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A Review on EPILEPTIC SEIZURE PREDICTION SYSTEM

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ABSTRACT: Epileptic seizures occur because of brain abnormalities which will indirectly have an effect on patient's health. It happens with none symptoms and therefore will increase the rate of humans. virtually 1 Chronicles of world's population suffers from epileptic seizures. Prediction of seizures before the start of onset is useful for preventing seizures by medication. Nowadays, trendy procedure tools, machine learning, and deep learning strategies are wont to predict seizures mistreatment EEG. However, EEG signals might get corrupted with ground noise, and artifacts like eye blinks and physical movements of muscles might cause "pops" within the signal, leading to electrical interference, that is cumbersome to observe through visual review for extended length recordings. These limitations in automatic detection of interictal spikes and epileptic seizures ar most well-liked, that is a vital tool for examining and scrutinizing the EEG recording additional exactly. These restrictions bring our attention to gift a review of machine-controlled schemes which will facilitate neurologists categorise epileptic and nonepileptic signals. whereas getting ready this review paper, it's discovered that feature choice and classification ar the most challenges in encephalopathy prediction algorithms. This paper presents numerous techniques betting on numerous options and classifiers over the previous couple of years. The strategies bestowed can provides a careful understanding and ideas concerning seizure prediction and future analysis directions.

KEYWORDS: filter, power, electro encephalo gram (EEG), epilepsy, seizure.

I. INTRODUCTION

I. INTRODUCTION:

Epilepsy is one amongst the chronic severe noninfectious brain disorders globally, and anyone are often plagued by seizures at any age notwithstanding gender or group. encephalopathy subjects expertise several challenges in their daily routine life. they have to take comfortable care to match up with this ill health. once a seizure happens, it should bring some injury or perhaps create life risky to the patient or others, principally managing serious machinery industries or driving vehicles. virtually 1 Chronicles of the planet population has encephalopathy, and annually, new cases of eighty per a hundred thousand individuals develop the case of encephalopathy even in developed countries. a facet of an individual's life could also be extremely afflicted by encephalopathy for psychological and social reasons. it's additional common for young kids and adults. It happens slightly additional in males than in females. encephalopathy is incurable, however the disorder are often in check with medications and different methods..

Electroencephalogram (EEG) signals ar primarily employed in encephalopathy studies to observe abnormality of the brain through seizure conditions. EEG may be a sensible, simple, not offensive technique typically used for brain activity checking and analysis of encephalopathy. this may be tired either manual or automatic manner. sleuthing AN expert's seizure and seizure length in EEG recording is sophisticated and long. One usually wants hours to days of knowledge to review EEG recordings for one seizure subject. If AN automatic seizure detection system is accessible, it might cut back the time needed by doctors to perform AN offline diagnosing by examining EEG knowledge. Therefore, automatic detection of seizure activity is of high connection. encephalopathy detection from input EEG signal involves many complicated examinations that need time and energy.

Furthermore, diagnostic accuracy is additionally not consistent even from the specialists with differing levels of

diagnostic expertise. In general, options within the time and frequency domain are extracted from the input and classified with the assistance of machine learning classifier models. Though feature extraction may be a crucial step in determining the classification, because it for the most part determines its accuracy, feature choice is additionally predominant in several existing works. Moreover, typical machine learning algorithms for seizure detection cannot effectively accommodate multichannel EEG (EEG) knowledge containing temporal and spatial data.

II. LITERATURE REVIEW

The following techniques are developed for diagnosing. Earlier during this work, many authors have reviewed the strategies and approaches that take care of seizure detection and classification.

Prof. Sandhya Shinde [1] having the ability to predict seizures and couple this data with state of the art technology can permit patients to require action before the incidence of the seizure and therefore, minimizing potential risk. Developing such prediction devices are very useful for the epileptic patients since they're going to be ready to perpetually monitor their state autonomously and maybe stop their hospitalization.

A short comparison of various techniques used for seizure detection mistreatment options of the signals is reviewed by Mosheni et al. [2]. This work has compared strategies supported nonlinear statistic analysis, supplying regression, time-frequency distributions, and ripple remodel analysis. The authors have all over that a median accuracy of 100 percent is earned for the individual dataset signals mistreatment the entropy feature.

Tzallas et al. [3] mentioned machine-controlled seizure detection strategies supported multiple aspects like detection supported morphological analysis, mimetic techniques, guide matching, parametric, feature-based, and artificial neural network base. lastly, the authors have mentioned that locating epileptic activity or interictal spikes within the EEG recording is cumbersome and needs effective machine-controlled strategies to exactly localize the delicate abnormality within the recording.

On the opposite hand, seizure detection mistreatment procedure intelligence techniques with around 278 patients was bestowed by Teixeira et al. [4]. The authors have compared multiple feature-based algorithms with completely different classifiers during this review. lastly, the authors have mentioned that testing on long continuous signals is crucial because it evaluates the realistic situation prediction, significantly for sleuthing false alarms. Finally, the authors have noted that a lot of testing samples will acquire adequate and correct results.

Parvez and Paul [5] have bestowed a short review of literature on feature extraction from the attack and interictal signal mistreatment numerous established transformation strategies. The authors have projected completely different strategies used within the remodel domain and its corresponding feature used for classification. they need all over that the smallest amount square-based support vector machine classifier yields high accuracy and responsibility once tested with completely different datasets and multiple feature sets. except for these remarks, the authors have all over that bigger consistency are often achieved once the recordings are taken at 2 or additional locations on the brain. Lin et al. [6] planned extraction and classification of options from encephalogram signal to visualize the link among the encephalogram signal variations and corresponding emotions. Current brain activity will be noted victimization associate degree medical instrument to spot the relation between emotions and brain activity signals. completely different machine learning systems area unit employed in this work to categorise encephalogram dynamics.

Wu et al. [7] explained a framework of theorem for modeling multichannel encephalogram signals. Multichannel encephalogram at the same time measures synchronic brain actions at several sites on the scalp at time unit temporal resolution. tiny spatial resolution is that the issue of encephalogram signal so the signal received at each channel could be a combination of diminished actions from several brain regions, and it usually undergoes interference from varied artifacts (e.g., muscular, cardiac, and ocular). S/N (SNR) should be raised to get rid of the matter of this sort.

Alotaiby et al. [8] given a criticism on convulsion detection. The seizure finding method will be done employing a single or multichannel conductor as a base. Seizure detection victimization monaural desires a correct channel selection that covers the sturdy encephalogram signal cached as a seizure spot. This assortment procedure principally depends on action trials assessed for the dissimilar conduits instantly. most seizure prediction and detection strategies settle for

time or rippling domain feature getting rid of techniques. Few approaches used time and frequency and wavelet-domain options as cross options and earned improved recital victimization either time or frequency domain.

Ilyas et al. [9] given a technique of classification of encephalogram signals victimization completely different classifiers. it's perpetually troublesome to extract the options and helpful data from encephalogram signals of a colossal volume and inferiority, less organized information and artifacts. The optimum classification technique and correct choice of a classifier for the encephalogram signals area unit essential.

Mursalin et al. [10] have given a combined approach during which the options area unit extracted in time and frequency domains. Time-domain options embrace a mean, kurtosis, mark and repose mark vary, skewness, and variance. Similarly, sure metrical options area unit extracted from the rippling domain. Later, the authors have utilized the liquid ecstasy, min, mean, and variance of the rippling coefficients. during this work, the authors have enclosed the idea of a correlation-based improved feature choice algorithmic program to pick optimum parameters, and a later random forest classifier is employed whose results area unit tested on the city dataset.

Dalton et al. [11] have planned associate degree algorithmic program that aims to observe seizure detection each in standalone and in-network modes. during this work, the authors have developed a body detector network that intends to extract a monaural encephalogram signal that may be monitored to observe associate degree convulsion. The detection is performed with the assistance of sure parametrical entities like mean, variance, zero crossings, entropy, and root mean sq. error. These entities all represent a feature vector for a time-domain signal.

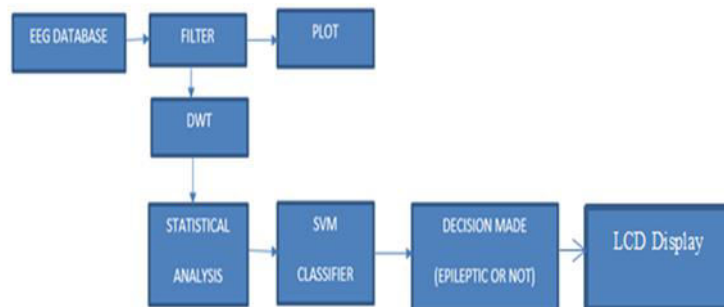
In [12], Hill has given a seizure detection mechanism during which quick Fourier remodel (FFT) was used for every window, and frequency within the vary of 1-47 Hz was thought-about, and part data was discarded. Eigenvalues and correlation coefficients area unit calculated in a very time domain and frequency domain, severally, and thus, it generates the feature vector matrix.

A multichannel seizure detection algorithmic program has been prompt by genus Rana et al. [13], and this uses a part slope index (PSI) algorithmic program. This metric is employed to differentiate seizures from nonseizures. It measures the variations of signals among 2[the 2} channels and so classifies the expansion within the spatio-temporal communications amid those two channels; this can be to differentiate between the interictal activity and seizure.

Guo et al. [14] planned a unique technique for automatic seizure discovery, line length feature parameters, multiresolution decomposition, and rippling analysis side with neural network (ANN) to categorise the encephalogram signals regarding the presence of seizure. This methodology includes 3 steps. within the starting, separate rippling remodel is applied for breaking down the encephalogram signal into a number of subband signals. Followed by DWT, the road length feature parameter is extracted from each frequency signal band

III. PROPOSED METHODOLOGY

The sign or encephalogram signal is given to FIR filter and also the smoothed output from this filter is taken because the input to next stage i.e. DWT (discrete rippling transform). Since encephalogram signal is time dependent we've to use DWT that introduces a helpful illustration of a perform within the time-frequency domain. the most objective of rippling analysis is to decompose signals into many frequency bands. Then the third stage is SVM (support vector machines). it's an automatic machine learning algorithmic program supported the idea of call planes that decides call boundaries. options of encephalogram signals area unit extracted and limits of all the options area unit determined victimization

Block Diagram**13.1 EEG Database :**

The dataset is a pre-processed and re-structured/reshaped version of a very commonly used dataset featuring epileptic seizure detection.

13.2 Band pass filtering :

A band-pass filter, additionally band pass filter or BPF, is a device that passes frequencies at intervals a definite vary and rejects (attenuates) frequencies outside that vary. Band pass is associate degree adjective that describes a sort of filter or filtering process; it's to be distinguished from pass band, that refers to the particular portion of affected spectrum. Therefore, "A twin band pass filter has 2 pass bands." A band pass signal contains a band of frequencies not adjacent to zero frequency, such signal comes out of a band pass filter.

In wireless transmitters and receivers Band pass filters are used. To limit the bandwidth of the transmitter of the output signal to the band allocated for the transmission is the main function of such a filter. This prevents the interference of the transmitter station. In a receiver side the main of band pass filter is, to allow signals within a selected range of frequencies to be heard or decoded, & avoiding signals at unwanted frequencies from getting through. A band pass filter also provide a function in which it optimizes the signal-to-noise ratio and sensitivity of a receiver. In both ends of applications means transmitting and receiving, band pass filters are used, which are having the optimum bandwidth for the mode and speed of communication being used, also it enables to maximize the number of signal transmitters that can exist in a system, and minimizing or avoid the interference or competition among signals

13.3 Discrete wavelet transform(DWT):

DWT (discrete wavelet transform). Since EEG signal is time dependent we have to use DWT that introduces a useful representation of a function in the time-frequency domain. The main objective of wavelet analysis is to decompose signals into several frequency bands.

DWT is the most promising method for extracting features from EEG signals. The wavelet transform is a linear time-frequency transform represents an efficient analytical tool in signal processing, pattern recognition and classification. It is widely used in biomedical signal processing since it is capable of localizing the information in both time and frequency. The EEG signal is decomposing into its sub-groups by discrete wavelet transform to extract highlights from the theta, alpha and beta groups

13.4 Statistical Analysis

The EEG signal is decomposing into its sub-groups by discrete wavelet transform to extract highlights from the theta, alpha and beta groups i.e. it is utilized to part the signal into five frequency groups. Different highlights, for example, the mean, variance, standard deviation, maximum amplitude, minimum amplitude, power, energy, correlation, homogeneity can be extracted from the sub-groups. The estimations of these highlights are fed to a Support Vector Machine to isolate the classes into epileptic and non-epileptic seizures after performing statistical analysis on it.

13.5 Support Vector Machine (SVM):

For the classification of the EEG signals the Support Vector Machine is used, it is used to differentiate between the electrical activity of a healthy subject and an epileptic one. We used SVM, to plot each data item as a point in n-dimensional space with the value of each feature being the value of a specific coordinate, hence the classification is done. The SVM primarily consists of constructing an optimum hyper plane that maximizes the margin of separation amid two different classes. To do so a kernel is used to transform the input data to a higher dimensional space followed by an optimization step for the construction of an optimum hyper plane. We will create non-linear decision boundaries using kernel to separate the raw data which is we are collecting from the brain waves and which is non linear. A kernel is used to convert non-separable problem into a separable problem by transforming low dimension all input space to a higher dimensional input space. The main function of the kernel is to compare the data into different feature space in order to construct linear or non-linear classifiers in the original space. Kernel also provides some function in which it does some extremely complex data transformations and then finds out the process to segregate the data based on the outputs we have defined. The classifier will thus be able to classify the seizure precisely and at the same time be robust with respect to EEG signal variations across assorted mental states and subjects. In our database we stored EEG signals obtained from healthy (non-epileptic) and epileptic subjects which is used by the SVM classifier for the epileptic seizure detection should, cross validation and testing with the extracted features using DWT of the EEG signal.

13.6 LCD Display:

Finally corresponding output will be displayed on LCD screen using ARDUINO UNO as either “patient can get epileptic seizure in future” or “patient is healthy” depending on SVM classifier output..

IV. CONCLUSION

In this paper the novel approach is presented to predict the epileptic seizure using power analysis in beta band of the EEG signals. The topographical map of the brain is divided into five region and the value of power is calculated from these five regions. So, the multichannel analysis of EEG signal is done with less computational complexity and fast speed. The particular time for the seizure prediction is the pre-ictal interval. Analysis with the EEG data shows the promising results. From results it is clear that the value of the power in beta band increases suddenly during the pre-ictal period. So, the epileptic seizure is predicted in advance and advance warning can be given to the epileptic patient. With the help of the advance warning and the medication on time the effect of the seizure can be aborted. Also, the particular region of the brain responsible for the epileptic seizure like temporal region in this work is also localized. Future work will be carried out to exactly predict the earliest time for onset of the epileptic seizure. Large sample size is required for the validation of findings of the result.

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