Epilepsy Prediction Using Convolutional Neural Network

Dr.D.P.Gaikwad[1], Kranti Patil[2], Utkarsha Shinkar[3],Yash Lunawat[4], Nikhil Hajban[5]
[1, 2, 3, 4, 5] Dept of Computer Engineering
[1, 2, 3, 4, 5] AISSMS College of Engineering,Pune.

Abstract- *This paper represents a novel design and control architecture of the continuous stirred tank reactor (CSTR) based on its mathematical equivalent modeling of the physical system. The plant is formed analytically for the normal operating condition of CSTR. Then the transfer function model is obtained from the process. The analysis is made for the given process for the design of controller with Convectional PID (trial and error method), Ziegler Nichols method, Fuzzy logic method and Model Reference Adaptive method. The simulation is done using MATLAB software and the output of above four different methods was compared so that the Model Reference Adaptive Controller has given better result. This thesis also compares the various time domain specifications of different controllers.*

Keywords- Deep Learning, Convolutional Neural Network, EEG , Epilepsy, Neural Network.

I. INTRODUCTION

Epilepsy is currently one of the most commonly diagnosed neurological disorders, which is characterized by the occurrence of spontaneous seizures. About 1 out of 3 patients has a drug resistant epilepsy which means that seizures cannot be controlled by medication. In such cases, seizure forecasting systems are vitally important, since they allow patients to avoid dangerous activities and bring themselves in a safe environment before a seizure starts.

Electroencephalogram is a signal regularly used for diagnosing epilepsy and predicting or detecting seizures. Despite a significant hardware progress which enables to get high-quality EEG signals, practitioners still lack reliable algorithms for identifying periods of increased probability of seizure occurrence.In an attempt to boost the development of better models, leading epilepsy research institutions organized an international competition:" American Epilepsy Society Seizure Prediction Challenge". The goal was to develop a method, able to classify ten minute long data clips of a pre seizure brain activity covering an hour prior to a seizure onset and ten minute clips of inter-seizure activity.

Our approach to the seizure prediction problem was based on conventional neural networks – a special class of multi-layer neural networks. We constructed several architectures in a way the network could learn various types of time-localized features on several levels of representation and afterwards combine the information across time to make a prediction for a data clip. Our design decisions regarding the architecture were crucial for networks to perform well.
We also performed the analysis of other solution with special attention we explored linear classifiers which appeared to beat more complex methods in terms of the evaluation metric used in the competition. At the moment we cannot draw any firm conclusion about the superiority of some methods over others, because many factors have to be considered when applying these models in practice.

II. IDENTIFY RESEARCH AND COLLECT IDEA

We stated by studying various paper to start our work , after deciding on epilepsy we start searching for dataset and used CHBT-MIT EEG data .CHB-MIT dataset contains scalp EEG (sEEG) data from 23 pediatric patients with 844 h of continuous sEEG recording and 163 seizures. The sEEG signals were captured with use of 22 electrodes at a sampling rate of 256Hz (Shoeb, 2009). We define interracial periods as being between at least 4 h before seizure onset and 4 h after seizure end. For algorithm we used Convulsion Neural Network and implemented our system. In deep learning, a convolutional neural network (CNN, or ConvNet) is a class of deep neural networks, most commonly applied to analyzing visual imagery.

III.WRITE DOWN YOUR STUDIES AND FINDINGS

The single problem can be solved by different solutions. This considers the performance parameters for each approach. Thus considers the efficiency issues.

We had also considered various algorithms. Following three algorithms were finally selected and tested Neural Network, Decision Tree, Support Vector Machine. From all of the above algorithms, Artificial neural network gave the best results when compared to other selected algorithms.

The EEG signals are saved in EDF file format. This EEG signal is converted to data spectrograms using Fast Fourier Transform (FFT).The spectrograms are then given to Convolutional Neural Network to train and build the model.The newly created model is used to predict weather the patient has epilepsy or not.

First we converted the EEG data into Spectrograms, then we pass this data to CNN, CNN has various layers input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, RELU layer i.e. activation function, pooling layers, fully connected layers and normalization layers.

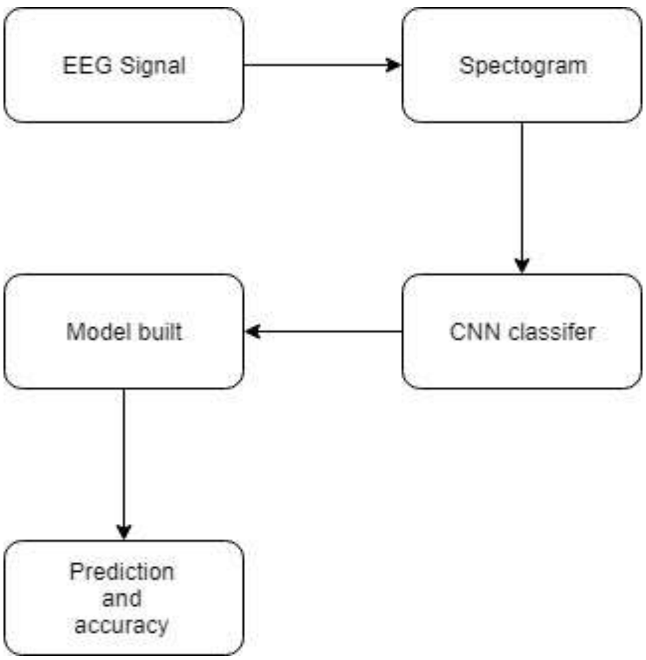

Fig:3.1:System architecture

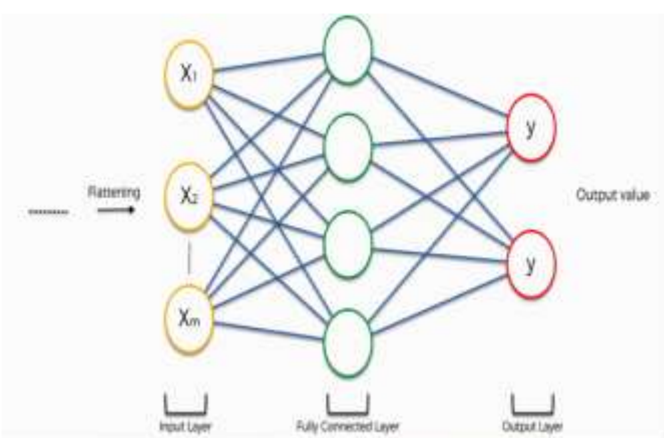

Fig3.2:Layers in CNN

IV.CONCLUSION AND FUTURE WORK

The accuracy we obtained is 96.54%. Currently, epileptic activity in EEG recordings is Mainly examined using a number of traditional and Trending technologies. Automation of this process Presents many advantages, including a faster Diagnosis. We used CNN structure. CHB-MIT Datasets were analyzed to confirm the validity of our Method. One limitation of this study is that, the non-Abruptness phenomenon and inconsistency of the Signals, along with different brain location, patient Ages, patient sexes and seizure types are challenging Issues that affect the consistency of performance. In The future, we plan to apply this method to online Epileptic signal detection using mobile application Based on Cloud Computing. After classification, our Next research object is to develop a successful seizure Mobile application.

REFERENCES

[1] Acharya U. R., Oh S. L., Hagiwara Y., Tan J. H., Adeli H. (2017). Deepconvolutional neural network for the automated detection and diagnosis of seizureusing EEG signals. Comput Biol. Med. 100, 270–278.
[2] Ahmadi A., Behroozi M., Shalchyan V., Daliri M. R. (2018). Classification ofEpileptic EEG Signals by Wavelet based CFC. Electr. Electro. Biomed. Eng. Computer.Sci. 10.1109/EBBT.2018.8391471.
[3] Chen G., Xie W., Bui T. D., Krzyżak A. (2017).Automatic epileptic seizure detection in EEG usingnonsubsampled wavelet–fourier features. J. Med.Biol. Eng. 37, 123–131. 10.1007/s40846-016-0214-0
[4] Cun Y. L. (1995). Convolutional networks forimages, speech, and time series, in Handbook ofBrain Theory & Neural Networks, edArbidA.,editor. (Cambridge, MA: MIT Press.
[5] Mutlu A. Y. (2018). Detection of epilepticdysfunctions in EEG signals using Hilbert vibrationdecomposition. Biomed. Signal Process Control 40,33–40. 10.1016/j.bspc.2017.08.023
[6] Pachori R. B., Patidar S. (2014). Epileptic seizureclassification in EEG signals using second-orderdifference plot of intrinsic mode functions. Computer Methods Programs Biomed. 113, 494–502.10.1016/j.cmpb.2013.11.014
[7] Patnaik L. M., Manyam O. K. (2008). Epileptic EEGdetection using neural networks and post classification. Comput. Methods Programs Biomed.91, 100–109. 10.1016/j.cmpb.2008.02.005
[8] Pei G., Wu J., Chen D., Guo G., Liu S., Hong Metal. . (2018). Effects of an integrated neurofeedbacksystem

with dry electrodes: eeg acquisition andcognition assessment.

[9] Ren Y., Wu Y. (2014). Convolutional deep beliefnetworks for feature extraction of EEG signal. inInternational Joint Conference on Neural Networks(Beijing:), 2850–2853.

[10] Shoeb A. H., Guttag J. V. (2010). Application of machine learning to epileptic seizure detection. In International Conference on Machine Learning (Haifa:), 975–982.

[11] Subasi A., Kevric J., Canbaz M. A. (2017). Epileptic seizure detection using hybrid machine learningmethods. Neural Comput. Appli. 1–9.

[12] Ullah I., Hussain M., Qazi E. U. H., Aboalsamh H.(2018). An Automated System for epilepsy detectionUsing eeg brain signals based on deep learningApproach. Exp. Syst.