iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** II **Month of publication:** February

DOI: http://doi.org/10.22214/ijraset.2019.2101

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue II, Feb 2019- Available at www.ijraset.com

Detection and Classification Epileptic Seizure

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Abstract: In this paper detection of epileptic seizure and non- seizure patient detected using the electroencephalogram (EEG). EEG of human brain is obtained by recording of EEG signal it is related to the medical field specialty, diagnosis of brain and brain related disease Proposed method based on wavelet coefficients types such as DWT, CWT, SWT (stationary wavelet transform) being translational invariant.in wavelet coefficient we use different properties. wavelet transform used for feature extraction and classifier used are support vector machine. Different artefact are removed using ICA.EEG advantageous for neurological disease if the uses of more feature extraction accuracy is better and also error rate is low.
Keywords: Epilepsy, kurtosis, Standard deviation, Wavelet transform

I. INTRODUCTION

10% of humans suffers this type of Epilepsy to cure this epilepsy electroencephalogram (EEG) signals is used to record epileptic patient brain activity. Epilepsy is a brain neurological disease EEG is diagnostic test and monitoring method, EEG is better understanding than MRI and CT scan. International 10-20 system is used in which electrode placed on scalp in different views. These electrode placed on scalp of brain.

At the time of EEG recording different artefact are formed or rises artefact such as ocular artefact, power line electrical noise etc. that's why accuracy of the EEG signal reduces so such artefact are need to removes removal of artefact are using independent component analysis (ICA). ICA separates component in signal between the artefact and brain electrical wave, wavelet coefficient in time and frequency domain. recognition or detection of seizure and non -seizure by SVM.

II. RELATED WORK

Cher Hau Seng, Ramazan Demirli, Lunal Khuon,Donovan Bolger research paper "Seizure Detection in EEG Signals Using Support Vector Machine" As a step toward practical simple Epileptic Seizure forecast Using Hybrid Feature Selection Over Multiple Intracranial EEG Electrode Contamination of this technology in patient, they present an individualized method for selecting EEG features. The algorithm is instruct on a series of baseline and pre-seizure records and then validated on other. [1]

Ales Prochazka and Jaromır Kukal research "Wavelet Transform Use for Feature Extraction and EEG Signal Segments Classification" a description of a texture sample and find which element of a database best matches that sample. One way to make the association is by finding the member of the class with measurements that differ by the least amount from the test sample's measurements. This is classification: to associate the appropriate class label (with the test sample by using the measurements that describe [2].

III.PROPOSED WORK

A. Methodology and Implementation

The proposed block diagram is shown in Fig.1 Input signal is pre-processed are feature extraction and classification is done to identify seizure or normal signal.

1) EEG DATASET: Two sets of data signal is normal and seizure these two set of data contain 10 signal of EEG one EEG dataset for healthy patient using 10-20 international standard in which electrode placed on scalp. Another EEG dataset for unhealthy that is seizure patient these database is available on internet. The CHB-MIT EEG database is available for download free of charge via http://physionet.org/physiobank/database/chbmit/. The EEG data was collected from 24 paediatric patients in Boston children's hospital. These signals were acquired from 21 surface electrodes placed to form channels by calculating the difference between potentials measured at a couple of electrodes following the international 10-20 system. The channels' labels are Pre-frontal (Fp), Frontal (F), Temporal (T), Parietal (P), Occipital (O), and Central (C). The sampling rate of the data accession system was equal to 256 samples per second with a resolution of 16 bits. In the present study, the EEG signals of the subject 24 were used. 22 files among them 12 presenting seizures are available. The number of seizure segments is equal to 16 with duration equal to 511 sec [7]

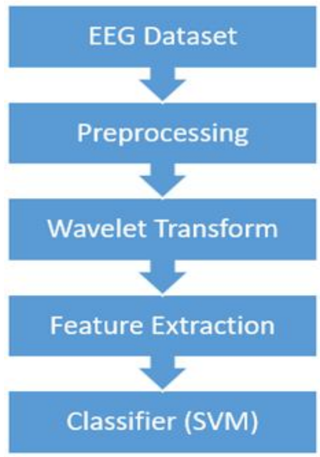

Fig. 1 Block diagram of EEG Signal Processing Stages

In typical scalp EEG, the recording is obtain by placing electrodes on scalp with a conductive gel. Some systems use caps into which electrodes are set; this is specific familiar when high-density arrays of electrodes are need [4].

