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Epileptic Seizure Prediction using EEG Dataset

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ABSTRACT: In this era, the neurological disease is rapidly increasing worldwide. Also varieties of disease are on rise. Increased demands on health care systems due to neurological disease have become a major concern. Epileptic seizures occur due to disorder in brain functionality which can affect patient's health. Prediction of epileptic seizures before the beginning of the onset is quite useful for preventing the seizure by medication. Machine learning techniques and computational methods are used for predicting epileptic seizures from Electroencephalograms (EEG) signals. However, pre-processing of EEG signals for noise removal and features extraction are two major issues that have an adverse effect on both anticipation time and true positive prediction rate. In that paper a model that provides an methods are pre-processing and feature extraction. Our model predicts epileptic seizures' sufficient time before the onset of seizure starts and provides a better true positive rate. We have applying empirical mode decomposition (EMD) for pre-processing and have extracted time and frequency domain features for training a prediction model.

KEYWORDS: Epilepsy, AED, EEG, LSTM, Natural Language Processing, Machine Learning, Supervised learning, Unsupervised learning, NLP feature, Convolutional Neural Network, FF and BPNN.

I. INTRODUCTION

An association between symptoms and diagnosis is majorly encapsulated within the Disease prediction system using EEG signals. The system tends to analyze and predict the disease/disorder based on the symptoms provided by the patient. EPILEPSY is described as a neurological brain disorder identified by the frequent occurrence of symptoms called epileptic seizure due to abnormal brain activities. Seizure's characteristics contain dropping of cognizance or alertness or responsiveness and disruption in movement, sensation or other cognitive functions.

The most affected age group is the people at extremes of age while among young individuals in ages between 10 to 20 years old the disease crests. Epilepsy has a high disease load where millions of people worldwide may have epilepsy and there are about two million new patients recorded every year. Maximum percentage of the epileptic patients could be controlled by the Anti-Epileptic Drugs (AED) while the other 30% are uncontrollable. The electrical recording of the brain activities is Electroencephalogram (EEG) and is considered the most powerful diagnostic and analytical tool of epilepsy. Physicians classify the brain activity of the epileptic patients according to the EEG recordings into four states: preictal state, which is defined by the time period just before the seizure, ictal state which is during the seizure occurrence, postictal state that is assigned to the period after the seizure took place and finally the interictal state which refers to the period between seizures other than the previously mentioned states. The evaluation of patient-scientific models takes place on the chosen patients by calculating some performance measures accuracy, sensitivity, specificity

and warning per hour. This work we develop a device for epileptic seizure detection which alerts the families of epileptic patients to seek emergency services.

II. RELATED WORK

There are many ways to detect the Epileptic Seizure of the any person like Electrocardiography (EEG), Electromyography (EMG), Galvanic Skin Response (GSR), Heart Rate (HR), and Electroencephalography (EEG). Among them EEG is the best, efficient and fast technique use for monitoring the brain. EEG also very safe and risk-free machine. Using EEG signals, there are many things are possible. One of them is Epileptic Seizure detection. There are many systems to detect Epileptic Seizure via EEG but none of them are detect the Epileptic Seizure and also give a recommendation of music or movie according to the Epileptic Seizure.

[1] Reviewed challenges faced in seizure prediction, analysis methods, and state-of-the-art techniques used, CNN architecture along with LSTM networks and cloud computing process. Additional research on feature extraction techniques. Further, a more sophisticated machine learning algorithm can be used for a more accurate prediction of seizure. Finally, it is difficult to achieve an accurate early seizure prediction because of the limited number and length of EEG data. CNN architecture along with LSTM networks.

[2] The proposed method consists of two significant folds preprocessing and processing, after preprocessing the preprocessed data are used to train the LSTM network followed by a Softmax function is used to classify the inputs data into normal and seizure data. The preprocessing includes three stages, which are the normalization of EEG data, applying appropriate filters to select the interesting parts of the data and data management. After preprocessing the preprocessed data are used to train the LSTM network followed by a Softmax function is used to classify the inputs data into normal and seizure data.

