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Decoding Brain EEG Signals to find State of Mind Using AI

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ABSTRACT

Emotions are primordial for human beings and they play a key role in human intelligence.Emotion is basically connected with sight,human correspondence and logical decision making.Now a days the need for attested and dependable remedies for the recognition of human emotional states is obligatory due to the rise in interest of upcoming researchers towards establishing some significant emotional interactions between humans and computers.By analysing we choose the best subset of characteristics for identification using electroencephalography (EEG) information, that are obtained by EEG sensors which non - invasively record the electrical impulses of nerves within the neural network.Then the signals are pre-processed using Hjorth parameters that measure signal activity of time-series data.The classification of signals obtained is based on supervised pixel classification.By using convolutional neural networks(CNN) the signal feature obtained is compared with the parameters set and thus it detects the state of mind whether the patient is happy,depressed or anger and the output generated will be in a text format.This is very much beneficial in many sectors especially in health sector where dealing with patients diagnosed from Locked In Syndrome,coma and various neuropsychiatric disorders .By detecting the emotional state of the patient which means to detect whether they are depressed or anger or happy and it will help the doctors in treating them in a better way and the patient can recover soon.In case of depression it is mandatory to treat those kind of patients or else they may take some psychotic decisions like suicide or they may become mentally weak.Similarly if the emotional state detected is anger,then we can make them happy by doing what they like which will help to make them normal In patients diagnosed with locked in syndrome their full body will be paralyzed except their eye muscles They can think,feelemotions,sense smell but cannot move.If we detect their state of mind it will be more beneficial in treating them..The accuracy of the overall project will be around 83%.Our approach shows better performance compared to existing algorithms

Keywords:-CNN,Hjorth.parameters,Electroencephalography(EEG),Coma,neuropsychology,Locked in Syndrome

I.INTRODUCTION

Identifying the emotional state of human,particularlyfor patients suffering from some disorders or syndromes is much important.It is achieved by using electroencephalography by which electrical activity of brain can be recorded [1-3]. Locked-in Syndrome (LIS), often called as pseudo coma, is often a disease where a person is conscious but is unable to speak or move orally resulting in a large immobility of virtually all active parts of the system with the exception of vertical facial expressions and winking [4]. The person is aware and intellectually competent enough to speak through facial expressions. [5-7]. Total lockable sickness (likewise referred as totally stuck condition or CLIS) is indeed a type of lockable condition in which the eyelids are also paralysed [8]. Idiopathic intracranial hypertension and the afraid to communicate are common symptoms of lockable disease in even the most mentally healthy people [9]. Lockable disease patients could be capable of communicating with each other by winking or twitching the eyelids, that are usually unaffected even by immobility. [10-13] The clinical signs are identical to sleeping immobility. Individuals with lockable condition are alive and aware, without any memory loss. Kinesthetic awareness and feeling can occasionally be retained through entire body [14]. Several individuals may be able to activate all or some of the their facial expressions, including some or the whole of their muscle layers. [15-18]. The disorder is characterized by a lack of synchronization among respiration and speaking. Although this voice box might not have been immobilized, this prohibits it for making intentional noises [19]. New Brain Computer Interface

(BCIs) could be able to help in the near. In 2002, a completely incarcerated person was given the ability to respond yes-or-no queries [20]. Scientists designed and tested the neurological connection in 2006 that enables people suffering lockable condition to use an internet browser [21]. These scientists believe to have devised a method for allowing lockable people to spend by scent [22]. EEG is a process of collection brain function via electrophysiology surveillance [23]. It's indeed generally noninvasive, using electrode inserted and along skull, while free electrons are occasionally used, such as in electrocorticography, also known as cerebral EEG, to determine the sufferers' mental state. [24].

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SCOPE OF THE PROJECT

1.The aim of our proposed system is to detect the state of mind using Image Processing methodology and predicting the mood of the patients diagnosed with Locked in Syndrome and Neuropsychotic

disorders through Machine Learning technique [25-26].

2 Using the Discrete Wavelet Transform (DWT), Input images are split into beta, gamma, alpha, and theta radio frequencies, then spectral characteristics are retrieved from each coverage area. Principal components analyses (PCA) is used to render the collected features independently exclusively associated by keeping the very same density as a transformation..

3.Using CNN algorithm the raw eeg signals are preprocessed,segmented and classified from which the output obtained gives the emotional state of the patient which inturn is helpful in treating patients [27-29].

II.EXISTING SYSTEM

The existing system uses multiple instance learning(MIL) which is a type of supervised learning. method for EEG based emotion recognition.They provide information about how to train the multiple instance learning method only.They detect emotions only via python ide.The accuracy of the overall project will be low[30].

LITERATURE SURVEY

Using EEG recordings, two extracting features algorithms are employed in conjunction. The first is Exponential smoothing values, and the second is wavelet packets segmentation, which divides the data into subcarriers. The vector auto regression model uses the wavelet packets components to create vector auto regression values, and are used for characteristics retrieved from source EEG data. The data are classified into a SVM classification algorithm, which uses them to categorize Brain activity. [31]

Feelings are recognized by associating such biomedical parameters with both the information of alertness and polarity of this database, perhaps to categorize overall emotional state of an individual, using only a deep learning model on a database of biomedical parameters (ECG and Galvan skin reaction). [32]

Wavelet and scalogram transforms are being used to compress inter neurobiological data into map images. Next, using a hybrid classification method that incorporates CNN with RNN, job vectors are derived. [33]

III PROPOSED SYSTEM

In the proposed system CNN classifier is used to classify the emotion..Here canny filter and gaussian filter are used to remove noise from the signals.HSV model is used if the coloured images are used for image processing.CNN algorithm is used for segmentation and classification of the image signal.The input will be in the form of frequency images.The output result will identify the mood of the desired EEG frequency image whether happy,anger or depressed.CNN classifier provides the more accurate result when compared to other classification methods.

IV.SYSTEM IMPLEMENTATION

The implemention starts with recording the electrical activity of brain by using electroencephalography.Once the signals are recorded they are fed as input for classification process to take place.Initial stage of classification is image preprocessing followed by segmentation and classification.Classification is the stage by which we detect the state of mind by undergoing comparision of the input image signal with the features set.It is done by using CNN algorithm.The final output will provide the emotional mind state whether happy,sad, or depressed in a text format [34-38].

MODULE DESCRIPTION:

The entire implementation is split up into three modules for easier processing.

Module 1: Image Preprocessing

Module 2: Segmentation

Module 3: Classification of emotion

The output of image preprocessing will be segmented in the next stage and by using convolutional neural network technique it undergoes classification process

A. ImagePreprocessing

In this module noise removal and soothing of the signals is performed by using various filters,as the signals initially contains noise,in order to remove them gaussian filter and canny filters are used.

- Gaussian filter:It is used to reduce noice especiallyblurred noise.It is a linear filter that is used tosoothe the images.
- Canny filter:It is the most common method for edgedetection of an image.

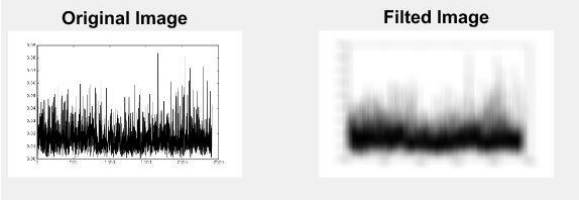

Fig1 Image produced by Gaussian filtration

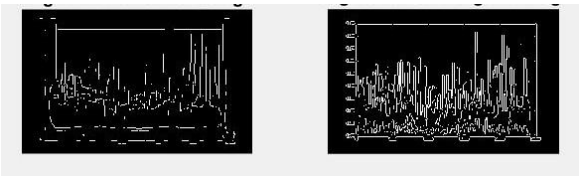

Fig2 Image produced by canny filtration

While the image processing is done for coloured images,various models are used.In our project we opted for HSV (Hue SaturationValue)model.By using this model the influence of light intensity from the external will be reduced by detecting the object with a certain colour.

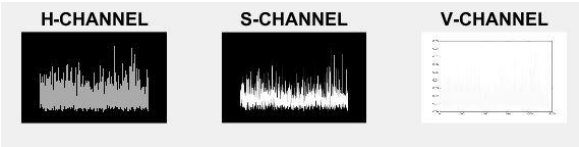

Fig3 Output of HSV Channel

B.Dataset

We downloaded publicly available datasets from the internet, Example, Kaggle, and various other sources. The dataset is basically the signals that has been recorded by EEG to find electrical activity

of the brain.The signals are frequency-amplitude graph from which various analysis could be done [39-44].

C.Segmentation

In this module,preprocessed image is used for segmentation and so enhanced image will be produced.Mostly the output of segmentation phase would be black coloured images,because during the preprocessing stage the grey scale images would have been used as input.Greybscale images are the one that has only shades of grey.The reason for using such grey scale images is that it needs less information to be provided for each pixel compared to coloured images.

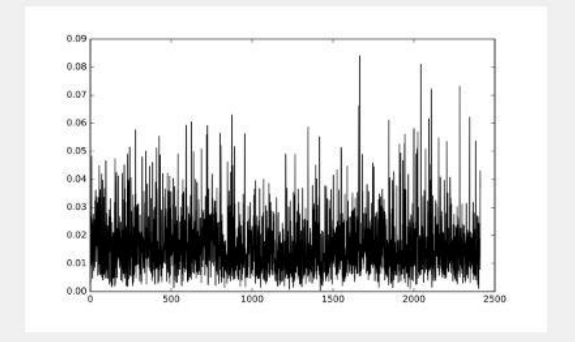

Fig4 image enhancement

D.Classification of emotion

Finally,by processing the image signals of the patient, we proposed convolutional neural network algorithm in the MATLAB software such that it concludes whether he/she is anger,depressed or happy. Now this will give the doctors an idea of the current scenario of their mental condition [45-49]

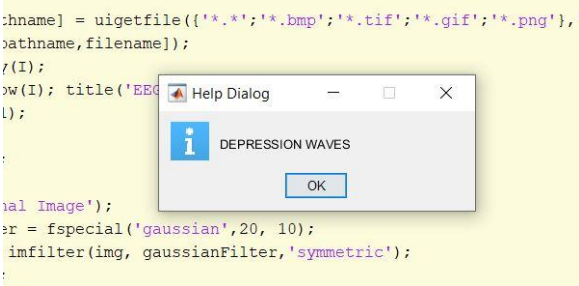

Fig5 output of classification stage

V CONCLUSION

Emotional Instability is a major problem nowadays that shouldn't be neglected and requires proper treatment.In many phycotic disorders and syndromes such as locked in syndrome finding the mind state of patients is much important so that the patients can be recovered form depression if they are found to be depressed or can undergo some anger management training incase of anger mind state.Thus, the novelty of our idea is to provide a diagnosis in more cost-effective and with greater evaluation accuracy, the proposed non-invasive method detects the emotional state of patients at an early stage. Furthermore, the results can be extended for therapeutic applications.

VI FUTURE ENHANCEMENT

With technology at its highest point of saturation, Also, automating the system involves the integration of all the

modules by developing a core system that is fully automated. The future of this project is to provide an algorithm to find what the patients are thinking,that is finding the thoughts of people who are unable to express it.Mindreading has started showing its progress in the research field.Once researches related to mindreading has been made successful anything could be made possible and achieved successfully

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