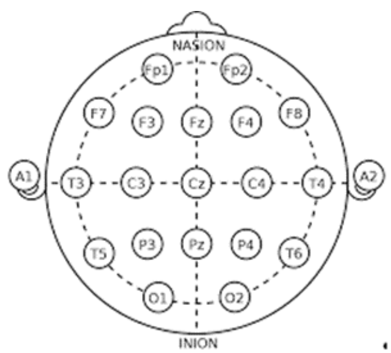

Fig. 2 Standard Electrode Placement

2) *Pre-Processing:* In the pre-processing stage we reduce artefact and filter using the ICA. It is a essential step it helps to remove unwanted artefact from EEG signal artefact such as power line noise interphase eye blinking etc. ICA detect and remove artefact it is available in EEGLAB software suite for removing artefact data is decomposed by ICA different metrics are used for artefact removal λ ΔSNR, RMSE ,SNDR, Pdis. It is effective in remove ocular that is related eye and vision artefact from EEG. This artefact removal process increase accuracy and reduce time consumption. it is computational method separates EEG signals if ICA detect whether data is artifactual then it subtracted the detected artefact from EEG data that's gives very good result it also used in mobile communication.
3) *Wavelet Transform:* In the Wavelet decomposition the unwanted artefacts are removed by applying threshold it is a well-known denoising process in biomedical field. Usually, this process refers to removing high frequency noise by thresholding the coefficients later than wavelet decomposition. However, by using the denoising process term, we refer to remove artifactual components from brain signals in the wavelet domain whether it is high-frequency or low-frequency artefacts. The objective of this stage is to decompose and analyse the raw era with a reasonable time-scale resolution in wavelet domain for feasible identification of artifactual components. Although there are three types of wavelet transform (e.g. DWT, CWT, SWT, etc.), we choose SWT because of its benefit of being translational invariant stationary wavelet decomposition, particular orthogonal wavelet specific orthogonal wavelet decomposition filters application of SWT is denoising [5].
4) *Feature Extraction:* Various feature of EEG signal will be extracted to identify the normal or seizure signal
a) *Skewness:* skewness is measure of the asymmetrical spread of a signal mean value if the skewness is data spread to right and if the skewness is negative data spread to left

$$S = \frac{E(x-\mu)^3}{\sigma^3}$$

b) *Kurtosis:* Kurtosis is Measures how much the peak of distribution is high.it also measure of whether the data are massive tailed, or light tailed relative to normal distribution tailedeness probability distribution. kurtosis of any univariate normal distribution.

$$k = \frac{E(x-\mu)^4}{\sigma^4}$$

c) *Standard Deviation:* The standard deviation is a measure of liability to vary or change of a signal about its mean value. For a trembling signal with a mean value of zero, the standard deviation is equal to the Root-Mean-Square value of the signal.

5) *Classifier:* SVM is an established machine learning tool and transforming data in to a high dimensional space SVM is motivated by training using those input nearby decision surface It is based on Vapnik hervonenk is dimension theory. In this technique, different classes of data are separated using a hyper-plane. This plane basically maximizes the margin which results in segregating the classes. Here, we employed it for automatically classifying the two classes i.e. Seizure and non-seizure. linear kernel SVM classifier are used. Features vector can be generated from different feature and used to teach SVM for classifying seizure and non- seizure

IV. PERFORMANCE EVALUATION

The performance of above three approaches will be evaluated using confusion matrix with following parameters:

1) Sensitivity or True Positive Rate (TPR): It measures the part of positives that are exactly identified.
SEN=TP(TP+FN)
2) Specificity (SPS) or True Negative Rate (TNR): It measures the part of negatives that are exactly identified.
SPS=TN(TN+FP)
3) Accuracy (ACC): It is the nearness of calculation results to the true value.

Table 1 Performance evaluation of the parameter

Sr. No.	Parameters	Optimization Rate
1	Sensitivity	0.9016%
2	Specificity	1.0000%
3	Correct rate	0.9523%
4	Error rate	0.0476%
5	Accuracy	95.23%

V. RESULTS

Graphical user interface is created on MATLAB and using the GUI check whether the patient is normal or seizure figure 4 ,5 shows the graphical representation or performance to detection of seizure or a normal on MATLAB process dataset input from database then at test input database with artefact and pre-processing we give without artefact data.

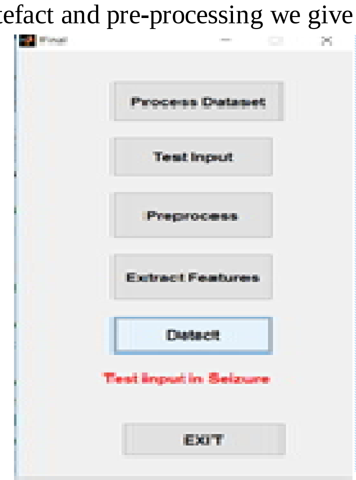

Fig.4 GUI EEG Detection with Test Input Seizure.

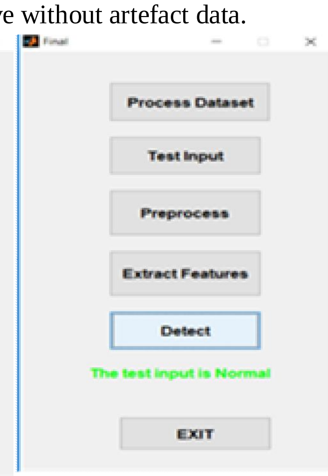

Fig.5 GUI EEG Detection with Test Input Normal

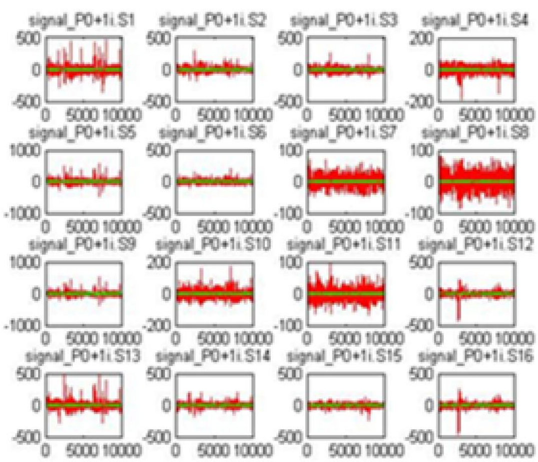

Fig. 6 Input database with artefact

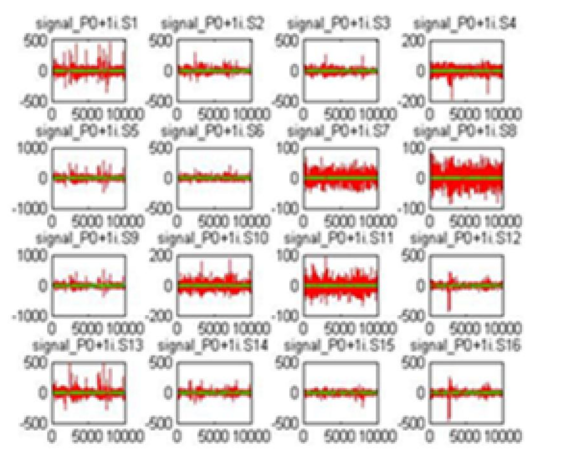

Fig. 7 Test input after pre-processing that is removing artefact

VI. CONCLUSION

In this work have implemented seizure detection for using physionet database. The processing is ready using SVM detector along with unique feature characteristics which shows 0.90% Sensitivity, Specificity 1% with better accuracy that is up to 95%.

