Epileptic Seizure Detection Using Eeg Signals And Multilayer Perceptron Learning Algorithm

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Abstract: Purpose: Epileptic is a neurological chronic disorder that causes unprovoked, recurrent seizure. A seizure is a sudden rush of electrical activity in the brain. The central nervous system characterized by the loss of consciousness and convulsions. Epileptic is caused by abnormal electrical discharge that lead to uncontrollable movements, loss of consciousness and convulsions. 50-80 million people in the world are affected by this disorder. Now a days children and adults are affected the most and it has been medically treated. Sometimes it may lead to death and serious injuries. In this technology world the computerized detection is an enhanced solution to protect epileptic patients from dangers at the time of this seizure. Method: Perceptron learning algorithm is a supervised learning of binary classifiers and also it is a simple prototype of a biological neuron in artificial neural network. EEG is extensively documented for the diagnosing and assessing brain activates and related disorders. In this paper EEG signals are taken as dataset for epilepsy detection. The data is been represented based on three domains namely frequency, time and time-frequency applied by the chebyshev filter for processing the signals. Result: Help the patients from dangers at the time of the seizure. Conclusion: The neurological diseases can be divided into two loss of consciousness and convulsions. In this technology world the seizure can be detected by computerized way like EEG and so on. This paper proposes an epileptic seizure detection using EEG (Electroencephalogram) and perceptron learning algorithm.

Index Terms: Epileptic Seizure,Electroencephalogram,Feature extraction,Multi-Layer Perceptron Learning Algorithm, Support Vector Machine, Wavelet.

1 INTRODUCTION
Brain is one of the soft tissue organ of human beings and the epileptic is the trouble that happen to the brain nervous. This is the neurological diseases due to loss of consciousness and convulsions. Still not yet find the exact reason for the epileptic seizure but it been medically treated based on the loss of consciousness and convulsions. Sometimes this diseases can cause harmful injuries and so lead to death. As it is affected to brain, when the brain perform rational task it is been tracked by the clinical tool called EEG (Electroencephalography). EEG is of the most significant diagnosis of epilepsy. The lasting EEG footage of each patient contain a massive volume of data. The epileptic detection is very challenging procedure that necessitate an in depth analysis of entire footage of EEG data. The seizure can occur in random time so the signal must pass through different stages like pre-processing, feature extraction and classification. Pre-processing is important process for feature extraction and is done by three domains i.e. time, frequency and time-frequency. Time is used to calculate the amplitude, regularity and synchronization. The frequency patterned the brain events at different frequencies and the time-frequency used to sketch the different actions of brain at different frequencies. The future extraction can be done using different methods like wavelet, wigner-ville distribution, EMD (empirical mode decomposition), matching pursuit etc. Perceptron learning algorithm is a supervised learning of binary classifiers. Given a vector of numbers, the binary classifiers decided, what specific class the input belongs. The objective of the paper is to help the patients from epilepsy using computerized way.

2 RELATED WORK
Brain is important fact for each and every human and the disturbance that happened to the brain due to different reasons like loss of consciousness and convulsions is been tracked by the electroencephalogram (EEG). Till now there is no standard technique has been assumed for studying or analysis on EEG signals, so the parameters keep on change as the use of different technique. In this section, a review of different papers that related to epileptic seizure and the different techniques used for detecting and classify the seizure have been discussed. In [1] have come up with the epilepsy seizure detection using EEG signals and continue the EEG signals in both time and frequency domain and using Chebyshev filter method for prepressing the EEG signals. Wavelet is used to decompose the filtered EEG Signals. For feature extraction Discrete Wavelet is been used, threshold methods has been used to implement the work to detect the noisy signals. In [2] authors have proposed a method that deals with the time-frequency of EEG signals and they compared the system performance and analyzed in terms of different domain like time, frequency and time-frequency analysis with Fourier Transform, Gabor Transform, and Wavelet Transform. In [3] authors have come up with Wavelet transform for detecting the Epileptic seizure. The motive of the paper is to study and to compare the different techniques used for the future extraction. As their observation Wavelet Transform is most efficient technique that can give healthier performance. In this [4] paper authors revealed with the mathematical methods like linear analysis of one dimensional in domain frequency and time frequency. They also used different methods like FFT (Fast Fourier Transform), Wavelet Transform, Discrete Wavelet Transform etc. In this[5] work authors have demonstrate time–frequency analysis to classify the EEG signal segments and also used different methods to calculate the power segment of each segment of EEG signals .This distributes the energy of signals on the plane. Later this features are provided into the artificial neural network that has classifies the segments.

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3 MATERIAL AND METHODS

Alpha, beta, gamma, theta and delta are different types of EEG signal that ranging from 0.5Hz to 30Hz. These are the signals that are composed from electrodes that positioned on scalp of epileptic patient. Diagnosis is the tactic use to analyses the seizure but different method is used for feature extraction to classify. All the methods are related to neural network. To detect the seizure there is several stage i.e. data collection, and pre-processing, feature extraction and classification.

