Improving Efficiency in EEG process using Linear Discriminant Analysis and Support Vector Machine

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Abstract: ***The advancement in the bio medical examinations with the help of advanced technologies is tremendously increasing. Here we represent a model in which the EEG images of frequency signals can be processed with the help of machine learning techniques and finding their seizure. We mentioned the accuracy to let the readers know how to get the most out of the given EEG images if processed. This also is process in which we process the images by extracting the features of the EEG by the usage of LDA and then changing over to SVM for the latter classification. This can also be useful for calculation of sleep states and neural disorders due to lack of neural activity in the brain. BCI plays a key role in the supply of the images of EEG and its analysis.***

KeyWords: ***EEG, Linear Discriminate Analysis, SVM, Classification, Seizure.***

I. INTRODUCTION

EEG is very essential in dealing with the neural activity related issues such as neural disorders and other brain related diagnosis[1,3,5].Disorders that cause psychological effects which sometimes lead to physical effects but not any physical effects directly are mental disorders [3]. At the pace of the present world there has been a steady increase in the pace of growing of the disorders which by now has reached a percentage of twenty five [10] which means a person from every four persons has a chance of having been effected by a mental disorder. Table 1: Common Adult Disorders Prevalence. Also the key note is that the number of persons who can treat mental illness is quite less in comparison with all diseases and disorders [8]. By the various techniques of machine learning there is a chance to learn something of the intelligence and the techniques [1, 5] are the base for the undertaking of the datasets of EEG signals.

Band Name	Frequency Range	Location
μ	8-12	Sensor motor cortex.
α	>8-12	Posterior regions, both sides and the central region.
γ	>30-100+	Somatosensory cortex.
δ	Up to 4	Frontally In adults, posteriorly, in Children.
β	>12-30	Both sides, symmetrical distribution, most evident frontally.
Θ	>4-8	Found in locations not related to the current mental task.

Table 1: EEG frequency bands and locations

I. LITERATURE SURVEY

From the early 90's there has been a tremendous effort for the amplification of all the predictions regarding the mental disorders for a clear and efficient analysis of estimations which can be more reliable for the people and the doctors. But in the past decade due to the vast changes in the technological aspects and insights of the artificial intelligence and big data the research has taken a huge leap. The usage of brain connectivity for the supervised learning of autism spectrum disordering classification by W. Jamal, S. Das [10] has been a stepping stone for the classifications. The neuro imaging advancement with the machine learning with ski-kit is ingeniously given by the A. Abraham, F. Pedregosa [9]. The anxiety disorder classification in the social issues is by the usage of BCIS by F. Liu has taken the BCIS quite forward [8]. The estimations and predictions in disorders of the autism spectrum for the youth with ANN have forwarded the research from [10] to a whole new level by A. Narzisi, F. Muratori [7]. The whole theory is quite greatly explained along with the pitfalls and guidelines for imaging data of the psychological patients with disorders by the usage of ML id showcased by P.

KassraianFard, C. Matthis [6].

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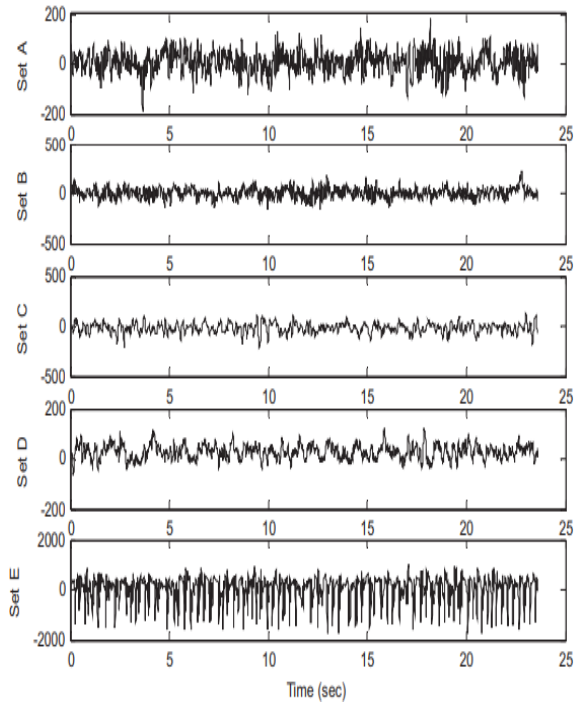

Fig 1: Example set from different subjects

I. SUPPORT_VECTOR_MACHINES

The SVM's basic classifier deals very much about the perception of things. Given classifier used is a direct classifier and is expecting distinguishable information from the process. When grouping of the taken examples is done efficiently then the ceasing of the iterative method takes place in the model of perception learning which is currently used in the process.

