iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 6 **Issue:** X **Month of publication:** October 2018

**DOI:**

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887*
*Volume 6 Issue X, Oct 2018- Available at www.ijraset.com*

# A Review on EEG Brain Signal to Detect Seizure and Non Seizure Condition

D. D. Gorde[1], A.A. Bardekar[2]
*Department of Computer Science and Engineering, SGBAU, Amravati., India.*

***Abstract:*** ***Epilepsy is the 4th most common neurological disease in the world among them 1%–2% of the world's population has epilepsy, a neurological seizure that occurs when several nerve cells in the brain generate excessive and repetitive electric impulses over a short period of time. Electroencephalography (EEG) enlighten about the state of the brain i.e. about the electrical bustle going on in the brain. A seizure is an event that causes an abrupt surge of electrical activity in the brain, where epilepsy is the disease involving recurrent unfair seizures. Signal modeling gives us automatic seizure detection in EEG signals. Diagnosis of epilepsy requires long term electroencephalography (EEG) monitoring. The perception of long-term EEG monitoring takes a lot of time and requires the assistance of experienced experts. This paper gives the ideas about analyzing EEG signals based on different reviews of authors.***

***Keywords: Detection, EEG , Epilepsy, Seizure ,Non- Seizure, Signals, brain waves.***

## I. INTRODUCTION

Your brain is alive. Your brain shapes how you see your environment, highlights objects and information most relevant to you. It creates its own stories based on your thoughts, emotions, desires and experiences. Electroencephalography (encephalon = brain), or EEG, is the physiological method of choice to record all of the electrical activity generated by the brain from electrodes placed on the scalp surface. For faster application, electrodes are mounted in elastic caps similar to bathing caps, ensuring that the data can be collected from identical scalp positions across all respondents. The diagnosis of epilepsy relies on the clinical history of the patient, computed tomography (CT), magnetic resonance imaging (MRI), video-recording, and electroencephalography (EEG). EEG measures electrical activity generated by the synchronized activity of thousands of neurons (in voltage). It also provides excellent time resolution, allowing you to analyze which brain areas are active at a certain time, even at sub-second timescales. EEG is one of the fastest imaging techniques available as it can take thousands of snapshots per second (256 Hz or higher). 100 years ago the EEG time course was a plot on paper. Although a routine EEG is usually performed in a neurophysiology laboratory over a short period of time, continuous EEG monitoring of more than 24 h is becoming a common procedure to assess brain function and detect seizure activity, especially in critically ill patient. Moreover, the analysis of continuous EEG monitoring takes a lot of time and requires experienced epileptologist. Therefore, it is difficult to use long-term EEG monitoring as the universal procedure in many hospitals.

A seizure is an event that causes an abrupt surge of electrical activity in the brain, where epilepsy is the disease involving recurrent unprovoked seizures. An epileptic seizure is a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain. Epilepsy is the 4th most common neurological disease in the world. Electroencephalography (EEG) is the most reliable and commonly used tool for the prediction of epilepsy. It requires long time monitoring and experts. Also it is time consuming and required high cost. When someone has had seizures, and it is thought that they might have epilepsy, there are various tests that their specialist might ask for. A neurologist (someone who specializes in nervous system disorders) interprets the recordings from the EEG and then sends the results to your doctor. There are two types of results include one is normal and other is abnormal.

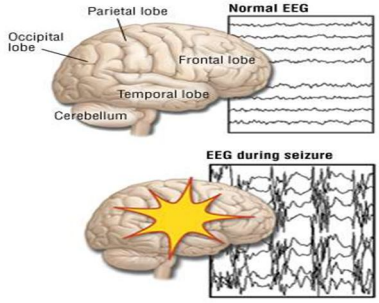



Fig. Seizure and non seizure EEG

## II. LITREATURE REVIEW

Seizure detection is performed in three stages: preprocessing, feature extraction, and classification. We used feature extraction which is nothing but the process of calculating the feature vectors of the EEG signals. Both feature extraction methods and classification methods are very important in pattern recognition, because their algorithms can affect the detection accuracy and calculation time. These methods require high detection performance for offline seizure analysis.

Miran Lee, Inchan Youn, Jaehwan Ryu, Deok-Hwan Kim[1] was proposed the technique of a novel feature extraction method, a slope of counting wavelet coefficients over various thresholds (SCOT) method based hidden markov model (HMM) for seizure detection. The purpose of that proposed method is to aid in the diagnosis of epilepsy, which requires long term electroencephalography (EEG) monitoring. The interpretation of long-term EEG monitoring takes a lot of time and requires the assistance of experienced experts. In order to overcome these limitations, it is important to apply the optimized feature extraction algorithm to the seizure detection system. The proposed SCOT method based HMM has a robust detection accuracy, and a short feature extraction time.

Anubha Gupta, Pushpendra Singh, et al [2] was presented the technique consists of three stages. First, a multirate filterbank structure is proposed that is constructed using the basis vectors of discrete cosine transform (DCT). The proposed filterbank decomposes EEG signals into its respective brain rhythms: delta, theta, alpha, beta, and gamma. Second, these brain rhythms are statistically modeled with the class of selfsimilar Gaussian random processes, namely, fractional Brownian motion (fBm) and fractional Gaussian noises (fGn). The statistics of these processes are modeled using a single parameter called the Hurst exponent. In the last stage, the value of Hurst exponent and autoregressive moving average (ARMA) parameters are used as features to design a binary SVM classifier to classify pre-ictal, inter-ictal (epileptic with seizure free interval), and ictal (seizure) EEG segments.

Ashley N. Johnson, Daby Sow, et al [3] had told the approach of accounts for the challenges of unbalanced datasets (seizure and non-seizure), while also showing a system capable of real-time seizure detection. The Minimum Classification Error (MCE) algorithm ,which is a discriminative learning algorithm with wide-use in speech processing, is applied and compared with conventional classification techniques that have already been applied to the discrimination between seizure and non-seizure states.

Jasjeet Kaur , Amanpreet Kaur [4] was presented the statistical approaches to analyze EEG data are conversed. The EEG signals have gained a lot of importance in the field of biomedical science in the past few decades. The advancement in technology and its ever increasing demands have encouraged the engineers to ascertain new methods for analyzing these signals. Some of the most widely used methods have been discussed in this paper. These methods can be further modified or combined with some other methods to get more appropriate results. Also, in the later stages, the support vector machines or the neural networks can be used for the classification of signal.

J Satheesh Kumar and P Bhuvaneswari [5] focused on the EEG signals and its characteristics with respect to various states of the human body and also deals with experimental setup of EEG analysis. The rapid advancements in biomedical technology for analysis bio medical signals are an important research area. One such technology is EEG , which is to measure the brain potential in order to help the disable people and obtain the accurate diagnosis of diseases. EEG records brain waves with respect to specific frequency by placing metal electrodes on the scalps.

Wan Amirah W Azlan, Yin Fen Low [6] was explained a review on signal analysis method for feature extraction of electroencephalogram (EEG) signal. It is an important aspect in signal processing as the result obtained will be used for signal classification. A good technique for feature extraction is necessary in order to achieve robust classification of signal. Techniques able to extract the relevant information embedded in EEG signal. The EEG signal contains information which can be correlated with the neuropsychology and brain activity of human brain. Moreover, integrating these techniques is also possible in order to achieve a good result. Basically, feature extraction is very subjective and there are no such best feature extraction techniques.

Tingxi Wena , Zhongnan Zhanga [7] told a genetic algorithm-based frequency-domain feature search (GAFDS) method is proposed for the electroencephalogram (EEG) analysis of epilepsy. In this method, frequency domain features are first searched and then combined with nonlinear features. Subsequently, these features are selected and optimized to classify EEG signals. The extracted features are analyzed experimentally. EEG provides important information for epilepsy detection. Feature extraction, selection, and optimization methods exert significant influence in EEG classification. In the experiments, the standardization and normalization of the features extracted by GAFDS do not affect the accuracy of classification results, indicating that the features extracted by GAFDS have good independence. Compared with nonlinear features, GAFDS-based features allow for high classification accuracy. Furthermore, GAFDS can effectively extract features of instantaneous frequency in the signal after Hilbert transformation, suggesting the good extensibility of GAFDS.

Hafeez Ullah Amin, Aamir Saeed Malik ,Ranai, et al [8] was described a discrete wavelet transform-based feature extraction scheme for the classification of EEG signals. In this scheme, the discrete wavelet transform is applied on EEG signals and the relative wavelet energy is calculated in terms of detailed coefficients and the approximation coefficients of the last decomposition level. The extracted relative wavelet energy features are passed to classifiers for the classification purpose. This presented the use of relative discrete wavelet energy along with machine learning algorithms for the classification and the quantitative analysis of spontaneous EEG signals recorded during complex cognitive task.

