

# Recognition of Human Emotional Activities using Brainwaves based on Time Frequency Analysis

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## Abstract

Emotion is not only a word it actually determines the current mind set of all humans. Even emotion represents character of all humans. But now days in the field of medicine stress is the commonly used word. Stress is generating in all ages of people. Because of this many people are suffering from low sleep, low energy, and low work. Presence of this stress fully collapses the life of humans. So a detailed study has to be done on this stress and help the people to overcome out of it. To measure the stress we will be using EEG (Electroencephalography). This EEG will be in the form of signals which has to analyze with new signal processing techniques. Here we will do machine learning techniques to analyze the emotion recognition of humans. We will use the concept of neural networks in order to classify the signals and determine the current emotions in which state they are in.

**Keywords-** Support Vector Machine, Alpha Wave, Beta Wave, Neural Network, Gamma Wave.

## I. INTRODUCTION

The most sensitive part of the human body is the brain. Each action generated in the entire body is controlled by the human brain. Brain along with spinal cord is got associated with the central nervous system. Behavior, sense, body movement all are controlled by the human brain. The human brain is made up of multiple numbers of cells. The central nervous system controls the movements such as walking, speaking, and blinking. The researchers are developed in the nervous system about the transmission of the signal to perform the activities in the human body. The electrochemical signals are generated when the brain communicate to the neurons. The group of nerve cells is called neurons. During the time of signal transmission the voltage is get changed, then the electrical and the magnetic field is measured outside the skull by Electro Encephalon Gram. The transmission of the electrical signals in the neurons is first developed by Benjamin Franklin in 1753. The brain has the three different region upper regions, middle region and the lower region. The brain is get subdivided into four various structures; they are cerebral cortex, cerebellum, brain stem,

hypothalamus and thalamus. Each structure can perform various sets of functions. Each structure function can control various movements in the human body.

The signal can be transmitted at the particular frequency in the range of 1 to 75 Hz with the signal amplitude of about 10 to 110 micro volts. Delta, alpha, beta, gamma, theta are the five major band limits of the brain wave. Several diseases which affect the brain such as Alzheimer's, Parkinson disease, epilepsy, dementia are identified by the EEG. The cortex is get divided into five different lobes, so the identifying and determining the activity in different parts of the brain is measured with the help of the EEG. Now the sleep processing signal is performed for the analysis of the EEG. There are three stages which are preprocessing, extraction and classification. The pre processing is for the extraction of the information from the brain waves. The mathematical calculation is derived for the localization of the brain activity on the basis of the Visually Evoked potential. The noise can be removed by the use of the external devices. The biological signal transmission is made by neurons.

## II LITERATURE SURVEY

David Espíndola et., al., proposed the shear shocks waves are generated by the cubic non linearity. The shocks waves are generated at the several portion of the human brain. The shock waves can be characterized by the homogeneous gelatin phantom with ultrasound imaging and correlation tracking algorithm. In this paper they propose the ultrasound imaging which reduces the side lobes with high frame rate to track the wave movement in the soft tissues. The brain injury can be explained by the image technique applied on the ex vivo porcine brain. In the existing method of tracking algorithm is evaluated the specific harmonic signature of the shock waves. By the help of the Fusanov- Fourier methods that describe the shear shock waves which supports the non linearity and the arbitrary frequency. The ultrasound images of the shear shock are generated by the full wave simulations. The ultrasound can be propagating in the medium based on the theoretical calculation. Camero Rao Lower Band method is getting compared with the tracking algorithm in predicting the performance. The experiment is performed using the tracking algorithm for monitoring the shear shock waves in brain. [1]

Shaojuan Ma et., al., proposed the brain wave reaction is characterized by the ferroelectric behavior is proposed in this paper. The various factors in the ferroelectric brain wave are evaluated by the random parameter. For the brain wave determination two stages has been considered namely the initial and the final stage. In the initial stage equivalent deterministic is reduced by the orthogonal polynomial expression for the brain waves. In the final stage random parameter are considered more that depends on the chaos behavior, the dynamic behavior of the brain wave is paid more attention. Experiments are performed in evaluating the parametric behavior for the sin brain wave model. The ferroelectric behavior is providing better result when compared to other such methods. [2]

Sandhya Chandrasekaran et., al., proposed the propagation of acoustical wave which helps in describe the ultrasound imaging in the soft tissue. The tissues maps are get displaced in the human brain by the use of the impedance flow method. In this paper they propose the wave

propagation in the human brain. The proposed method is used into various section motion of tissue in the brain due to shear shock propagation. Scattering of light signal from the pulse image and estimate the displacement from the radio frequency data. The harmonics of the shear shocks waves are detected by the sequences of image. The displacement tracking algorithm is used to reach the maximum accuracy. Several mathematical calculation are used for the calculation of the shear shocks displaced in the brain. By the use of the tracking algorithm the shift angle is calculated. The error of tracking is minimum of about  $\beta/216$ . This method can be applied to the discontinuous model which can be applied to the complex motion. [3]

C. Sheikholeslamiet., al., proposed the human brain is active when they involve in a particular activity. The resolution of the wave generated at the time of activity is maximum. In this paper they made the study of EEG on the human during the activities of game play. The performance of the game play has recorded which will be for the short span of time. The segmentation of the activity was determined and the spectral analysis of the segments is beta wave (6-10 Hz) and lambda wave (2-6 Hz). The frequency range of the beta and the lambda wave whose changes in the spectral contribution is analyzed. From the above experiment the result shows that during the eye open beta wave activity is increased. The lambda wave activity is decreased at the time of resting period and the lambda wave is increased. It provides the high resolution of EEG tool for the brain activity. [4]

Yaqing Heet., al., proposed the wireless charging method is implied in the field of neuron psychological. The WPT can take place by the linkage of the flux with the secondary portion. The wireless power transfer is combined with electromagnetic radiation of brain waves activities. In this paper we made the experiment which includes the 13 subjects under the one domain operating the electromagnetic radiation EMR of about 12MHz of wireless power transfer WPT. The Electroencephalographs EEG is recorded for every 10 minutes before, at the present and after is exposure to the electromagnetic radiation. The real time method is conducted by participants were inquired by the questions with scales of after, before and the present psychological status. Based on the study the electromagnetic radiation of the wireless power transfer can cause impact in the brain wave activities. Due to the changes in the activities it will not affects the emotional factors. [5]

YashrajS et., al., proposed the security is need in the every person life it an plays a vital role in all the places. From the bank to the experimental labs all the automation technique the security is the must. The security is in the form of password, biometric etc. Mostly the password, PIN, card readers are easily hacked by the others. When the person puts the security lock for the app or bank account which is able to visible by other people. So to overcome the problems in this paper they proposes the brain wave locking system. It has the several features compared to the normal security lock method, the signal generated by the brains are not able to visible by the other members. It also helpful for the visually impaired people who cannot able to use the finger print or the retina for he lock they use the brain wave. The brain wave pattern is a combination of the eye blink and attention of the various alpha, beta, gamma, delta, theta signals. The authentication is involved in two levels first level is the brain signal. Once the signal pattern is matched then it will ask the pass key as the second stage of security. [6]

Seiji Nishifujiet., al., proposed the frequency of the brain waves is respond to the external environment. The investigation of the phase dynamics of brain waves to periodic stimuli is compared the properties of the beta waves with the SSVEP which is steady state visually evoked potentials. The resolution of the wave generated at the time of activity is maximum. The phase variations between the frontal and occipital lobes are made by the brain wave response. The frequency is about 2-10 Hz for the flicker stimuli. The brain injury can be explained by the image technique applied on the ex vivo porcine brain. In the existing method of tracking algorithm is evaluated the specific harmonic signature of the shock waves. The phase difference between the frontal and the occipital lobe is varied with depends on time. The SSVEP and the beta waves which is approximately related to each other. The Steady state visually evoked potential is considered in the non linear oscillators. [7]

T.W. Huanget., al., proposed if a person needs to learn the other languages they refer the book or surface the internet. These methods are followed in the past technology after the technology development in this paper they propose the brain computer interface system. This system called as fast Phonics to Chinese character system. The person can able to write the Chinese languages by using the brain waves. The proposed method to combine the response. In the existing method the phonics to Chinese character system use the parameter such as P300 and N200 to identify the target. The previous method also achieved maximum performance but we tried to reduce the time in choosing the items. The four sets of rules are used to combine the stimuli for the brain computer interface and the system is made faster. The brain wave potential are better for predicting the intentions. The proposed method whose accuracy is about 97%. It is also the fastest BCI for writing the Chinese language with the help of brain waves. It has the highest academic value and practical value. [8]

Kaixuan Chuet., al., proposed the brain waves play a vital role in many fields it used for the authentication, languages etc. In this paper they mainly shows about the brain computer interface, the BCI P300 can detects the targets and interconnects the machine intelligence and biological intelligence. The mechanism of the frame rate EEG characteristics is studied. Consider seven different subjects using nine different images for the testing of the frame rate. The image frame rate is positively interlinked the latency of P300 and negatively interlinked the intensity of P300. In the various frame rates the P300 signal is extracted using HDCA classification algorithm. From the results the classification of P300 achieves the high accuracy. The frequency is about 2-3Hz for the target detection with high efficiency. [9]

SuminJinet., al., proposed several technologies are getting developed to make the system smarter in all the fields. By the use of the brain waves several applications are developed in the future. The brain waves are generated in various frequency ranges based on the pattern recognition by using deep learning for the real time applications. In this paper they propose the method to recognize the behavior of the human using human bio signal is the brain waves. The signal data generated are get collected by the use of the head set and it is stored in the database. The collected data is trained and tested using CNN convolution neural network. The LSTM is used for the successful neural network. From the use of the proposed

method we can be able to differentiate the positive recognition and the negative recognition. The positive recognition is applicable for various kinds of applications in our proposed method. The frequency range is about 6-9 MHz for the brain waves recognition. This method has the maximum accuracy and the high efficiency. [10]

### III PROPOSED METHOD OF CHARACTERISTICS OF BRAIN WAVE

The main aim of this paper is to determine the emotions of humans. Here we will be using an EEG sensor and this sensor collects all the signals from the brain. Each and every signal will be different depending on the emotions given by the humans. Here the emotions such as happy, sad, anger, anxiety etc are been analyzed from the corresponding input signals that we got from EEG Sensor.

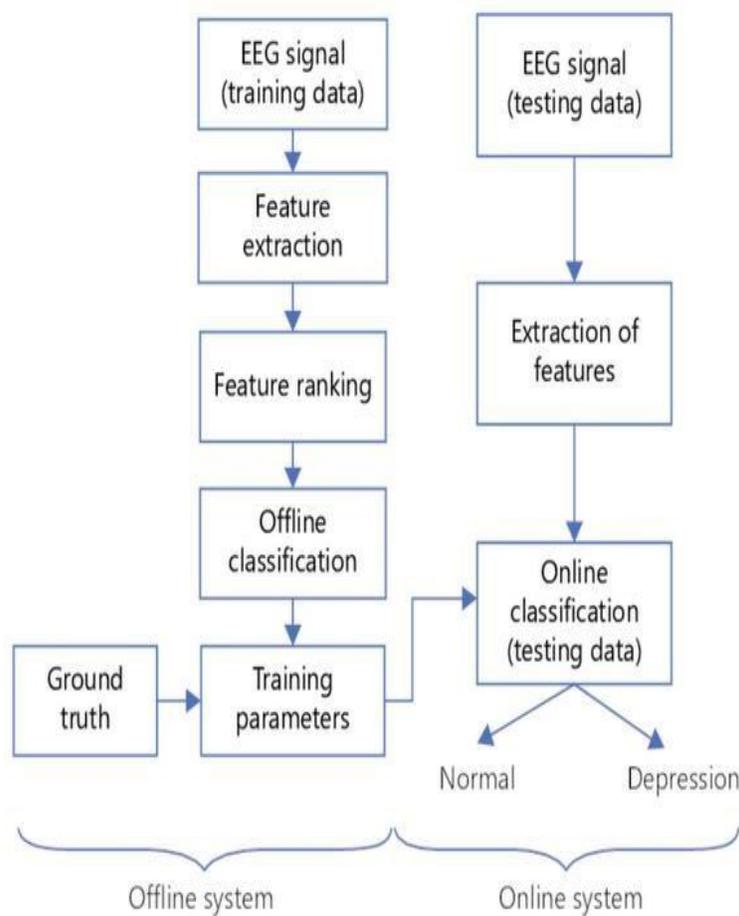


Figure 1: Flow Chart of Proposed System

### IV RESULTS AND DISCUSSIONS

Here the EEG sensor will be connected to the microcontroller. The EEG sensor will produce the electromagnetic radiation that will penetrate towards the brain. This will be converted

into the form of signals which we can see in the form of graph. The waves are defined as alpha, beta and gamma waves respectively. All the waves discovered

here will have different type of characterization

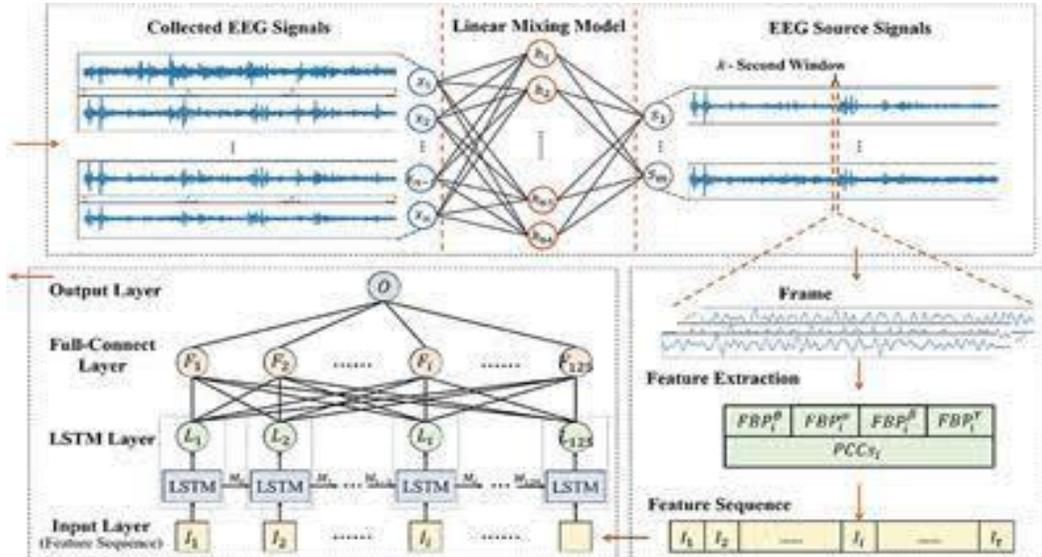


Figure 2: EEG signal analysis system.

Here we are going to analyze two types of modes that are positive mode and negative mode. We will check these two modes by means of EEG sensor. Both the waveforms are generated and it is found that in positive mode the brain waves will be normal and in negative mode the waves will be abnormal and results are stored in database.

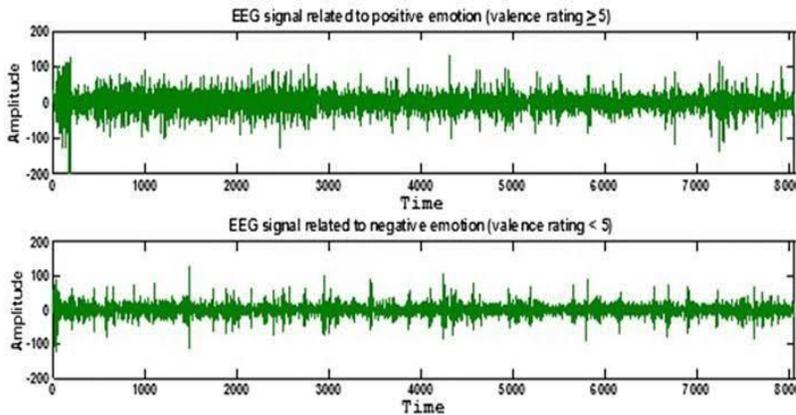


Figure 3: Waveform generated in two cases

## V CONCLUSION

The whole entire setup of finding the characteristics of brain waves will help us to know the complete function of the brain w.r.t to stress that is occurring in an human. Our test will clearly give us the waveform generation with two cases namely relaxation mode and thinking mode. It is found out results obtained will be in the correct and highly accurate.

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