BIT ERROR RATE PREDICTION ANALYSIS ON DAUBECHIES WAVELET TRANSFORM BASED CHANNEL ESTIMATION IN COMPARISON WITH TRADITIONAL LEAST SQUARE METHOD FOR MIMO OFDM SYSTEM.

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Abstract

Aim: The aim of the Bit Error Rate (BER) Prediction Analysis on Novel Modified Daubechies wavelet transform based Channel Estimation in comparison with Traditional Least Square Method for Multiple Input Multiple Output (MIMO) Orthogonal Frequency Division Multiplexing (OFDM) system. **Materials and Methods**: The categorizing is performed by adopting a sample size of n = 10 in Daubechies Wavelets with a sample size n = 10 in Traditional Least Square Method with Alpha error threshold by 0.05, 95% confidence interval, power 80% and simulation is performed using Python Programming software. **Results and Discussion**: The analysis of the results shows that the Daubechies Wavelets have a high accuracy of (94.36) in comparison with the Traditional Least Square Method (93.26). There is a statistically significant difference between the study groups with its value 0.0740 (p <0.005). **Conclusion**: Detection of systems using Daubechies Wavelets compared over Traditional Least Square Method with better accuracy.

Keywords: Novel modified Daubechies wavelet transform, Traditional least square scheme, Orthogonal Frequency Division Multiplexing, Bit Error Rate Prediction, Multiple Input Multiple Output, Wireless Communication.

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1. Introduction

The wavelet change is a somewhat new apparatus for dissecting geophysical information.A benefit of the symmetrical Novel modified Daubechies wavelet transform is its capacity to segment the difference of the components of y on a scale by scale premise. This parceling prompts the idea of the scale-subordinate wavelet fluctuation, which in numerous ways is comparable to the more recognizable recurrence subordinate Fourier power spectrum (Lark and Webster 2001). The wavelet change is along these lines a characteristic apparatus for researching the spatial sizes of inconstancy in geophysical information. Not just is the scale-subordinate fluctuation assessed, yet the areas of occasions adding to the change at each scale are too decided. The pack ice of the Arctic Ocean is crossed by a messed up organization of leads that present a lot of barely gathered inconsistency in the surface properties of the ice (Labat, Ababou, and Mangin 2001). Between the leads, on the ice floes, the outer layer of spring pack ice is generally profoundly uniform for estimations arrived at the midpoint of north of a few meters. Numerous actual cycles in the leads are fundamentally not quite the same as those found on the floors. The cycles of most concern to geophysicists incorporate the hotness transition from the ice, the ice development rate, the breeze weight on the ice, and the strength of the ice (Massel 2001). The exact estimation of these lead properties is, thus, subject to the size of the leads and the precision and estimation goal of the instruments. A broadly accessible satellite instrument frequently utilized in the Arctic is the high level extremely high goal radiometer (AVHRR) which has an ostensible goal of 1.1 km at nadir (Barbosa, Fernandes, and Silva 2006). Pictures obtained with this instrument show a rich grouping of leads in practically any sans cloud picture of pack ice, yet the inquiry remains in regards to how much inconstancy related with leads is missed (arrived at the midpoint of out) by the huge region tested in each pixel. It can be tended to through the one-layered wavelet examination of executes from a high-goal picture (Cornish, Bretherton, and Percival 2006). In this paper, we have described the connection with regard to the air conditions and further for relieving the environmental choppiness consequences for a signal, on the other hand on signal insights (Subramani et al. 2020). It is widely used in wireless networks, audio broadcasting, Wi-fi, Wi-max, and therefore the generations of 4G mobile wireless communication applications. (Wang and Gao 2020) multicarrier modulation scheme Multiple Input Multiple Output and Massive Multiple Input Multiple Output Orthogonal Frequency Division Multiplexing (Wang and Gao 2020).

This work proposes a method on Novel modified Daubechies wavelet transform and on the wavelet change also to exhibit the helpfulness of these devices to the remote detecting local area by breaking down the surface properties of ocean ice for instance (Steel, Ashley Steel, and Lange 2007). The DWT is figured out altogether as far as limited lattices and vectors and consequently thought to be promptly open by experts. Our detailing of the wavelet change and the connected idea of wavelet covariance examines both how to productively assess these amounts and furthermore how to create certainty spans for them (Flato 1995).

Our team has extensive knowledge and research experience that has translated into high quality publications (Matheswaran et al. 2022; Baker et al. 2022; B et al. 2022; Dutta et al. 2022; Yabalak et al. 2022; Geetha et al. 2022; Arslan et al. 2022; Krishnan et al. 2022; Aravind Kumar et al. 2022; Sai Preethi et al. 2022). The major drawback of Multiple Input Multiple Output -Orthogonal Frequency Division Multiplexing is a poor Bit Error Rate and its average power ratio. It decreases the strength of the signal. To upgrade the blunder pace of MRC is utilized in the proposed framework. Programmatic experiences are done to check the presentation of the proposed approach. A recreation device with a Graphical User Interface (GUI) which carries out these calculations is additionally evolved to give ease in the execution (Bhagwatkar, Patil, and Satpute 2016). The main aim is to achieve an improvement in Bit Error Rate Prediction and compare the Novel modified Daubechies wavelets with the Traditional Least Square Method.

2. Materials And METHODS

The research work was performed in the BER Prediction Analysis , Department of ECE, Saveetha School of Engineering, SIMATS. Basically it is considered with two groups of classifiers namely Daubechies Wavelets and Traditional Least Square Method BER Prediction Analysis on Novel modified Daubechies wavelet transform methods with better Accuracy. Group 1 is the Daubechies Wavelets with the sample size of 10 and the Traditional Least Square Method is group 2 with the sample size of 10 and it was compared for more accuracy score and Loss values for choosing the best algorithm to detect Daubechies Wavelets. Sample size has been calculated and it is identified as standard deviation for Daubechies Wavelets

3.20529 and Traditional Least Square Method 3.37048.

Daubechies Wavelets

The Daubechies wavelets, in view crafted by Ingrid Daubechies, are a group of symmetrical wavelets characterizing a discrete wavelet change and described by a maximal number of disappearing minutes for some given help.

Pseudocode for Daubechies Wavelets
Input: Training dataset T.
Output: A class of testing dataset.
Steps:
1.Read the training dataset T
2. Calculate the mean and standard deviation of the predictor variables in each class;
3.Repeat Calculate the probability of fi using the gauss density equation in each class; Until the probability of all predictor variables (fi, f. fs,...,fn) has been calculated.
4.Calculate the likelihood for each class;
5. Get the greatest likelihood:

Traditional Least Square Method

Assuming the information shows a more streamlined connection between two factors, the line that best fits this direct relationship is known as a least-squares relapse line, which limits the upward separation from the information focus to the relapse line.

Pseudocode for Traditional Least Square Method
1.candidate SV = { closest pair from opposite classes}
2.while there are violating points do
3.Find a violator
4.candidate SV=U candidate SVS
5.violator
6.if any a, <0 due to addition of c to S then candidate SV = candidate SV\P repeat till all such points are pruned
7.end if
8.end while

Statistical Analysis
SPSS version 21 was used for statistical analysis of collected data for parameters by gain in dB and frequency in GHz. The independent sample T-test and group statistics are calculated using SPSS software (Sajjad et al. 2014). For both proposed and existing algorithms 10 iterations were done with a maximum of 10 samples and for each iteration the predicted accuracy was noted for analyzing accuracy. The value obtained from the iterations of the Independent Sample T-test was performed. The number of subcarriers and OFDM symbols are the independent variables, while Bit Error Rate and Signal to Noise Ratio in dB are dependent variables.

3. Results

Table 1 Shows the Comparison of Bit Error rate and Signal to Noise Ratio sample values between Daubechies wavelet and Traditional Least Square Method. Table 2 shows the Group statistics comparison of BER to represent the statistical data for 10 samples between Daubechies wavelet and Traditional Least Square Method. Novel modified Daubechies wavelets achieved the highest mean value as compared to the Traditional Least Square Method which is suitable for Multiple Input Multiple Output orthogonal frequency division multiplexing. The SPSS tool was used for statistical analysis. The significance of the study is calculated by using an Independent Sample t-Test. The dependent variables in the study are BER.The standard deviation for Daubechies wavelets is 3.26843 and for Traditional Least Square Method is 2.83632. Table 3 shows the Independent sample test of BER. The significance of the BER is 0.861.
Figure 1 shows the results of BER using the Fractional Spline wavelets method and Traditional Wavelets method. Fig. 2 shows the Bar chart representing the comparison of mean BER of Fractional Spline wavelets and Traditional Wavelets method. There is a significant difference between the Novel modified Fractional Spline Wavelets method and the Traditional Wavelets method. The Fractional Spline Wavelets method appears to produce the most variable results with its standard deviation.
The outline introduced here has provided the peruser with some thought of the likely employment of Novel modified Daubechies wavelet transform in investigating geophysical time series. There are quite a large number of parts of wavelet investigation that we have not addressed, including the reality that each of the strategies we have talked about can be applied to time series whose measurable properties are developing over the long run. The capacity of DWTs to handle this case, which is evaded momentarily in the MRA for the oxygen series introduced, is restricted with the way that the wavelet coefficients separate data across various scales, yet additionally across time. For instance, a wavelet difference assessor in which the squared wavelet coefficients are found the middle value locally rather than all around the world is an powerful approach to concentrating on time-shifting properties in a period series. The peruser ought to counsel (Percival and Walden 2006). For subtleties on this and different parts of

wavelet investigation not shrouded in this short overview.The overt repetitiveness in the CWT, nonetheless, can make legitimate understanding of 'heat' plots of the CWT dangerous, i.e., scale versus time plots in which the extents of the CWT coefficients are shading coded (Percival and Walden 2006). These plots frequently have rather striking designs that our eyes are drawn toward, yet that can be generally credited to the way that CWT coefficients are ordinarily exceptionally associated both spatially and briefly. Legitimate factual evaluation of the meaning of these constructions includes a few unpretentious issues , especially on the off chance that they are selected by eye before being evaluated. Subsampling to the dyadic scales in the MODWT and ODWT basically breaks this connection structure spatially, and subsampling the MODWT to get the ODWT does the same for a brief time. The way that assortments of coefficients from these DWTs are roughly uncorrelated makes it simpler to devise factual tests and to carry out bootstrapping techniques (the last option are not practical with CWTs). At last we note that the CWT doesn't officially include parts in a time series that are dealt with in Novel modified Daubechies wavelet transform by the scaling coefficients. These are regularly valuable for separating enormous scope drifts that are a significant piece of a few geophysical time series and that are a critical part in wavelet-based signal extraction (Percival and Walden 2006). System using BER Prediction Analysis on Modified Daubechies Wavelets transform based Channel Estimation in comparison with Traditional Least Square Method for Multiple Input Multiple Output Orthogonal Frequency Division Multiplexing system.The statistical analysis of two independent groups shows that the Daubechies Wavelets have higher accuracy mean 5.3500 and Less Loss mean 2.0300 compared to Traditional Least Square Method.

4. Discussion

In this paper, A basic scale examination of the inconstancy of a field, as acted in this review, doesn't need a two-layered informational collection except if the field is essentially anisotropic. In the event that this is the situation, the information cuts along various headings could be examined autonomously or the two-layered field could be broken down all in all. The wavelet decay can be stretched out to two aspects (Donner and Barbosa 2008). In the two-layered technique the symmetrical two-layered wavelet premise frameworks are each related with a scale, an area, and one of three directions: level, vertical, and corner to corner. An effective decay calculation in light of one-layered wavelet channels was presented by Mallet (Barnes, Baxter, and Lark 2007). Uses of the two dimensional decay incorporate surface examination, picture smoothing, picture pressure, edge recognition, direction examination, and PC vision. Notwithstanding the investigation of difference and the pressure of information, the wavelet disintegration offers a one of a kind strategy of spatial-versatile smoothing of a sign that contains enormous discontinuities, for example, those got over ocean ice with leads. The strategy is called wavelet shrinkage and was created by Donoho and Johnstone (França and De Mesquita 2007). Wavelet shrinkage is based on the rule that commotion in the sign is reflected in the wavelet disintegration as commotion in the coefficients and that discontinuities in the sign are addressed by a couple of enormous coefficients. All coefficients under a limit are set to zero and those bigger than the edge are contracted toward nothing. Donoho and Johnstone created explicit ideal edges. Tests with the Landsat information show exceptionally reassuring outcomes; the smoothed sign shows up exceptionally smooth over floes, the leaps at leads stay sharp, the greatness of the sign inside leads stay high, and the clear widths of the leads stay exactly (Chun, Liu, and Sung 2007) (Scope Crafts et al. 2022).

Hence the study results produce clarity in performance with both experimental and statistical analysis, but there are some limitations to the proposed work is its average power ratio. It can be slightly improved based on the random data sets analysis in future for the massive MIMO Orthogonal Frequency Division Multiplexing system. Using Daubechies Wavelets compared to the Traditional Least Square Method process improved the accuracy for Multiple Input Multiple Output-Orthogonal Frequency Division Multiplexing system while doing Bit Error Rate Prediction (Fan and Koul 2006).

5. Conclusion

The study focused on Bit Error Rate Prediction Analysis on Daubechies Wavelets and Traditional Least Square Method with better accuracy. The outcome of the Daubechies Wavelets shows 94.36 higher accuracy which is significantly better than Traditional Least Square Method having accuracy 93.26.

Declaration

Conflict of Interests

No conflict of interest

Authors Contribution

Author MS was involved in writing the code for the Daubechies wavelet for the estimation of channel OFDM system and manuscript writing. Author AR was involved in Guiding to analyze the performance, data validation, and the review of the manuscript.

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6. **Reference**

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Tables And Figures

Table 1. Comparison of Bit Error Rate Prediction and Signal to Noise Ratio values between Daubechies wavelet and Traditional Least Square Method.

	Daubechies wavelet		Traditional Least Square Method	
Sl.No	**BER**	**SNR**	**BER**	**SNR**
1	1.8	0.9	-0.9	1.2
2	2.1	2	-0.3	2
3	3	3.1	-0.5	3
4	2	4	1.8	4
5	6	5	3.8	5
6	5.7	6	3.9	6
7	6	7	4.3	7.1
8	6.1	8	4.9	8
9	9.7	9	5	9.1
10	10.5	10	8.1	10

Table 2. Group statistics comparison for the Daubechies Wavelet with Traditional Least Square method with its statistical significance with p-value (0.001). The mean sum capacity of a Daubechies Wavelet is 5.3500 and Traditional Least Square Method is 2.0330. Daubechies Wavelet has significant improvement in the mean sum capacity performance compared to Traditional Least Square Method.

	Group	**Mean**	**Std.Deviation**	**Std.Error mean**	**N**
BER	Daubechies Wavelet	5.3500	3.20529	1.01360	10
	Traditional Least Square method	2.0330	3.37048	1.06584	10

Table 3. The mean Difference, standard Error Difference, and significant difference in BER for Daubechies Wavelet and Traditional Least Square method Schemes. There is a significant difference between the two groups since p<0.05 (Independent Sample t-Test).

						Significance		**T-test for equality of means**		**95% confidence interval of the difference**	**T-test for equality of means**
		F	**Sig.**	**t**	**df**	**One Sided-P**	**Two sided-P**	**Mean Difference**	**Std.Error Difference**	**Lower**	**Upper**
BER Prediction	Equal variances assumed	0.114	0.0740	2.257	18	0.018	0.037	3.32000	1.47085	0.22986	6.4104
	Equal variances not assumed			2.257	17.955	0.018	0.037	3.32000	1.47805	0.22930	6.41070