[3] Selection of a suitable classifier, performed a classification of the ictal state with rest of states of seizure. In first phase Support Vector Machine is chosen as a classifier due to its superior performance in terms of sensitivity. After selection of classifier, they have applied their model for prediction of epileptic seizures on CHB-MIT dataset that contains EEG signals recordings of several hours. With applying the proposed model on the dataset, on average they have predicted epileptic seizures 23.6 minutes before the start of the onset of a seizure. With the help of this proposed model, epilepsy affected patients will get more time for proper medication required for preventing the seizure before it actually occurs.

[4] Introduce a methodology based on machine learning model for both preprocessing and features extraction. The first stage utilities an algorithm based on scalp EEG zero-crossing intervals in scalp electroencephalogram (EEG). The first phase uses moving-window analysis, the histogram intervals for the current EEG epoch is computed, and the values corresponding to specific bins are selected as an observation. In next phase, the set of observations from the last 5 min is compared with two reference sets of data points (preictal and interictal) through novel measures of similarity and dissimilarity based on a variational Bayesian Gaussian mixture model of the data. A combined index is then computed and compared with a patient-specific threshold, resulting in a cumulative measure which is utilized to form an alarm sequence for each channel. Finally, this channel-based information is used to generate a seizure prediction alarm.

[5] In Decision Trees, Random Forest forms a voting ensemble. Multiple trees are formed on randomly generated input data subsets (Bootstrap Aggregation) and then those trees, the random forest, will all vote on their predicted outcome and a prediction is obtained. Adaptive Boosting is the process of creating multiple unique instances of one form of model prediction so as to effectively improve the model in situations where selected parameters can prove ineffective.

[6] Address EEG emotion recognition problem, adopt the common frequency function used to define the EEG signal by dividing the complete EEG frequency band into five parts, and frequency bands, and then extract the frequency band features from each band for GSCCA model learning and emotion recognition. Finally, detailed EEG-based emotion recognition studies based on the SJTU Emotion EEG Dataset (SEED) and experimental findings indicate that the proposed GSCCA system would outperform the state-of-the-art EEG-based approaches to emotion recognition.

III. METHODOLOGY

EEG (electroencephalogram) machine is used for monitoring the brain activity of the person. Many professional doctors uses EEG machine for monitoring the brain activity of the patient. But EEG is also used for many condition like, brain tumor, head injury, seizure disorder, memory problem, brain stroke, dementia, sleep problems etc. Main thing in using EEG is that it is very safe there no risk in using or side effects. There are many types of EEG machines available for different use. Every EEG machine's functionality is different. So, for them, Using EEG

(electroencephalogram) to capture the data of the handicapped dump person's brain is easy and relevant. EEG basically used for motoring the brain of the person. The LSTM network followed by a Softmax function is used to classify the inputs data into normal and seizure data after preprocessing. The preprocessing includes 3 stages, which are normalization of EEG data, applying appropriate filters to select the interesting parts of the data, and data management.

SYSTEM DESIGN

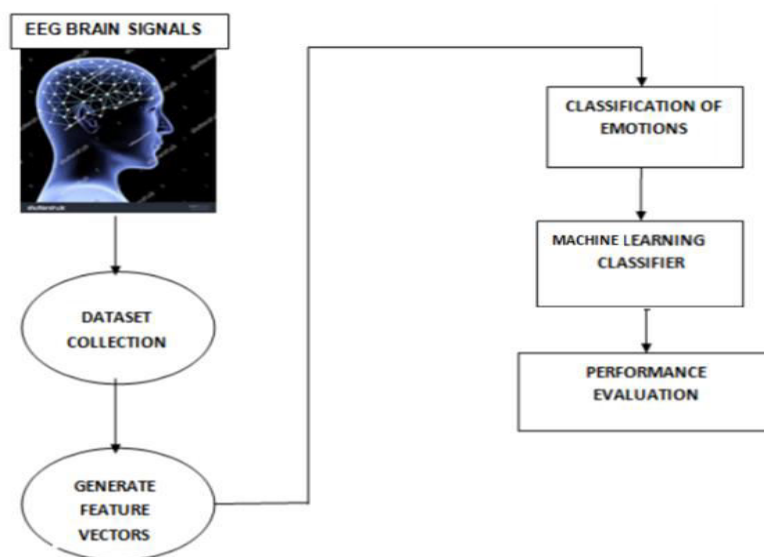


Fig.1. Proposed System Architecture

In proposed research work testing the entire system with supervised learning algorithms, we collect brain data as EEG signals initially. To extract the different features from Seth inputs, and generate the trained model from both machine learning algorithms accordingly. This work is done in two phases, training phase and Test phase training step, use all of the proposed algorithms in each case. The systems first step, then, is to get the persons EEG signals data. Signal pre-processing plays a crucial role in bringing the machine-learning algorithm effective output. The EEG Input signals the values are entered in the machine learning classifier and thee motions are classified by hyper plane using machine learning drawn with the Epileptic Seizure detection identified.