M. R. Nazari Kousarrizi, A. Asadi Ghanbari, [9] was described the Brain Computer Interface which is one of hopeful interface technologies between humans and machines. Electroencephalogram-based Brain Computer Interfaces have become a hot spot in the research of neural engineering, rehabilitation, and brain science. The artifacts are disturbance that can occur during the signal acquisition and that can alter the analysis of the signals themselves. Detecting artifacts produced in electroencephalography data by muscle activity, eye blinks and electrical noise is a common and important problem in electroencephalography research. In this research, we used five different methods for detecting trials containing artifacts. Finally we used two different neural networks, and support vector machine to classify features that are extracted by wavelet transform. In our SVM classifier we examine different values for ı which is a very essential parameter in designing a SVM classifier with Gaussian RBF kernel and then the one which obtained the best result was selected.

## III. CONCLUSION

The rapid advancement in biomedical technology for study bio medical signals are an important research area. One such technology is EEG, which is to measure the brain potentially in order to help the disable people and obtain accurate diagnosis of disease. EEG records brain waves with respect to specific frequency by placing metal electrodes on the scalp. The EEG signals have gained a lot of importance in the field of biomedical science in the past few decades. The advancement in technology and its ever increasing demands have encouraged the engineers to ascertain new methods for analyzing these signals. EEG provides important information for epilepsy detection. Feature extraction, selection, and optimization methods exert significant influence in EEG classification. Here we analyze the reviews of different authors and study its techniques for detection of EEG signals.

