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# Application of Artificial Intelligence for Epilepsy Disease

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***Abstract:** In this paper, brain purposeful machine learning application of AI, of electroencephalogram (EEG) indications for the finding of unknown epilepsy attack is described. For the study we anticipated deep learning algorithm applications. The methodology when used to EEG device which gives a self-operated process for the observation of epilepsy.*
***Keyword:** World Health organization, Deep learning, Electroencephalogram, Artificial neural network, Recurrent Neural Network, Artificial Intelligence, Machine Learning.*

## I. INTRODUCTION

In neurological diseases epilepsy holds most common place. In accordance with WHO one out of four people in the world will be shaped by mental or Neurological disorders in their lifespan and 1% face multiple seizures. Tabulate them as epileptic. A tough side of epilepsy seizures is their unpredictable nature. Seizure could smash at an inappropriate time consequent in disgrace, taint, and grief. It has been notice that there is some sign that stipulate seizure is creeping. Diagnose of mental health issue in children are much more obscure than diagnosing them in adult. Hence one needs to be accuracy to identify seizure disorders. Fact says that psychiatric disorders strikes brain structure and function. Still findings of neuroimaging research shows limited diagnostic tools and this indicate insufficient analysis tool. To analyze neuroimaging data machine learning, pattern recognition is in use. Artificial intelligence can empower the computer to imagine. AI make computer to think rationally. In consequence computer machine begin to be intelligent. Machine learning is the subpart of AI learning. Many researchers suppose that in the absence of learning, intuition cannot be grown. There are numerous approaches of learning, some of them are supervised, unsupervised, semi-supervised, reinforcement and deep learning Figure.1 shows this precisely.

*A.* Supervised learning: works on instruction set of examples accompanied by correct aims and based on this instruction set, algorithms acknowledge accurately to all achievable inputs. Learning from example model is one more label of supervised learning. Classification and regression are two categories of supervised learning. Classification: only response YES or No senses to prediction of the data set in classification, such as “Is this seizure epilepsy?”, “Will India win 2019 cricket world cup?” Regression: regression answer in quantity such as “How much” and “How many”.

*B.* Unsupervised learning: right answers and goals are not imparted. Unsupervised learning aptitude attempts to discover the analogies between the input data based on these analogies. Un-supervised learning facility categorize the data. This is recognizing as density estimation. UN-supervised learning includes clustering [1] Clustering: it creates clusters on premise of resemblance.

*C.* Semi-supervised learning: semi-supervised learning approach is set of supervised learning approaches. This learning useful for unlabeled data for priming aspiration. Normally a minimum number of labeled accompanied by a great amount of unlabeled data. Semi supervised learning placed in the middle of unsupervised learning and supervised learning.

*D.* Reinforcement learning: this learning is motivated by psychological expert. Algorithm is well versed when the response is false, but never tells how to precise it. It inspects and tryout different prospects till it discovers the true result This is studied as training accompanied by denigrator. Reinforcement learning does not approve enhancements. This is unlike from supervised learning for the reason that clear-cut input and output collections are not gave, nor quality efforts distinctly specified furthermore it bases on accomplishment.

*E.* Deep learning: machine learning technique of this class is built on collection of algorithms. Inside data, these learning algorithms model large-scale abstraction. It achieves intense graph accompanied by different processing surface, composed of numerous sequential and non-sequential conversion. Electroencephalograph(EEG) is an examining system which can assist to note the electrical scheme of the cerebrum. This electrical scheme can assist to ideal view, the human brain and how it effectuating.

*F.* Brain computer interface integrate hardware and software information exchanging procedure that enables brain activity uniquely to influence computers and other appliances. BCI allows to negotiate with the vicinities in the absence of complicity of surroundings nerves and muscles, by utilizing control evidences provoked from electroencephalographic effort. It finishes in several phase as symbolize in figure.2 and its operation appeared as

*1)* Acquire the signals: catch the brain activities and figure noise depletion and preprocessing the activities in further an appropriate manner.

*2)* Trait extraction: recognizes discriminative data in the brain activities that have been figured. This can be tough for the reason that numerous mixed activities with hug number of groups activity in the brain that coincide in time and space, we don't like to loss data figure.

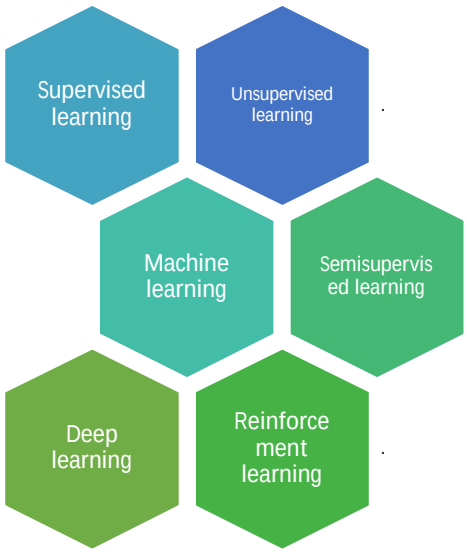


Figure. 1 AI approaches Diagram

*3)* Classification: group the signals to accomplish pattern identification in sequence to decode the user's objectives.

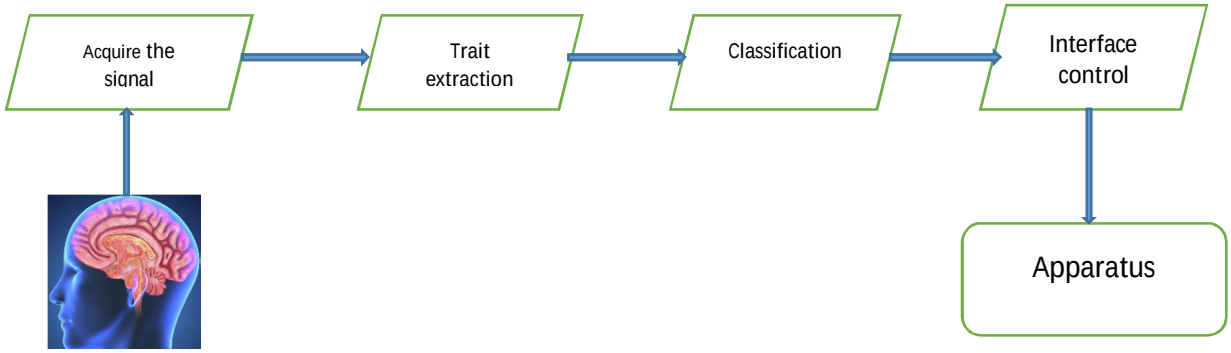


Figure 2 A BCI system

Interface control: interpret the categorized activities into the user hopped orders for sort of apparatus like a computer.

## II. DEEP LEARNING METHODS

Deep learning is a precise structure of the group of machine learning methods. Deep learning is a precise structure of depiction-based learning, where a system assimilates and forms fundamental aspects from each sequential invisible surface of neurons [2]. The word "deep" is obtained from the various invisible surface in the artificial neural network (ANN) configuration. The ANN algorithm paradigms the functionality of a biological physical brain [3]. The replica is perceived with a configuration that is built of input-hidden, and output layers, in figure.3 each neuron or node is attached to every neuron in the succeeding coating through an

interrelation linkage. A nerve cell is built up of axon, dendrites, a soma, nucleus and synapses, which is popularly recognized as output, input, node, activation function and weights [4]. In artificial neuron the activation function behaves as the nucleus of a biological neuron. The dendrites and synapses are model by their input signals and its particular weights figure.4 shows the configuration of neuron.

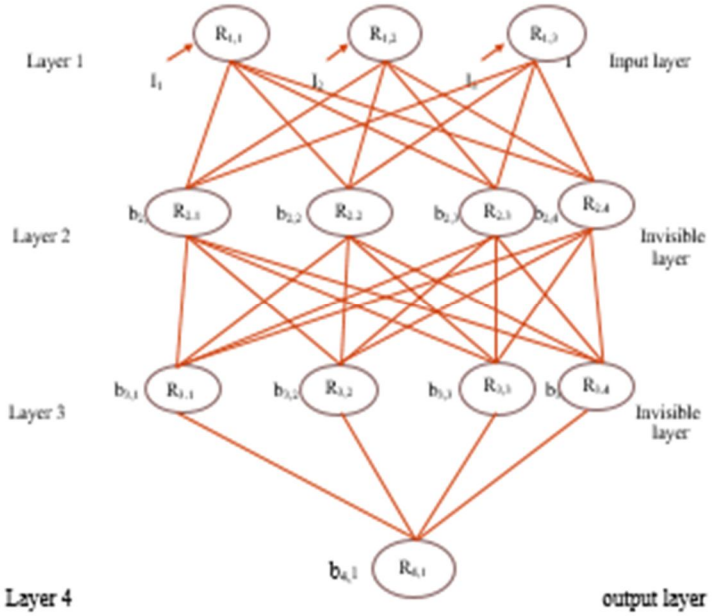


Figure.3 Conventional ANN structure

The convolution neural network (CNN) is an extension of ANN in which translation and shift deviation is improved which influence the classification performance in ANN [5] [6]. The CNN arrangement provides translation and shift invariance [2], Figure.4 interprets a common CNN configuration. Convolution, pooling and fully-connected layers are comprising the CNN which is also known as a feed-forward network [2]. They are concisely described along.