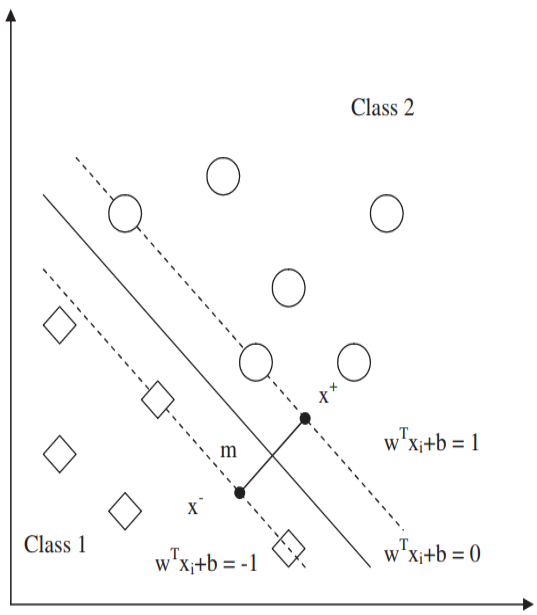

Fig 2: Linear Support vector classifier

For directly distinguishable information, this implies the discovered perceptron is one arrangement discretionarily chosen from an (on a fundamental level) interminable arrangement of arrangements. Interestingly, the help vector classifier picks one specific arrangement. It very well demonstrates about specific arrangement which happens to have the most elevated speculation capacity.

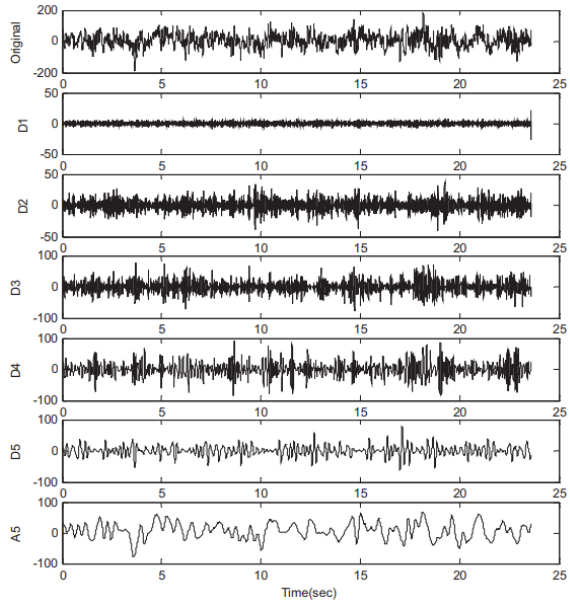

Fig 3: Signal of healthy subject

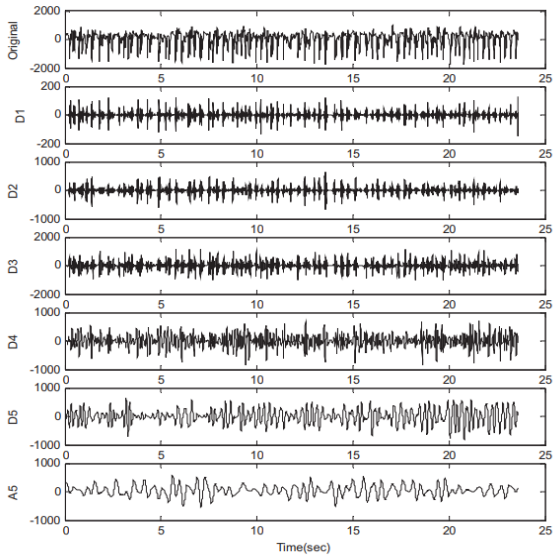

Fig 4: Signal of unhealthy subject

Additionally, its execution is exceptionally focused with different techniques ;see Fig. 3 and Fig. 4. A disadvantage is that the issue multifaceted nature isn't of the request component present in the examples, however request quantity of tests. Exceptional reason enhancers utilizing issue explicit speedups must be utilized to comprehend the streamlining[3].

I. METHODOLOGY

Seizure disclosure (Epileptic) in EEG [8] is a of precedent affirmation thought in a way of thought process. Data obtainment, banner taking care of, incorporate extraction, and feature lessening and seizure area are often involved criteria.

A story EEG banner gathering methodology is proposed, which relies upon DWT [9], the estimation decline (in light of LDA) and SVM course of action. The technique of the proposed structure can be dense as seeks after:

Step 1: The features calculated with statistical features parameter from time–frequency domain using DWT.

Step 2: We extract the features using LDA algorithm to reduce the dimensionality. This step is performed to remove the irrelevant features which are redundant and even degrade the performance of the classifier.

Step 3: The classification process for epileptic seizure detection is carried out using SVM-based classification.