Preprocessing

All machine learning algorithms required proper format of dataset. Some noisy data are in the dataset and that noisy data need to be removed by pre-processing. Every data needs to check is there any null values are there or not.

Feature Extraction

To learn the characteristics of expression confiscation from EEG data, machine learning was deployed to eliminate discrimination features related to seizures in EEG. In Feature Extraction the aims to reduce the number of features in a dataset by creating new features from the existing ones. In feature selection the process of reducing the number of input variables when developing a predictive model. The motivation for this was small learning long-term dependence on EEG departments in between each signal and a different EEG signal across same class. Natural language processing (NLP) is the ability of a computer program to understand human language as it is spoken. NLP is a component of artificial intelligence. The correlation patterns are found in the EEG channel, showing the most significant changes over time in terms of feature information retrieval.

Feature selection

In the system, various feature selection approaches are analyzed and hybrid approach for feature selection is proposed.

Classification

After we get the training model, we can feed the testing data into it and get the prediction of classification. The testing stage includes preprocessing of testing data and classification of the testing text. Some classification is required to detect epileptic seizures, an individual can detect epileptic seizures using the stimulation and valence values system.

TRAINING

Input: Training dataset TrainData[], Various activation functions[], Threshold Th

Output: Extracted Features Feature_set[] for completed trained module.

Step 1: Set input block of data d[], activation function, epoch size,

Step 2: Features.pkl $\leftarrow$ ExtractFeatures(d[])

Step 3: Feature_set[] $\leftarrow$ optimized(Features.pkl)

Step 4: Return Feature_set[]

TESTING

Input: Test Dataset which contains various test instances TestDBLits[], Train dataset which is built by training phase TrainDBLits[], Threshold Th.

Output: HashMap <class_label, SimilarityWeight> all instances which weight violates the threshold score.

Step 1: For each read each test instances using below equation

$$testFeature(m) = \sum_{m=1}^n (. featureSet[A[i] \dots \dots A[n] \leftarrow TestDBLits)$$

Step 2: extract each feature as a hot vector or input neuron from

$$\exists extracted_FeatureSetx[t, \dots, n] = \sum_{x=1}^n (t) \leftarrow testFeature (m)$$

$\exists$ extracted_FeatureSetx[t] contains the feature vector of respective domain

Step 3: For each read each train instances using below equation

$$trainFeature(m) = \sum_{m=1}^n (. featureSet[A[i] \dots \dots A[n] \leftarrow TrainDBList)$$

Step 4: extract each feature as a hot vector or input neuron from

$$\exists extracted_FeatureSetx[t, \dots, n] = \sum_{x=1}^n (t) \leftarrow testFeature (m)$$

$\exists$ extracted_FeatureSetx[t] contains the feature vector of respective domain.

Step 5: Now map each test feature set to all respective training feature set

$$weight = calcSim (FeatureSetx || \sum_{i=1}^n FeatureSety[y])$$

Step 6: Return Weight

LSTM with optimization Recurrent Neural Network

Input: Training Rules Tr[], Test Instances Ts[], Threshold T.

Output: Weight w=0.0

Step 1: Read each test instance from (TsInstnace from Ts)

Step 2: $TsIns = \sum_{k=0}^n \{Ak \dots An\}$

Step 3: Read each train instance from (TrInstnace from Tr)

Step 4: $TrIns = \sum_{j=0}^n \{Aj \dots Am\}$

Step 5: $w = WeightCalc (TsIns, TrIns)$

Step 6: if ($w \geq T$)

Step 7: Forward feed layer to input layer for feedback $FeedLayer[] \leftarrow \{Tsf, w\}$

Step 8: optimized feed layer weight, $Cweight \leftarrow FeedLayer[0]$

Step 9: Return Cweight

Steps to develop a LSTM model:

1. Classification of epileptic seizures from EEG signals using deep learning.
2. Data preprocessing.
3. Intuition of epileptical signal in the dataset.
4. Creating a LSTM neural network for the classification.
5. Saving the trained model.
6. Visualisations.