1) *Convolution Layer:* The input instance is entwined with a kernel in this coating. The output of this coating is the trait graph. The progress influence how much the kernel links with the input instance. The convolution action proceeds as an extractor by instruction from the various input indications. The produced traits can be utilized for classification in upcoming surfaces. Figure.5 interprets a convolution action amid input f and kernel g, permitting an output c. Equation shows convolution example.

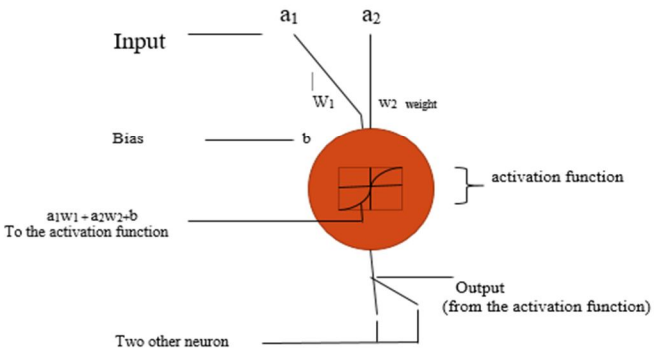


Figure. 4 Neuron Configuration

Calculation

$$C(4) = 4 \times 6 + 5 \times 5 + 6 \times 1 = 55$$
$$C(5) = 5 \times 6 + 6 \times 5 + 7 \times 1 = 67 \quad (1)$$
$$C(6) = 6 \times 6 + 7 \times 5 + 8 \times 1 = 79$$
$$\text{Output } 1 = 67 \times w_1 + 91 \times w_3 + 115 \times w_5 \quad (2)$$
$$\text{Output } 2 = 67 \times w_2 + 91 \times w_5 + 115 \times w_6$$

*2)* Pooling layer: the spatial dimension of the input instance is decreased by the pooling operation while the remarkable data. Average, max or sum are possible by the pooling operation. The max-pooling operation is usually appointed. Figure.6 shows max-pooling operation accompanied by step of 2, here the figure of input instances is bisected by maintaining only the maximum valuation inside a chosen step. In a step that carries 14 and 22, the valuation 22 is kept, and 14 is rejected.

*3)* Fully-connected layer: fully-connected surface shows that every neuron in the preceding surface is associated to all the neurons in the current surface. The quantity of classes is resolved by the total figure of fully-connected neuron in last surface, Figure.7 impart a diagrammatic depiction of fully-connected surface. The neurons are all associated and all links has a definite weight. This surface substantiates all outputs of the preceding surface to discover a certain target output. A leaky rectifier linear unit [7] is practiced as an activation function following the convolution surface. The motive is to chart the output to the input group and instigate non-linearity along with sparsity to the network. The CNN instructed with backpropagation [8] and the hyper-parameters may be adjusted for most favorable instruction accomplishment. Apart from CNN there are some more deep learning architectures, for example deep generative models [9] [10] and recurrent Neural Network (RNN) etc. are monitoring the physiological signals equally. A deep generative model has two general structure deep belief network [11] and restricted Boltzmann machine [10], in short it is written DBN and RBM. The RBM is built up of a two-surface neural net accompanied by one perceptible and one concealed surface. In opposite to the feed-forward network. The RNN appoints a recurrent approach broadly recurrent network by which the network accomplishes a schedule job accompanied by the output existence determined by the preceding computation. The most prevalent sort of RNN is the long short-time memory network [12]. The LSTM algorithm subsumes a memory block accompanied by three gates: the input, output, and forget gate. These gates influence the cell condition decision is taken to add or remove data-info from the network. For each input the process replicate itself. The architecture of deep learning verifies their potential with exceptional interpretation of conventional machine leaning procedure [2]. Further deep learning algorithms reduce the desire for feature engineering.