Class	Training set	Test set	Total
Epileptic	400	400	800
Normal	400	400	800
Total	800	800	1600

Table 2: Sample distribution of image datasets

I. RESULTS

In the process by using the DWT we extract the data (Statistical) which is required for the process within the locality of the domain of time-frequency. These can be termed as the features extracted for the execution of the process on a whole. Later on we use the 'LDA' algorithm which is primarily a feature extraction algorithm for getting a one hundred percent of accuracy in the feature extraction phenomenon. Now, by the usage of the SVM we classify the seizures and predict the values using the below statements:

$$\text{Sensitivity} = \frac{TP}{TP + FN}$$

$$\text{Specificity} = \frac{TN}{TN + FP}$$

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN},$$

Feature extraction method	Accuracy	Specificity	Sensitivity
PCA (%)	98.75	98.5	99.00
ICA (%)	99.5	99	100
LDA (%)	100	100	100

Table 3: Feature extraction statistical analysis

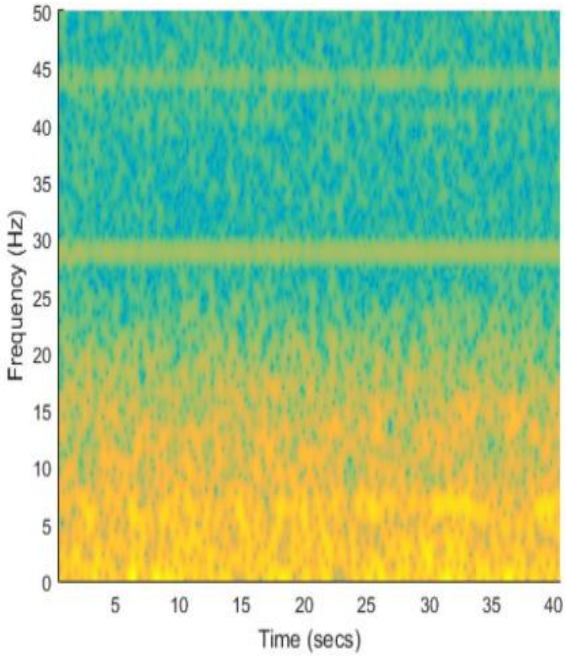

Fig 5: Spectrogram of healthy subject after analysis

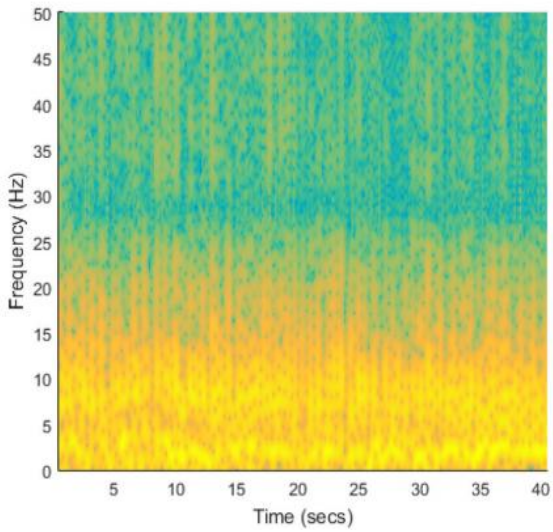

Fig 6: Spectrogram of healthy subject after analysis

The SVM classification is carried on both the healthy and unhealthy patients image sets for clearly observing the difference in the parameters and data obtained. We now formulate the spectrograms for both the data such that the analysis of the data will be much easier.

II. CONCLUSION

With the implementation of the ML methodologies [5] for the predictions in the neural disorders and the estimations [4] has made a huge impact for taking radiant measures to reduce the effect of the mental disorders and illness on the people. The BCIS is delivering the data [10] required for the machine learning methodologies to implement and gather the required results for the further implementations and implications [6].

Vast datasets are acquired by the process for fair examining and implicit computations [4]. The effects are minimized and the doctors are taking the help of the ML methodologies for the construction of the expert systems for the data translation and acquire the results. More and more research is being carried out by the researchers for a more sophisticated and well versed approach which can be better than the present system and are advancing with the resolve to achieve success on the mental disorders and eradicate the spreading as quickly as possible. The examinations depended on two scalar execution estimates got from the disarray networks; in particular explicitness and affectability. The aftereffect of EEG flag characterization utilizing SVMs demonstrates that nonlinear component extraction can enhance the execution of classifier as for decrease the quantity of help vector.

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AUTHORS PROFILE

LellaKranthi Kumar, Currently working as an Assistant Professor in the Department of Computer Science and Engineering in Lakireddy Bali Reddy College of Engineering, Mylavaram, Krishna District, Andhra Pradesh, India. I am an enthusiast of learning new things and applying that knowledge for solving real-world problems. I am not like a nerd but socially conscious about everything happens around me and take the decisions wisely and politely without hurting others opinions. This is the main reason that my research interests are mainly focused on Education Technologies, especially about "Online based blended Teaching-Learning process" that effectively uses current network infrastructure perfectly and makes the process of learning easy to all sort of people around the globe. In addition to the above, my research interests go on Data Analytics, IoT and Medical Image Processing.