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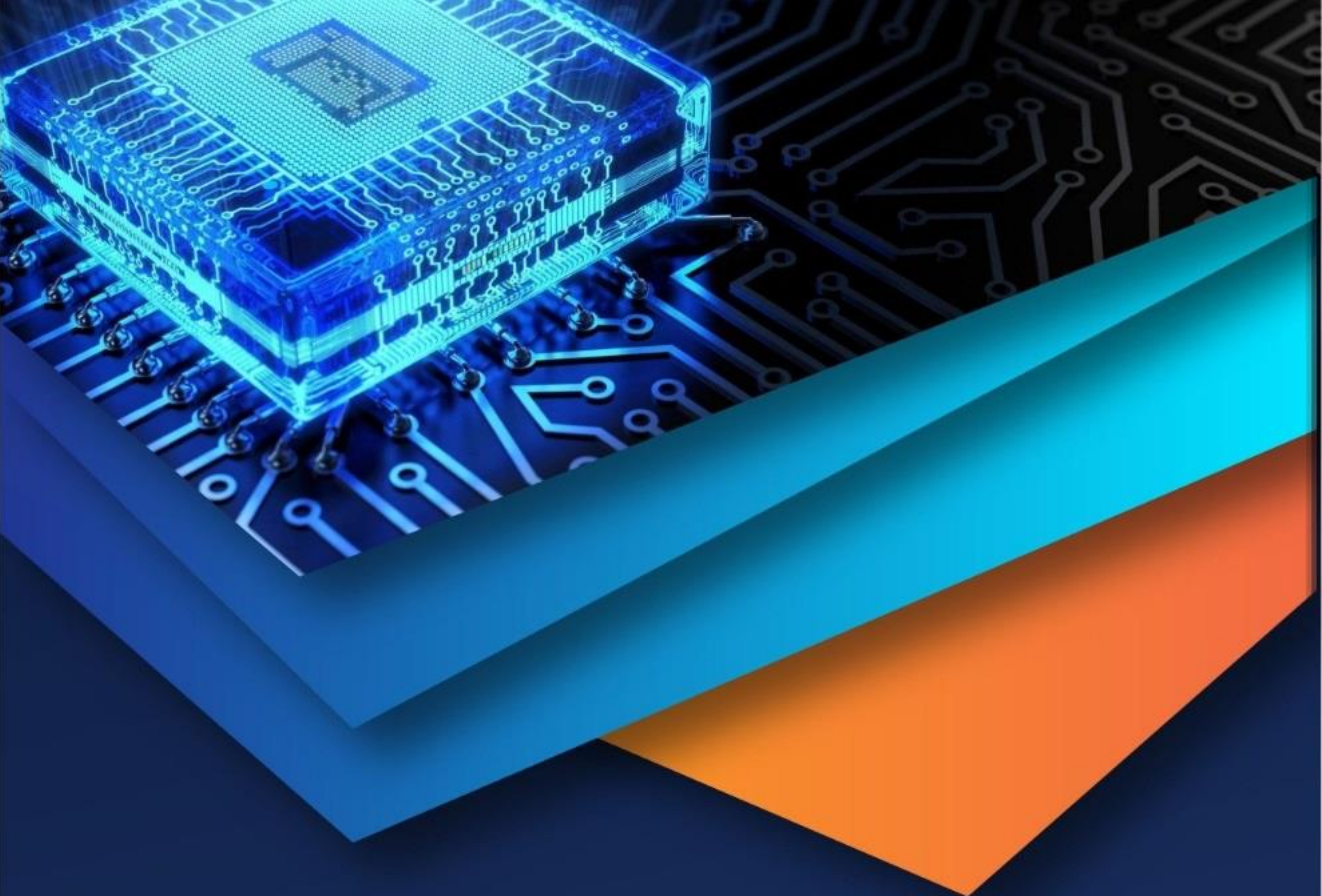

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