3.1 Proposed Method

The main objective of this paper is to identify the occurrence of epileptic seizure or non-occurrence of seizure using EEG signals. We have used the online available dataset from university hospital of Bonn and the data set is divided into 5 subset. Set A and Set B gives the EEG report of healthy patients. Set A describes the healthy person during eyes open. Set B describe the healthy person during eyes closed. Set C and D describes the recordings of the seizure free epileptic patients and the last set E contain the epileptic seizure patients. To accomplish the supreme spectral effectiveness, we have applied the Chebyshev filters to clean the unwanted data from EEG signals. After the filtration, decompose the signals with Wavelet analysis. During decomposing the signals, the frequency can fluctuates at different level, in order to avoid this we use dissimilar wavelet filters on individual level with respect to frequency response. Intended for feature extraction, we used Discrete Wavelet Transform as far as coefficient vector and in respect of time and frequency examination utilizing DFT and IDFT process, and the vitality of every coefficient was determined. Hard and soft thresholding used as the final extraction development for finding the noisy signals. For classification part used Multi-layer perceptron algorithm to identify the presence on seizure in the EEG signals of the patients. The following fig.1 shows the overflow of the proposed method.

3.2 EEG Signals

As revealed above, we have used online available dataset is used which contains five different sets (A, B, C, D, and E). Each dataset contain 100 segments with the frequency sampling of 173.60 Hz with the duration of 23.6 seconds. In this paper, this dataset is used as the input for the proposed method. The following fig.2 shows one sample input signals used as input in the work.

3.3 Filtration

For the filtration part Chebyschev1 filter method is used for getting maximum spectrum proficiency that is directly proportional to the order of the filter, band stop and band pass coefficient. This filtration reduce the spectrum noise. The following fig.3 shows one sample filtration output of this work.

3.4 Decomposing

Utilizing Wavelet Analysis, the separated EEG sign was deteriorated into different sub-band levels in both time and frequency. In spite of the fact that we have disintegrated the sign into di diverse sub-groups, we just utilized the most minimal recurrence sub-band for highlighting extraction and processing it features will diminish range of utilization as the time complexity decrease. The decomposing of EEG signals is
shown below in fig.4 [7].

3.5 Feature Extraction
Discrete Wavelet Transform was applied for feature extraction for obtain time and frequency factor by applying DFT and IDT process. Moreover, we have chosen the most minimal removed recurrence sub-band for further investigation. Also the energy of each wavelet coefficients and calculate to obtain features of the signals. Subsequently coefficients are separated at each sub band level and applied to the first sign in both time and recurrence area.

3.5 Thersholding
Separating and expelling the clamor of the signal was utilized for the combination of conclusive extraction of the EEG flag by applying Wavelet compression technique. At that point both hard and soft thresholding was applied so as to decide the loud pieces of the signal. In any case, hard thresholding was not able to recognize the loud piece of the signal. Subsequently we have covered the sign with a rectangular capacity so as to see the intermittence because of commotion. For thresholding have experienced soft, hard, firm non-neg garrote. The following fig.5 threshold output of the work.

3.6 Classification
Multi-perceptron algorithm is used for classification. Which is feedforward artificial neural network. It creates output from a fixed inputs, which is described by a few layers of info hubs associated as a coordinated chart between the information and yield layers as in the figure 5 which is given below[8].

SVM (Support Vector Machine) is a binary classifier which is considered as an amazing asset of genuine information arrangement. SVM is a discriminative classifier that finds an isolating hyperplane between two classes which will distinguish the biggest least edge between them [9]. The following fig. 7 shows a support vector machine method.
The following table shows about the sensitivity (Se), specificity (Sp) and accuracy (Acc) values in Percentage for the Multilayer perceptron algorithm and Support vector machine classifications.

Table 1. Sensitivity, Specificity and Accuracy in percentage.

<table>
<thead>
<tr>
<th>Classifier</th>
<th>Se</th>
<th>Sp</th>
<th>Acc</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLP</td>
<td>98%</td>
<td>93%</td>
<td>97.7%</td>
</tr>
<tr>
<td>SVM</td>
<td>99%</td>
<td>98%</td>
<td>97%</td>
</tr>
</tbody>
</table>

As shown in above table 1 we have compared the performance of MLP and SVM in various aspects and have achieved the best results for our proposed method added to the existing one that we have come across through the literature review.

5 CONCLUSION
In this paper we have come up with the efficient detection of epilepsy using the EEG processing methods that can be implemented in the microcontroller device. The methods that were utilized in this paper, for example, separating, deteriorating, include extraction, thresholding and ordering are all among the most effective and instructive procedures that are utilized in examining EEG signal and with an accuracy of 97% using SVM and 97.7% using MLP. We determine that our work can be appealing when actualized on an inserted gadget for checking Epileptic patients.

6 REFERENCES
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