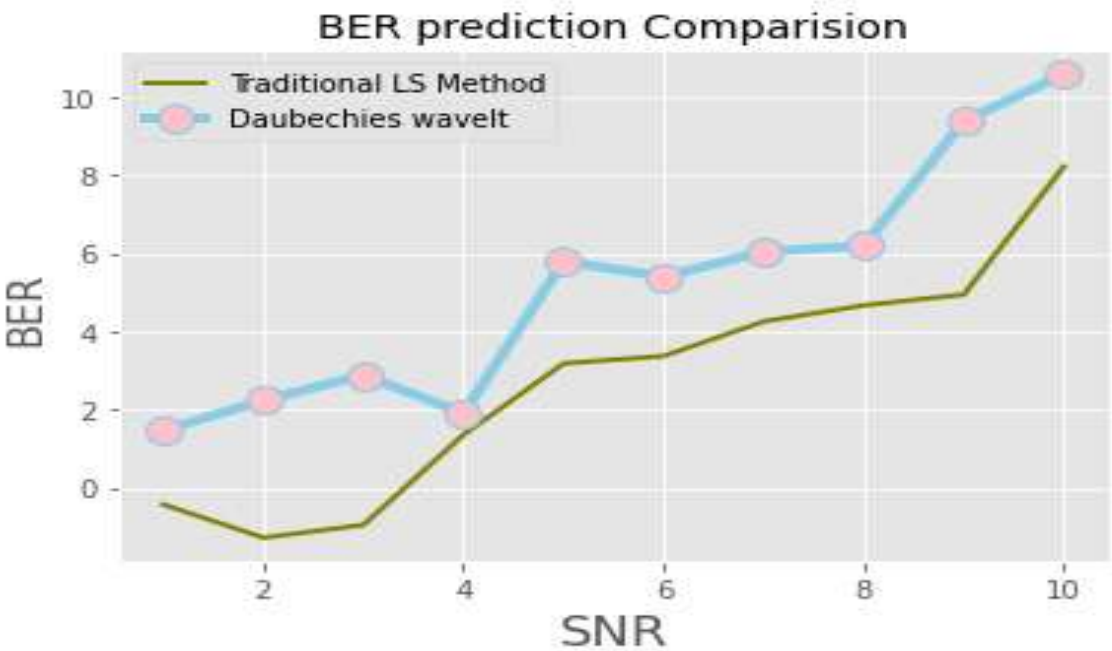

Fig. 1. Bit Error Rate Prediction (BER) analysis of Daubechies wavelet in comparison with Traditional Least Square Method. Blue: Daubechies wavelet, Green: Least Square Traditional Wavelet Method, Y-axis: Accuracy, X-axis: Comparison of Daubechies Wavelet with Traditional Least Square Method.

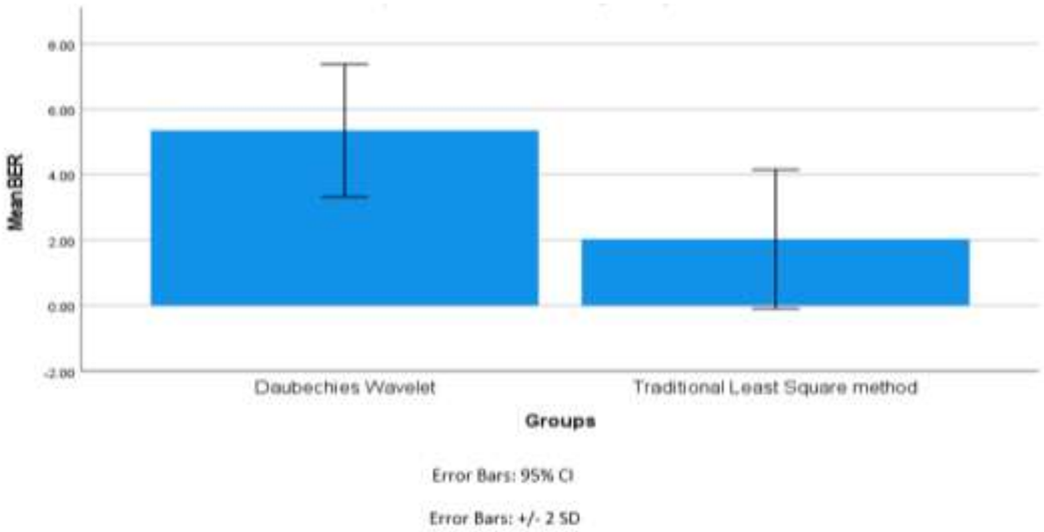

Fig. 2. Bar chart representing the comparison of mean BER of Daubechies Wavelet and Traditional Least Square method. There is a significant difference between theDaubechiesWavelet and Traditional Least Square methods. X-axis: Types of Channel Estimation methods, Y-axis: Mean BER with standard deviation +/- 2 SD