD”, Progress in Wavelet Analysis and Applications, pp. 109-128, 1993.

[11] M. S. Chaven, “Studies on implementation of wavelet for denoising speech signal”, International Journal on Computer Application, Vol. 3, No. 2, pp. 1-7, June 2010.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY