Analysis of EEG Signal Using Wavelet Transform and SVM Classifier

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Abstract— Electroencephalogram (EEG) signals are used to measure the brain activity. For analyzing the EEG signal various transform methods are used. This paper is devoted to the use of wavelet transform i.e. db1-db4 and SVM classifier is employed for calculating the accuracy. In this paper, we calculate the accuracy of the input signal using wavelet transform, also calculate the features of the signal i.e. energy and entropy.

Key words: EEG, PLN, EBA, EBA, EMA, RA

I. INTRODUCTION

The electroencephalography (EEG) is a tool to study the brain activity dynamics non-invasively. However during acquisition the EEG signal encounters various artifacts, which degrades the feature resolutions of the signal. The predominant artifacts are Power Line Noise (PLN), Eye Blink Artifact (EBA), ElectroMioGram (EMG), Cardiac Signal Artifact (CSA), Respiration Artifact (RA) and Electrode Motion Artifact (EMA). In this aspect to facilitate the neurologist for accurate diagnosis these artifacts have to be disregarded. Thus, extraction of high-resolution EEG signals from the background contaminations is an important issue to investigate. The goal of brain signal enhancement is to separate the valid signal components from the undesired artifacts and to present an EEG that facilitates easy and accurate interpretation.

II. METHODOLOGY

The EEG signals are collected from /www.physionet.org which gives free access via the web to the large collections of recorded physiologic signals. Features of EEG signals are extracted using DiscreteWavelet Transform at 5th level of decomposition. For classification and to analyze the parameters of EEG signal such as entropy and energy, svmtrain SVM classifier is used. Comparative analysis of EEG signal by Daubechies wavelets from db1 to db4 are used for improving the accuracy.

III. RESULTS AND ANALYSIS

The features of EEG signal is extracted using wavelet transform at different levels and svmtrain classifier is used for classification.

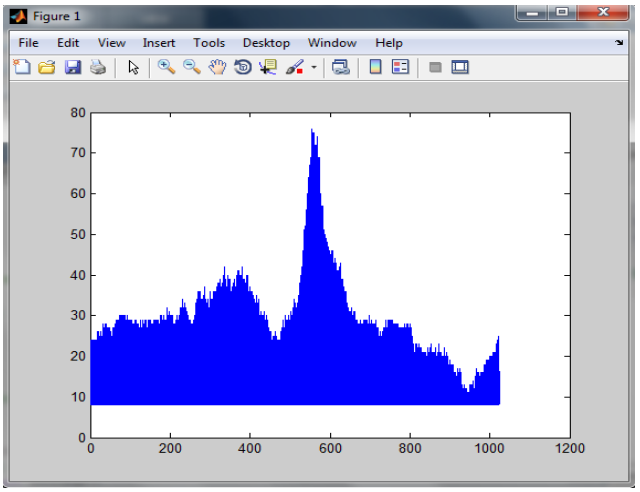

Fig. 1: Original EEG signal.

Fig 1 shows the input EEG signal. This signal is analyzed and features are extracted using wavelet transform.

A. Analysis using wavelet db1:

The analysis of the input EEG signal using wavelet db1and svmtrain classifier.

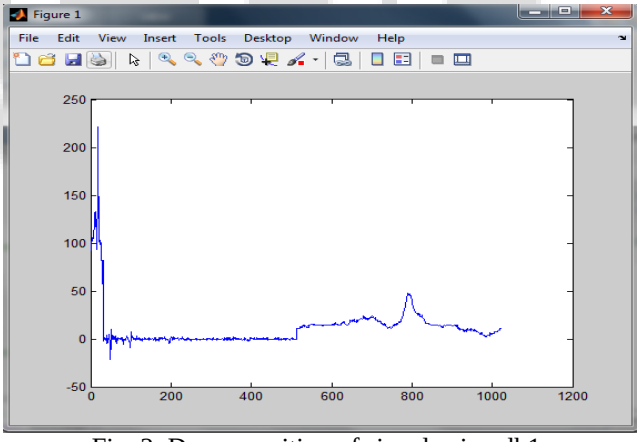

Fig. 2: Decomposition of signal using db1.

The above fig shows the decomposition of original signal using db1.

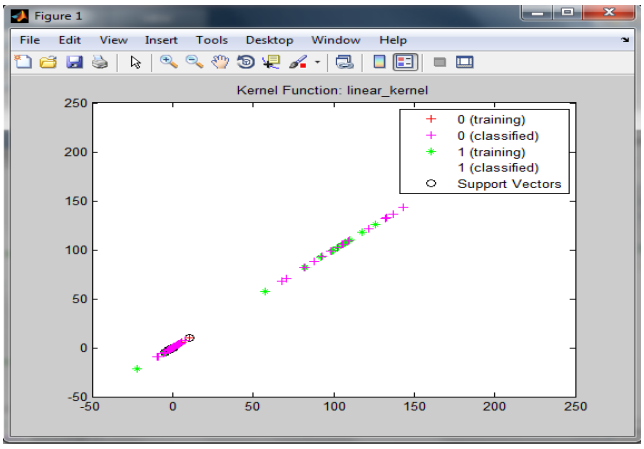

Fig. 3: Classified signal output using db1

The fig shows the accuracy of classifier using wavelet db1.

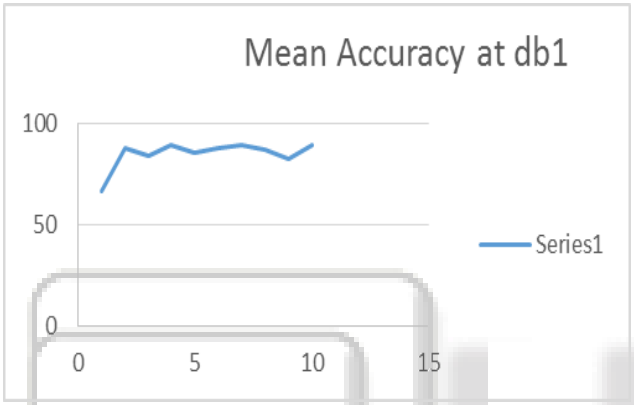

Fig. 4: Mean accuracy using db1.

The mean accuracy using wavelet db1 is 84.93.

B. Analysis of input signal using wavelet db2:

The analysis of the input EEG signal using wavelet db2 and svmtrain classifier.

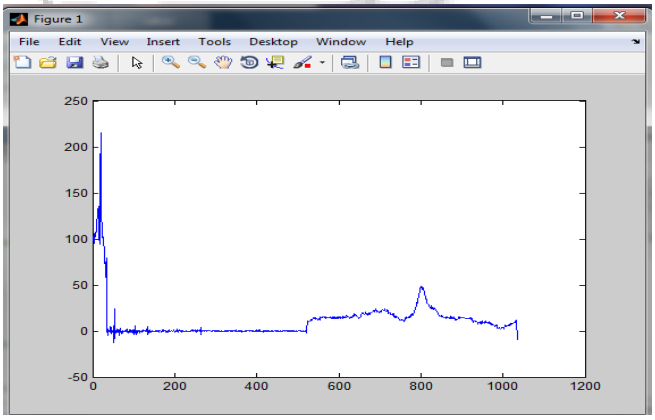

Fig. 5: Decomposition of signal using db2.

The above fig shows the decomposition of original signal using db2.

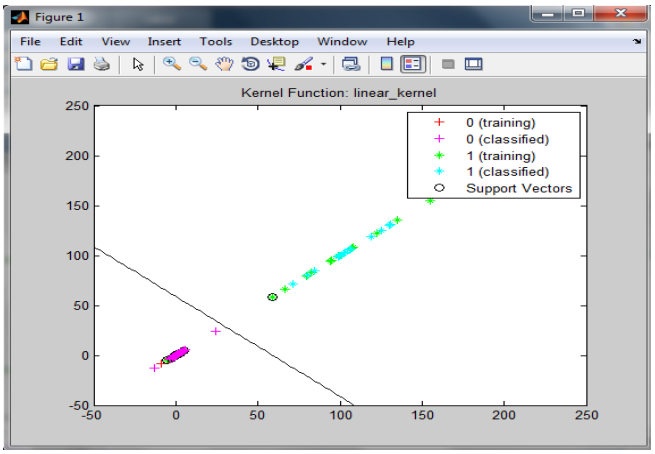

Fig. 6: Classified signal output using db2.

The fig shows the accuracy of classifier using wavelet db2.

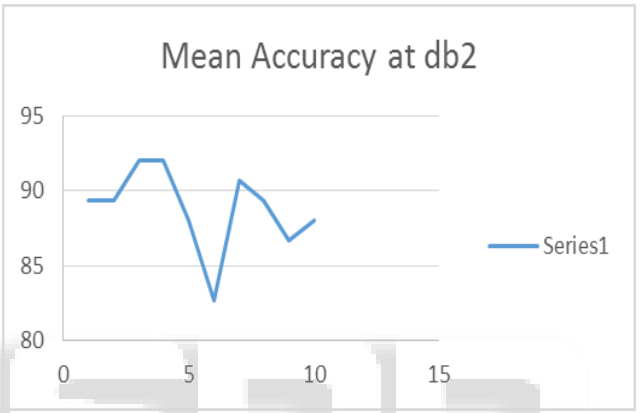

Fig. 7: Mean accuracy using db2.

Mean Accuracy using wavelet db2 is 88.80.

C. Analysis of input signal using wavelet db3:

The analysis of the input EEG signal using wavelet db3 and svmtrain classifier.

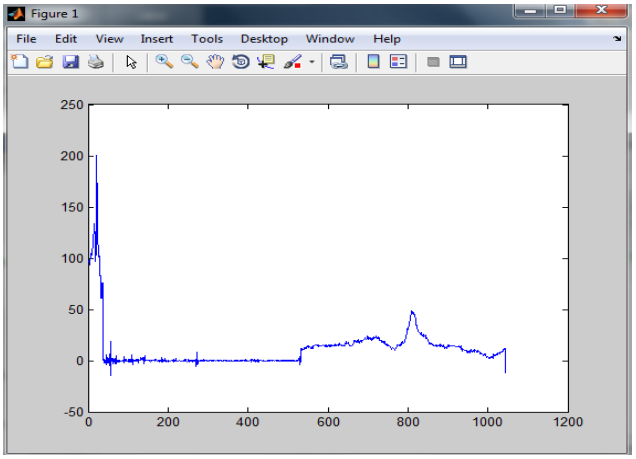

Fig. 8: Decomposition of signal using db3.

The above fig shows the decomposition of original signal using db3.

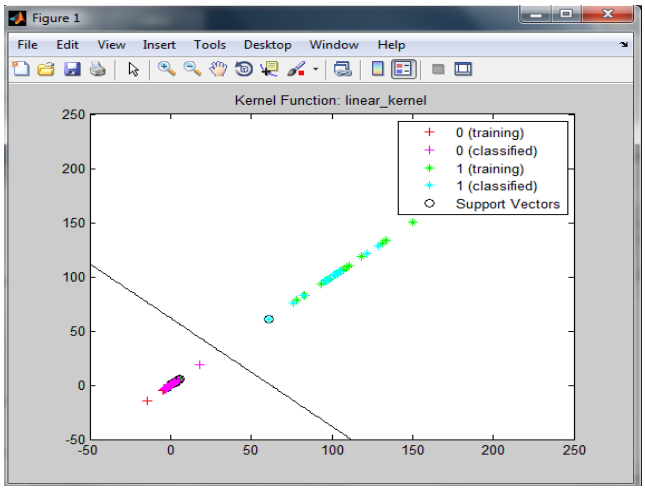

Fig. 9: Classified signal output using db3.

The fig shows the accuracy of classifier using wavelet db3.

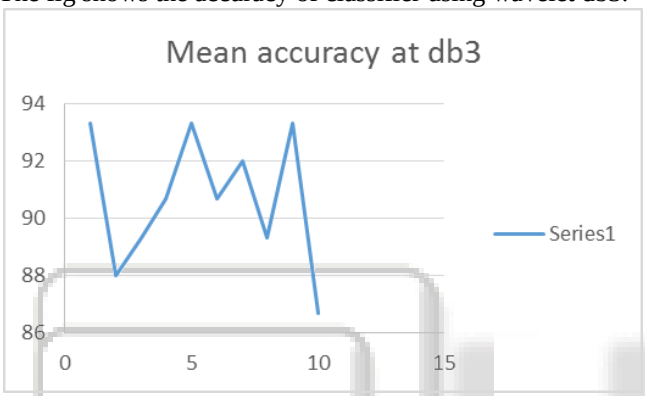

Fig. 10: Mean accuracy using db3.

Mean accuracy using db3 is 90.67.

D. Analysis of signal using db4:

The analysis of the input EEG signal using wavelet db4 and svmtrain classifier.

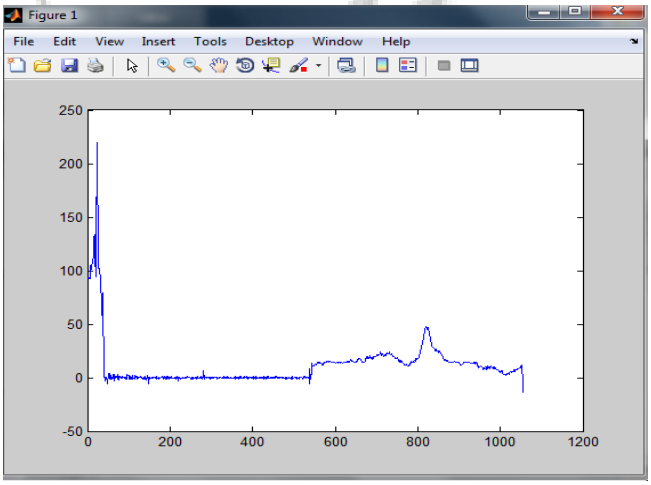

Fig. 11: Decomposition of signal using db4.

The above fig shows the decomposition of original signal using db4.

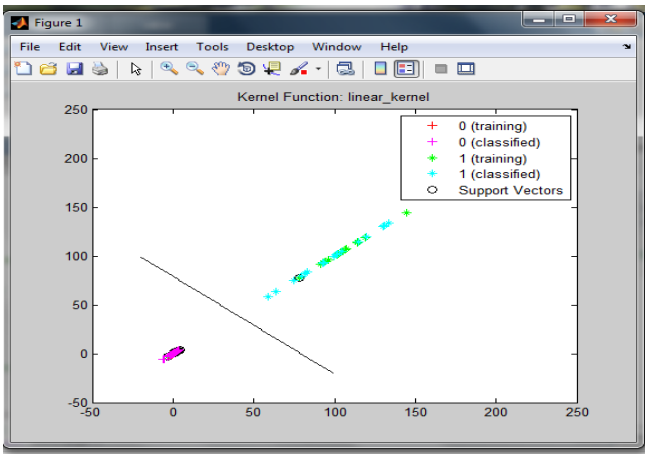

Fig. 12: Classified signal output using db4.

The fig shows the accuracy of classifier using wavelet db4.

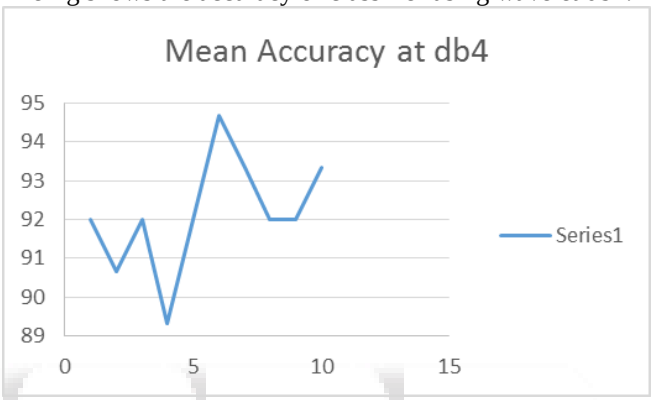

Fig. 13: Mean accuracy using db4.

Mean accuracy using db4 is 92.13.

IV. COMPARATIVE RESULTS

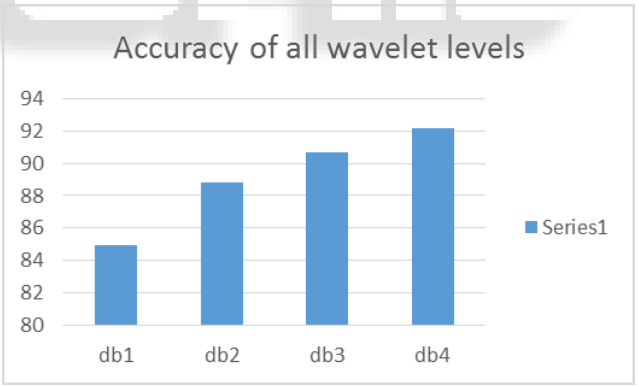

Fig. 14: Comparison of mean accuracy from db1 to db4.

Accuracy using db4 is more than other wavelet transforms. The accuracy is 92.13 and we calculate the entropy and energy of the signal using db4 is:-

Level	db4
Energy	94.93
Entropy	2.8

Table 1:

V. CONCLUSION

The features of EEG signal extracted using wavelet transform and svmtrain classifier is used to obtain higher accuracy. The result shows that wavelet db4 gives more accuracy then others i.e. db1, db2, db3. The accuracy using db4 is 92.13, entropy of signal is 2.8 and energy of the signal is 94.93.Our

method gives better result without any complexity and also retain the original information contained in the EEG signal.

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