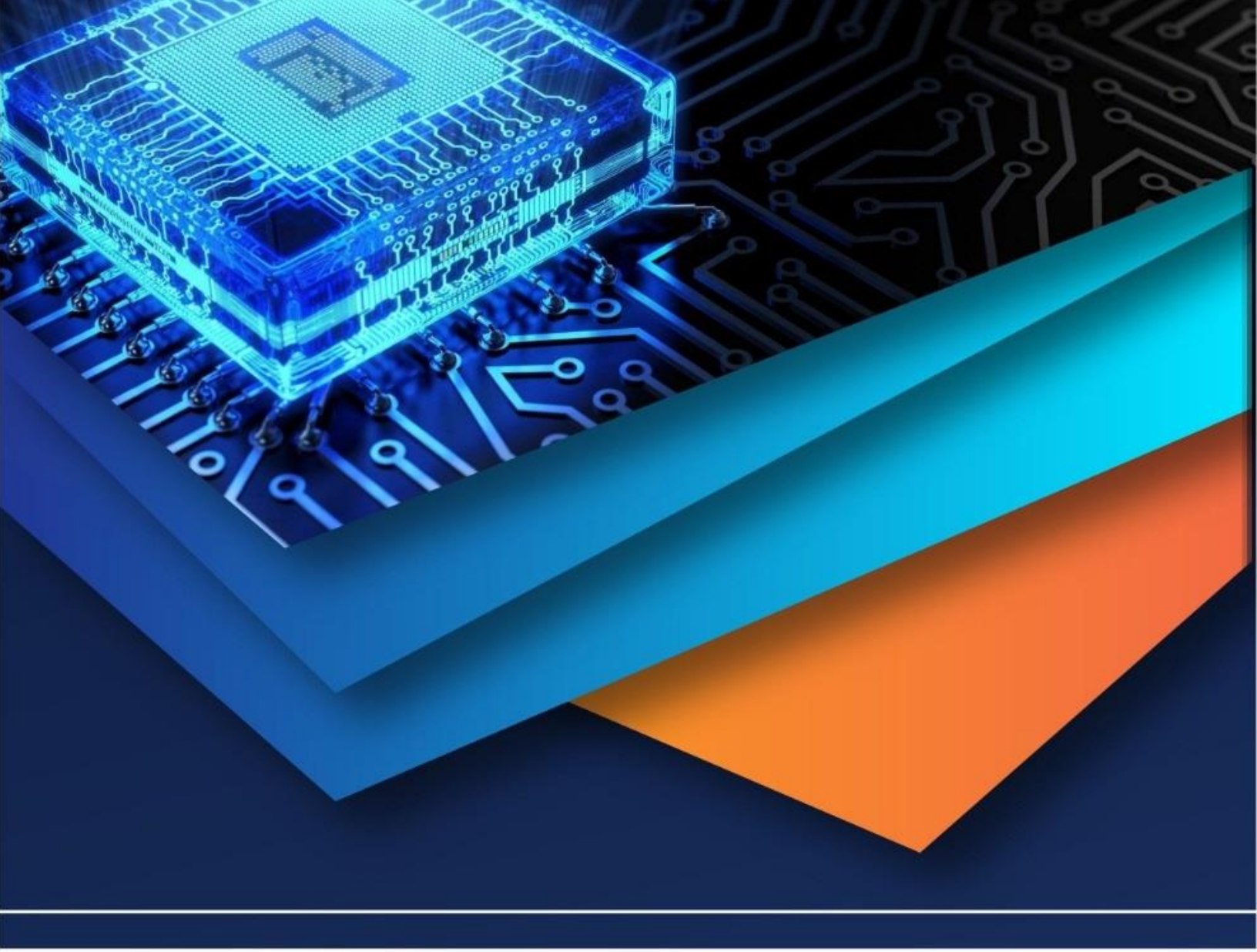
## IV. ACKNOWEDGEMENT

A moment of pause, to express a deep gratitude to several individuals, without whom this paper could not have been completed. I feel immense pleasure to express deep sense of gratitude and indebtedness to my guide Prof. A.A.Bardekar for constant encouragement and noble guidance. I would like to thank Dr.S.A.Ladhake, Principal, Sipna college of Engineering andTechnology,Amravati for his kind co-operation, Guidance and for providing necessary facilities during the period of working on this paper. I express my sincere thanks to Dr.S.S.Dhande H.O.D Department of Computer Science and Engineering for their kind co-operation.

## REFERENCES

[1] Miran Lee, Miran Lee, Inchan Youn, Jaehwan Ryu, Deok-Hwan Kim, “Classification of both seizure and non seizure EEG signal using Hidden Markov Model”, 2018 IEEE International Conference on Big Data and Smart Computing.
[2] Anubha Gupta, Pushpendra Singh, Mandar Karlekar, “A Novel Signal Modeling Approach for Classification of Seizure and Seizure-free EEG Signals”,2018 IEEE.
[3] Ashley N. Johnson, Daby Sow, Alain Biem, “A Discriminative Approach to EEG Seizure Detection”, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta,Georgia, USA; IBM T. J. Watson Research Center, Hawthorne, NY, USA.
[4] Jasjeet Kaur , Amanpreet Kaur, “A Review on Analysis of EEG Signals”, International Conference on Advances in Computer Engineering and Applications (ICACEA) 2015 IMS Engineering College, Ghaziabad, India
[5] J Satheesh Kumar and P Bhuvaneswari, “Analysis of Electroencephalography(EEG) Signals and Its Categorization – A Study”, International Conference on Modeling , Optimization and Computing(ICMOU 2012).
[6] Wan Amirah W Azlan, Yin Fen Low, “Feature Extraction of Electroencephalogram (EEG) Signal – A Review”, IEEE Conference on Biomedical Engineering and Sciences , 8-10 December 2014, Malaysia.
[7] Tingxi Wena , Zhongnan Zhanga ,“Effective and Extensible Feature Extraction Method Using Genetic Algorithm-Based Frequency-Domain Feature Search for Epileptic EEG Multi-classification”, Software School, Xiamen University, Xiamen, Fujian, China.
[8] Hafeez Ullah Amin, Aamir Saeed Malik ,Rana Fayyaz Ahmad, Nasreen Badruddin , Nidal Kamel , Muhammad Hussain , Weng-Tink Chooi, “ Feature extraction and classification for EEG signals using wavelet transform and machine learning techniques” , Australasian College of Physical Scientists and Engineers in Medicine 2015.
[9] M. R. Nazari Kousarrizi, A. Asadi Ghanbari, M. Teshnehlab, M. Aliyari, A. Gharaviri , “Feature Extraction and Classification of EEG Signals using Wavelet Transform, SVM and Artificial Neural Networks for Brain Computer Interfaces” , International Joint Conference on Bioinformatics, Systems Biology and Intelligent Computing 2009

[10] Yilin Song , Jonathan Viventi , and Yao Wang, "Unsupervised Learning of Spike Patterns for Seizure Detection and Wavefront Estimation of High Resolution Micro Electrocorticographic Data"
[11] Malik Anas Ahmad, Waqas Majeed and Nadeem Ahmad Khan, "Advancements in Computer Aided Methods for EEG-based Epileptic Detection", BIOSIGNALS 2014 - International Conference on Bio-inspired Systems and Signal Processing.
[12] Drausin F. Wulsin, Emily B. Fox, Brian Litt, "Parsing Epileptic Events Using a Markov Switching Process for Correlated Time Series", Proceedings of the 30 th International Conference on Machine Learning, Atlanta, Georgia, USA, 2013.
[13] P.Ramina and M.Vanitha, " Fast and Effective Real Time Seizure Prediction on Streaming EEG Signals" , International Journal of Electronics Engineering Research. ISSN 0975-6450 Volume 9, Number 2 (2017).
[14] Steven Baldassano,Drausin Wulsin1, Hoameng Ung,Tyler Blevins, Mesha-Gay Brown, Emily Fox and Brian Litt , "A novel seizure detection algorithm informed by hidden Markov model event states", J Neural Eng. 2016 June.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY