

Epilepsy Detection using GSM and Real Time EEG Device

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Abstract: Epilepsy is a type of brain activity that momentarily interferes with a brain's ability to function normally. A hereditary condition or a traumatic brain injury may cause epilepsy. The Electroencephalogram (EEG) signal is the name given to brain waves. Different EEG signal characteristics are needed for medication. The energy, standard deviation, and Shannon entropy of EEG waves can be used to identify epilepsy. Medications, surgery, neurostimulation, and dietary changes are frequently used to treat epilepsy.

Four frequency components are identified after decomposing EEG signals. According to a report by the World Health Organization (WHO), epilepsy affects more than fifty million people worldwide. The time-frequency domain coefficients of EEG signals were segmented up to the sixth level of wavelet packet decomposition. Proposed EEG gadget connected to a buzzer, GSM module, and DSP processor. Utilized MATLABKeywords: EEG, SVM, GSM, Wavelet transform, MATLAB & DSP

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1.0 Introduction

In the UK, there are more than 6 lakh instances of epilepsy. About 2% of the population around the world (approximately 56 million) have epilepsy, and almost 75% of the cases occur in creating nations [2]. Epilepsy can't be cured, however epilepsy seizure is doubtlessly controllable with prescription in around 60% of aggregate epilepsy cases. However in those whose seizures don't react to pharmaceutical, surgery changes identified with eating regimen might be considered [4].

Electrical movement is occurring in our cerebrum constantly [3]. A seizure consequences of a hasty blasted of extreme electrical movement [6]. This movement makes a brief aggravation the typical working of cerebrum, implying that the mind's messages getting stirred up in this way result in an epileptic seizure [2].

In medication, treatment is not given unless its level get identified. EEG signal characters are statistically calculated and send through GSM to doctor. EEG has three stages preictal, ictal and postictal. Ictal stage records are stored.

Interdisciplinary type of research allows the researcher to learn by making connections between ideas and concepts across different disciplinary boundaries. Researcher learning in this way is able to apply the knowledge gained in one discipline to another different discipline [7]. Collaboration is necessary for effective research and research output. Interdisciplinary work together to serve a common purpose and to help exchange of ideas between different disciplines or subject areas. In medicinal approach to give treatment on epilepsy R waves in the gathered ECG information were recognized and each RRI (R-R interim) .The got crude RRI information was resample with the goal that its testing focuses were masterminded at break even with interims. In this work, the third-arrange spline was utilized for RRI insertion, and the inspecting interim of the inserted RRI was one seconds.

There are two types of epilepsy primary (Idiomatic) and secondary (Symptomatic).

Primary (Idiomatic):

1. Onset in childhood.
2. Good AED response.
3. Probably genetic.
4. Favorable prognosis

Secondary (Symptomatic).

1. Onset any age.
2. Multiple etiologies.
3. Variable response.
4. Brain pathology.

Rhythm/ Brain Waves	Amplitude (uV)	Frequency Band (Hz)
Delta	20-100	0.5Hz-4Hz
Theta	10	4Hz-8Hz
Alpha	2-100	8Hz-13Hz
Beta	5-10	13Hz-30Hz
Gamma	-----	>30Hz

Fig.1 Types of EEG signals

2.0 Literature Review

Internationally large number of researcher are working on epilepsy because of its increasing problems or cases. Epilepsy and seizure control have been published more than hundred kinds of international journals, patents and reports. Epilepsy cases were separated into three

gatherings (G, GF, and F) in light of dispersion of ictal release. Instances of summed up NCSE with central power, comparative to our gathering GF cases, have been accounted for in the writing (Niedermeyer-1979). Published in book written by Simon Shorvon, University of London. Different examiners (Roger -1974; Bauer in 1982; Tomson -1986, 1992; Fagan and Lee, -1990) published his work in springer from University of London.

Our information exhibit that the EEG attributes of NCSE are heterogeneous. Morphology was exceedingly factor, with the four classes of seen in a few cases in each gathering, however no noteworthy distinction was noted among the gatherings [4]. By and large, ASW happened as the prevalent example much of the time. TSW (the morphology of regular nonappearance seizures) was uncommon. MSW happened infrequently in bunch G, be that as it may, not in bunch GF and in just 1 case in assemble F. Generally few cases in the last two gatherings may represent some portion of this inconsistency [9].

A DWT-Entropy-ANN Based Architecture for Epilepsy Diagnosis Using EEG Signals worked at Riyadh, Saudi Arabia with greater accuracy (2016) [4]

Automatic identification of successful memory encoding in stereo-EEG of refractory, mesial temporal lobe epilepsy. This work carried out at University of Texas Southwestern, Dallas, TX, USA with 73% accuracy (2017) [9].

Structural Connectivity of Temporal Lobe Structures Detects Temporal Lobe Epilepsy worked on MRI & DTI at University of Tehran, Iran (2016).

Indian institutions have gained top position in basic research among the top 100 highest performers across the globe, including the Council for Scientific and Industrial Research (CSIR), Indian Institute of Science Education and Research (IISER), Tata Institute of Fundamental Research (TIFR), Indian Institute of Science (IISc) and Indian Institutes of Technology (IITs). Epilepsy is the second most basic unending neurological condition. It is assessed that there are 55, 00,000 people with epilepsy in India, that is, one-eighth of the aggregate epilepsy patients in the world. Though monotherapy is generally suggested in epilepsy however polytherapy is frequently required for patients with numerous seizure sorts or unmanageable disease. Epilepsy can be dealt with viably in roughly 60% of patients who move toward becoming seizure free with the first or second antiepileptic tranquilize (AED) that they are prescribed. The disadvantage of polypharmacy is higher occurrence of antagonistic impacts, sedate cooperation's and included expenses. The last constitutes a practical weight on the patients notwithstanding the current mental therapeutic and social burden.

Pharmacoeconomics is a branch of financial aspects that measures and looks at the cost, dangers, and advantage of projects, administrations or treatments and figures out which elective delivers the best wellbeing result for the asset contributed.

A Real Time Based Wireless Wearable EEG Device for Epilepsy Seizure Control works on wavelet and Heart Rate Variations (HRV) (2015) [3].

Performance Analysis of KNN Classifier and K-Means Clustering for Robust Classification of Epilepsy from EEG Signals worked at Sathyamangalam, Tamil Nadu (2016) [6].

SVM based Automated EEG Seizure Detection using 'Coiflets' Wavelet Packets work carried out at IIT Delhi, New Delhi (2015) [7].

Multichannel Detection of Epilepsy using SVM classifier on EEG signal work carried out at SSGM college of Engineering, Shegaon (2016) [8].

3.0 Materials And Methods

It is related with collection of EEG database from clinic or generate sample signals using formulae using Matlab software for experiment purpose. Training of database using SVM and testing of sample for stored signal. Feature extraction operation is performed using pair of coiflet wavelet transform. SVM classifier algorithm can be used for identification of epilepsy. Then training and testing of signal performed for real time applications. Coiflet wavelet and Pair of wavelet are used for feature extraction process so that 100 percentage accuracy can be obtained. Testing results with suitable DSP processor, buzzer and GSM module interfacing. Design portable device for epilepsy detection and sending recorded data to authorized cell phone with buzzer indication.

SVM- It was spearheaded by Vapnik and Cortes in 1995. It is an overseeing learning model regarded appropriate for handling a lot of information, for example, EEG recordings. SVM is, for the most part, intended to prepare the parallel characterization issue. The primary SVM rule is to locate an ideal hyper plane that isolates two information classes and expands the remove between them.

Automated pre-ictal phase detection-The procedure of the automated pre-ictal phase detection includes a set of described steps.

4.0 Results And Discussion

For EEG signal classification DWT-Entropy-ANN are used but generally SVM gives better results as compare to ANN. For temporal lobe efficiency one can get less accuracy of classification. Real time EEG classification for epilepsy detection carried out using ECG signals (HRV) which is less effective because EEG are brain waves.

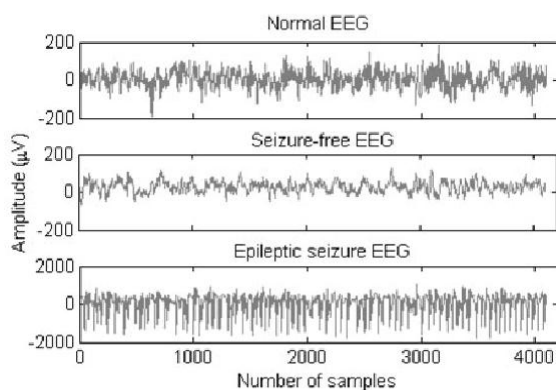


Fig.2 Comparison of EEG

K-means clustering and KNN algorithms are used for EEG classification which gives less accuracy as compare to SVM & DWT. SVM and Coiflet wavelet transform can be used for better accuracy but it is not implemented for real time. Multichannel SVM classifier used for Epilepsy detection with different parameters

5. Conclusion

The proposed system includes a wearable, portable EEG epilepsy detector that is implemented in real time. SVM and a pair of coiflet wavelets are used in the training of an EEG signal database and the testing of sample signals to increase accuracy. To achieve 100% accuracy, a pair of wavelets are used in the feature extraction process.

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