Steps to develop an ANN model:

1. Epileptic seizure detection from EEG signals using deep learning.
2. Data preprocessing.
3. Intuition of the Epileptic signal in the dataset.
4. Creating artificial neural net model for the classification.
5. Accuracy on validation set.

Steps to develop the final product model:

1. Predictions on trained model.
2. Loading the trained model.
3. Data handling

4. Accuracy on validation dataset.
5. Accuracy on training dataset.

IV. EXPERIMENTAL RESULTS

Figures shows the result of epileptic seizure prediction from dataset by using LSTM and ANN algorithms,(a) shows Training set Accuracy(Red) and Loss(Green) while (b) shows Validation set Accuracy(Black) and Loss(Blue).

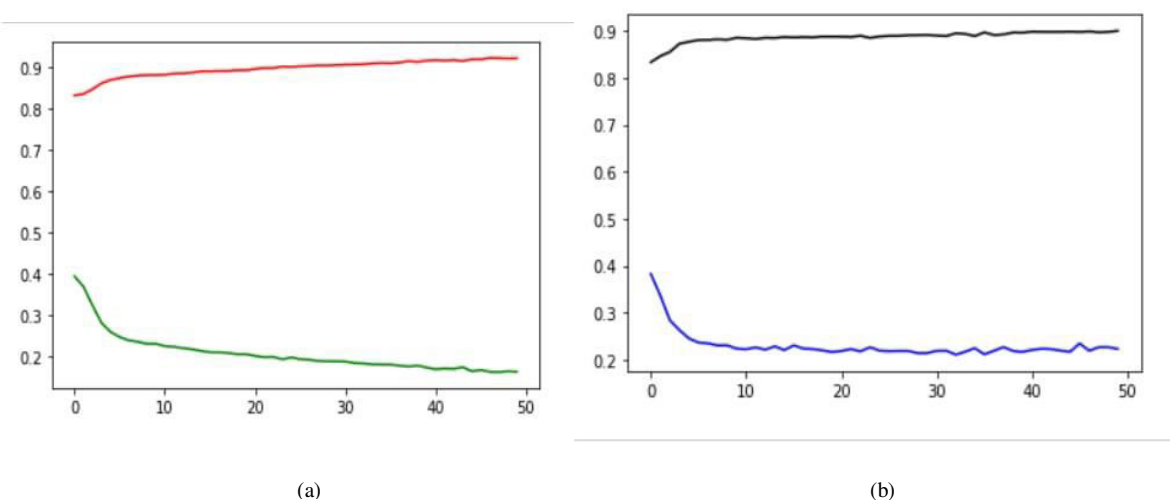


Fig. 2. Increasing Accuracy and Decreasing Loss of (a) Training set and (b) Validation set

In (a) Red signal is indicating Accuracy and Green signal is indicating Loss of Training set while in (b) Black signal is indicating Accuracy and Blue signal is indicating Loss of Validation set. We can see in both (a) and (b) that as the Accuracy is increasing, Loss is decreasing which shows that our model is implementing correctly giving more accuracy so far.

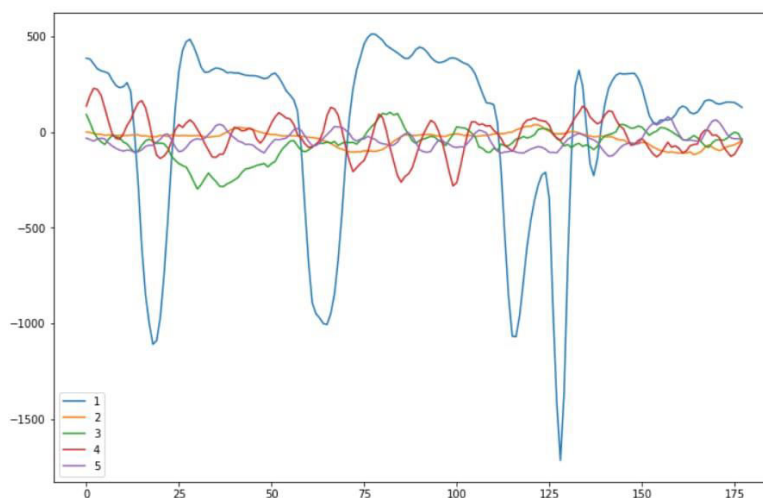


Fig. 3. Intuition of epileptical signal

Fig. 3 shows the intuition of epileptical signal in the dataset. We can see the 4 signals with different colours: Orange, Green, Red, and Pink, showing the patients with normal conditions. And Blue one showing patient with epilepsy.