## III. DEEP LEARNING METHODS USED TO EEG

For measure the EEG put the electrodes on the cranium of the tolerant here they collect electrical scheme of the cerebrum [13] [14]. That scheme consequences from stimulant neurons ejecting activity powers. At some conferred time, the electrode adds up numerous charges from various origins. The occurring EEG indications has a tumult like trait, which builds the analysis tough it holds the experienced eye of a professional to mark the features that point out an identified mental condition [15]. One of the prime operator before the execution of DL algorithms exerted to EEG is BCI [16]. The actual-time essence of this execution builds human signal explanation impossible [17]. As a consequence, BCI needs self-operated decision generating network. To trait neural dynamics of the cerebrum [18]. In arterial neuron the activation function reacts as the center of a biotic neuron. The particular weight and their input signal model the synapses and dendrites.

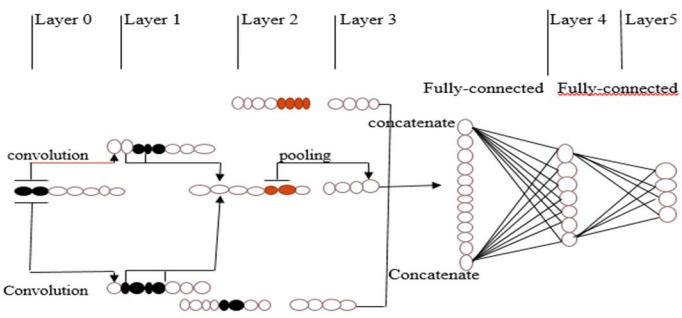


Figure 5 CNN network configuration

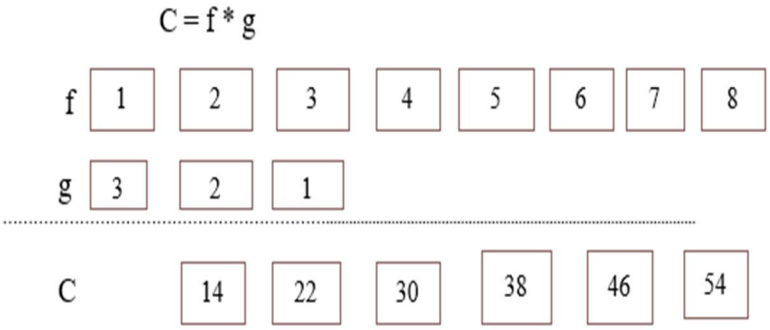


Figure 6 Convolutional layer

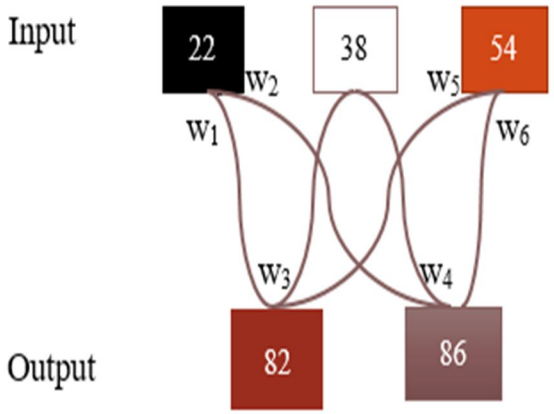


Figure. 7 CNN network configuration

Table 0-I
Outline of tasks brought out utilizing dl algorithms with eeg indication

| Author | Application | DL algorithm data | Outcomes |
|---|---|---|---|
| Cecotti and Graeser [19] | Motor imagery classification-CNN | 2 concerns 5 examination of about 3 minutes | Observation reliability:53.47% |
| Nurse et al. 2016 [20] | BCI | 1 concern 30 min of data | Reliability:81% |
| Van putten et al.2017 [21] | Butcome forecasting CNN for sufferers with a post-anoxic coma after cardiac arrest | EEGs from 278 sufferers at 12 h after cardiac seize and 399 sufferers at 24 h after cardiac seize | Responsiveness of 58% at a specificity of 100% for the forecast of poor outcome |
| Ahmed et al.,2013 [22] | Removing target images DBN | Not specified | DBN perform better than SVM |
| Hosseini et al.,2017 [22] | Epileptogenicity CNN localization | EEG and rs-fMRI computation from the ECoG information-set [24] | Normal p-value 1.85e-14,p-epilepsy value 4.64e-27 |
| Schirmeister et al.,2017 [23] | EEG interpreting CNN visualization | BCI competition 4 information-set 2a [26] and computation information | Up 89.8% reliability. |

## IV. CONCLUSION

In medical sector, numerous expert systems are present to forecast injury disorder at most prior phase to make the care successful and methodical. In psychological health division for forecasting the brain health issues at initial phase. Numerous machine expertise is available for making expert systems analysis of the procedures, and their differentiation for recognizing the leading methodology which pursuits area. This paper gives a review of machine learning application of AI. That are usually operated psychological health division supervising. Also this article gives a survey of how accepted Machine learning; Deep learning methodology have been used in supervising distinct EEG devices. From the learning it is imparted that a wide figure of self-regulating and self-semi-regulating procedures are accessible for EEG device ejection. Some talk convinces that Machine learning is narrow but fact says that machine learning algorithms give preferable classification precision than other process. In various research it is recommended that deep learning method is preferable technique.

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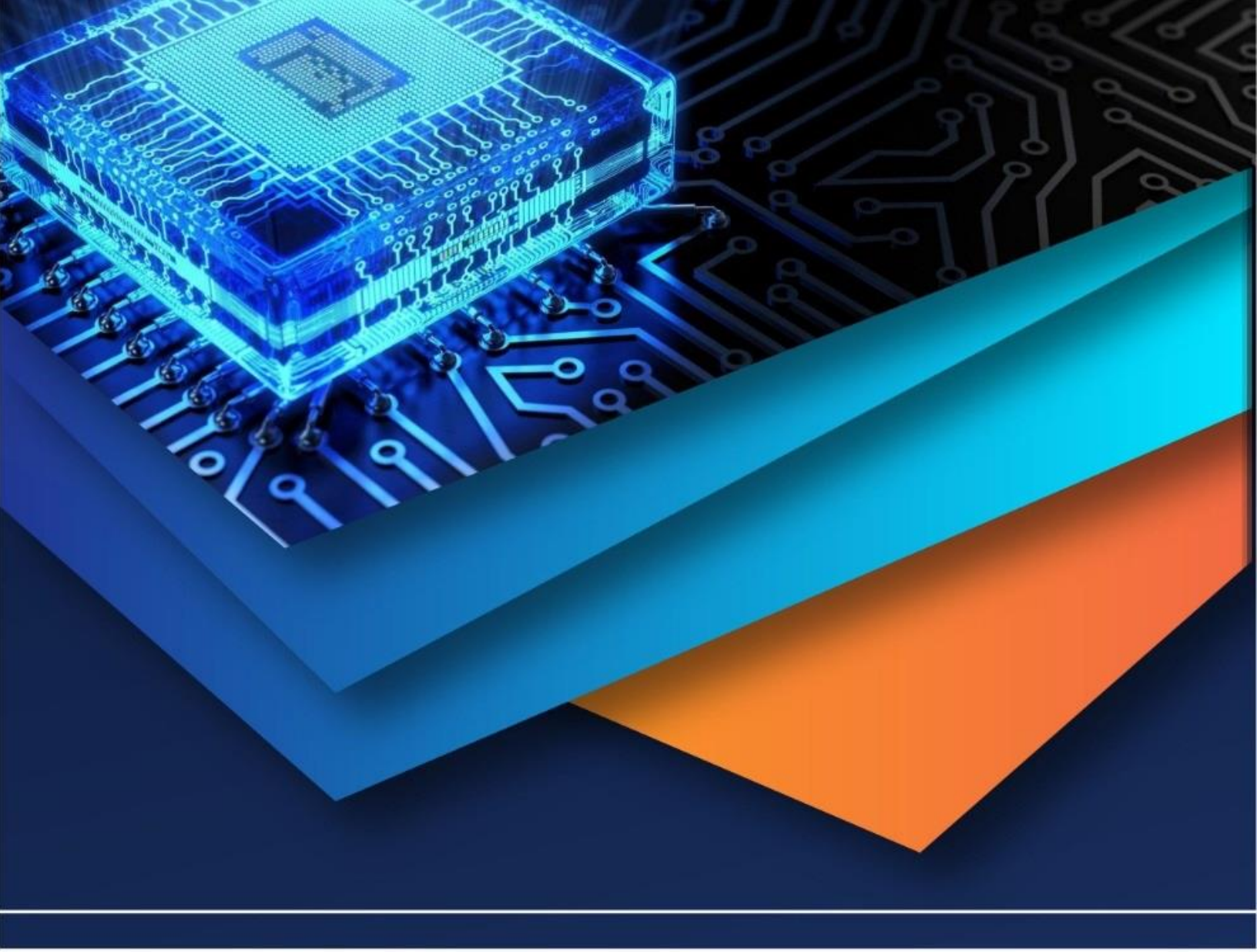

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