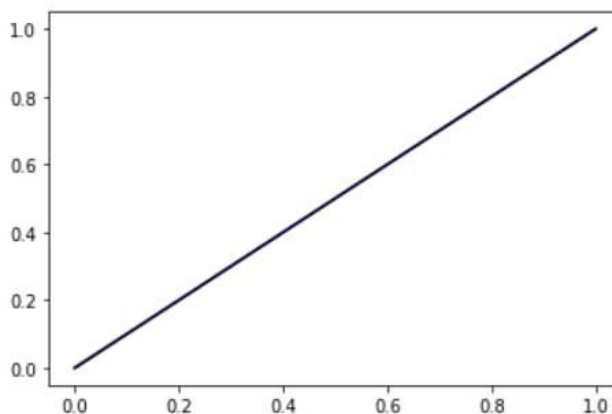


Fig. 4. Accuracy graph

Fig. 4 shows final result of the model which gives Accuracy as 0.99 i.e. 99%.



Fig. 5. Image which is sent to mail as alert

Fig. 5 shows the image which is sent on mail with message “Positive Result” when the output shows that the patient is having epilepsy to alert specific people with mentioned email ids.



V. CONCLUSION

This project aims to predict the disease on the idea of the symptoms. In this project the system collects data in symptoms pattern from the user as input and it produces output i.e. predict epileptic seizure and that predicted results are divided into two parts patients having epilepsy and others with normal condition. Then after applying ML methods on the basis of symptoms, it shows graphs with accuracies, losses and actual output. We also provide alert system to alert specific people if a patient is having epilepsy attack by sending mail. This technique will also help the doctors analyze the pattern of presence of epileptic disease in the society.

REFERENCES

- [1] Automated Seizure Prediction". Authors: U. Rajendra Acharya, Yuki Hagiwara, and Hojjat Adeli. Year: 2018.
- [2] Epileptic Seizure Detection using deep Learning Approach", VHD Journal of science and technology paper, Author: Sirwan Tofiq Jaafa. Year: 2019.
- [3] Epileptic Seizures Prediction Using Machine Learning Methods" Authors -Syed Muhammad Usman, Muhammad Usman, Simon. Year: 2017.
- [4] Predicting epileptic seizures in scalp EEG based on a variational bayesian gaussian mixture model of zero-crossing intervals," Authors – A. S. Zandi, R. Tafreshi, M. Javidan, and G. A. Dumont. Year: 2015
- [5] Y. Bengio, I. J. Goodfellow, and A. Courville, "Deep learning," Nature, vol. 521, no. 7553, pp. 436–444, 2015.
- [6] Zheng, Wenming. "Multichannel EEG-based emotion recognition via group sparse canonical correlation analysis." IEEE Transactions on Cognitive and Developmental Systems 9, no. 3 (2017).
- [7] Liu, Yong-Jin, Minjing Yu, Guozhen Zhao, Jinjing Song, Yan Ge, and Yuanchun Shi. "Real-time movie induced discrete emotion recognition from EEG signals." IEEE Transactions on Affective Computing (2017).
- [8] Katsigiannis, Stamos, and Naeem Ramzan. "DREAMER: A Database for Emotion Recognition through EEG and ECG Signals from Wireless Lowcost Off-the-Shelf Devices." IEEE Journal of Biomedical and Health Informatics (2017).
- [9] Chinmayi Bankar, Aditya Bhide, Anuja Kulkarni, Chirag Ghube, Mangesh Bedekar. Driving Control (Via music) Using Emotion Analysis via EEG 2018 IEEE Punecon. 27 June 2019.
- [10] Barjinder Kaur, Dinesh Singh, Partha Pratim Roy. EEG Based Emotion Classification Mechanism in BCI In: 2018 Procedia Computer Science. Volume 132, 2018, Pages 752-758.



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