ISSN (Online) 2278-1021
ISSN(Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 7, July 2015

BCI and Audio Responce Approach for Improved Emotional State Classification

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Abstract: This paper reports on the human emotion recon- ignition using different set of electroencephalogram (EEG) channels using discrete wavelet transform. Emotion recognition could be done from the text, speech, and facial. In the past few days, many studies have been done on emotion recognition. Anderson utilized facial expressions to recognize emotion. However, these signals shared the same disadvantage. They are not reliable or perfection is not there to detect emotion, especially when people want to conceal their feelings. In this paper, The EEG-based emotion recognition algorithm based on spectral features and neural network classifiers is proposed. In this algorithm, spectral, spatial and temporal features are selected from the emotion-related EEG signals by applying wavelet transform. We concentrate on recognition of "inner" emotions from electroencephalogram (EEG) signals as humans could control their facial expressions or vocal intonation. We observe the different brain position as Left Hemisphere and Right Hemisphere to recognize the significance according to different moods. The powers of alpha are more alert during National, Happy, Romantic mood as compared to Sad mood. We have used wavelet function for deriving a set of conventional and modified energy based features from the EEG signals for classifying emotions.

Keywords: EEG, Human Emotion, Discrete Wavelet Transform, Speech**.**

I. INTRODUCTION

A brain–computer interface (BCI) is a system that can be communicated in between brain and a computer by which a person can send messages without any use of peripheral nerves and muscles. The ability to effectively classify (EEG) electroencephalograms is the basic building block for Brain-Computer Interfaces. In this proposed work EEG signals will be used to specified the extract data and classify with different variety of human emotions using speech. Emotion is most important for humans. It is not only contributes to communication between humans, but also plays a critical role in rational and intelligent behaviour. Its functions can be seen in many aspects of our daily lives. It is needful system in human. Thus, the study of emotion recognition is indispensable.

The system defined a mechanism of quantification of basic emotions using emotion model. In this study we show that it is possible to recognize the different moods of person using EEG signal. We observe the different brain locations as Left Hemisphere and Right Hemisphere to recognize the significance according to different moods like (happy ,sad ,surprise ,anger) The powers of alpha are more exciting for during National, Happy, Romantic mood as compared to Sad mood. So it is possible to distinguish these different moods using alpha power values. The distance matrices also show that it is possible to differentiate the emotions of persons using alpha power values. Traditionally, EEG-based technologies were used only in medical applications like epilepsy and seizures .EEG used in many sophisticated place that given to perfect result. In the past few decades, many studies have been done on emotion recognition. Anderson and Mc Owen utilized facial expressions to recognize emotion. Ang and colleagues did emotion recognition based on prosody.

However, these signals shared the same disadvantage. They are not reliable to detect emotion, especially when people want to conceal their feelings. In recent years, more and more researchers have started to use EEG signals in recognizing emotion because they are reliable.

II. RESEARCH METHODOLOGY

A. EEG Data Acquisitions

Music and video induces emotion in mind. These emotions are dependent not only types of music, video but also sensitivity of the person subjected to music. we designed a acquisition of customize data protocol using audio-visual stimuli (video clips) to induce discrete emotions. However, songs may be classified as per their general effect on mind. During the study of this classification has

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been done on the basis of song's appeal with respect to happiness, romantic patriotism, or sadness. Understanding of induced brain signals due to hearing of music will be essential information for training computers to identify different types of music. We can used 10/20 system of EEG while getting EEG signal from scalp.

B. Subject Selection

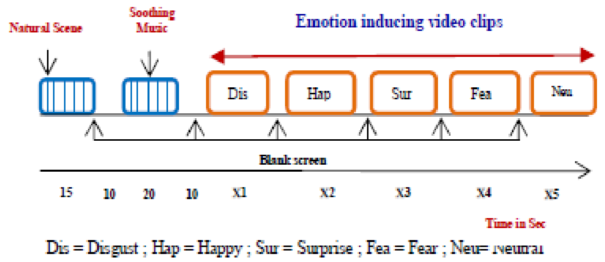

Fig. 1. EEG data acquisition protocol using audio-visual stimulus

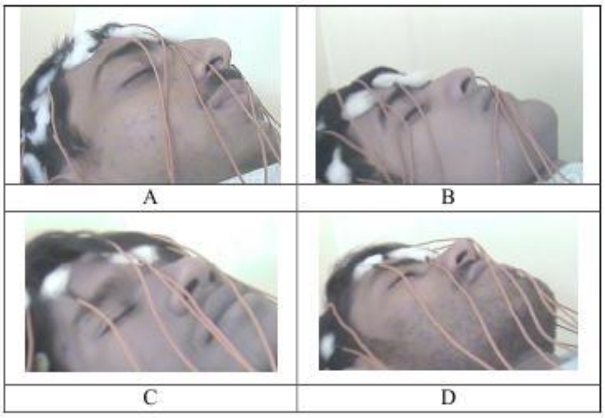

Fig. 2 During Acquisition of EEG signals

C. Pre-processing and Normalization

All subjects were instructed that this experiment has been designed to be used for BCI as mood recognition system. We have designed EEG dataset containing data of five emotion tasks of four different subjects. Subject sleep was conducted on a relaxed arms resting on their legs. The electrodes were placed on scalp of the subject as per the International 10-20 standard. The test was conducted for 25 minutes, with eye closed and each subject was asked to perform these tasks.

EEG signals recorded over different positions on the scalp are usually contaminated with artefacts Muscular noises Vascular (ECG) .In this project, we use of Surface Laplacian (SL) filter for removing the noises and artefacts. The SL filter is used to emphasize the electric activities that are spatially close to a recording electrode, filtering out those that might have an origin outside the skull.

EEG recordings of 4 male right-handed subjects in the age group of 20-25 were taken. The subjects were normal without any mental disorder. All of the subjects were under graduate or graduate students .They did not have any problem in communicating and had normal vision. Subjects were made to sit comfortably on an arm chair. The subjects had given their written consent for recording EEG signals before participating.

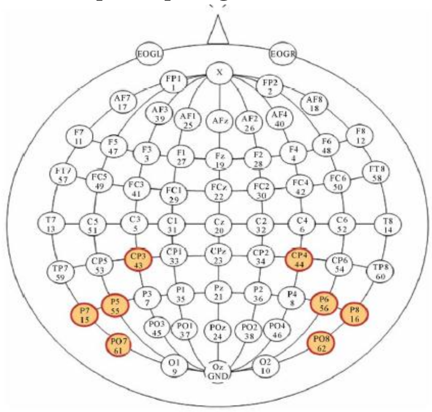

Fig. 3. Electrodes diagram 8 channel

The mathematical modelling of Surface Laplacian filter is given as

$$Xnew = X(t) - \frac{1}{Ne}\sum_{i=1}^{Ne} Xi(t) \qquad (1)$$

Where Xnew : filtered signal ; X(t) :raw signal ;
N : Number of neighbor electrodes

D. Feature Extraction

In the emotion recognition, the non-parametric method of feature extraction based on multi-resolution analysis of Wavelet Transform (WT) is quite new. The different types of spatial and temporal approaches have been applied to extract features from the physiological signal. The joint time-frequency resolution obtained by WT makes it as a good candidate for the extraction of details as well as approximations of the signal. which cannot be obtained either by Fast Fourier Transform (FFT) or by Short Time Fourier Transform (STFT).The signals of EEG is non-stationary nature to expand them onto basis functions created by expanding, contracting and shifting a single prototype function (Ψa,b,the mother wavelet), for the signal under consideration.

The mother wavelet function Ψa, b (t) is given as

$$\psi a, b(t) = \frac{1}{\sqrt{a}}\psi\left(\frac{t-b}{a}\right) \qquad (2)$$

where a, b $\in$ R, a > 0, and R is the wavelet space. Parameters 'a' and 'b' are the scaling factor and shifting factor respectively. The only limitation for choosing a prototype function as mother wavelet is to satisfy the admissibility condition.

$$C\psi = \int_{-\infty}^{\infty} \frac{|\psi(w)|^2}{w} dw \angle \infty \qquad (3)$$

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IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
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where Ψ(ω) is the Fourier transform of Ψa,b (t).
Decomposition of EEG signals into different frequency bands with a sampling frequency of 256 Hz.

Frequency Range (Hz)	Decomposition Level	Frequency Bands	Frequency Bandwidth (Hz)
0–4	A5	Delta	4
4–8	D5	Theta	4
8–14	D4	Alpha	6
14–32	D3	Beta	18
32–64	D2	Gama	32
64–128	D1	Noises	64

The discrete wavelet transform decomposes the signal into Approximation coefficients and detailed coefficients. In this project work, the multi-resolution analysis of "db6"Discrete Wavelet Transform (DWT) has emerged as powerful technique in diverse areas such as Multi-Resolution Analysis (MRA), feature extraction and peak detection of physiological signals. This wavelet function has been chosen due to their near optimal time-frequency Localization properties. Such that, extraction of EEG signals features are more likely to be successful. In order to analyse the characteristic natures of different EEG patterns.

E. Classification of Emotion

In this work experiment, we have used neural network classifiers for classifying the discrete emotions. Among these classifiers, design of neural network with respect to the no of layer and transfer function such as log sig, tan sig, pure linear. After training the neural network and simulation the data network with test data. Comparing expected result with actual result.

III. RESULTS AND DISCUSSIONS

Among all four subjects, 3 trials of emotions happy, surprise, sad, fear and normal and sampled for emotion classification. There are 15 EEG epochs from five discrete emotions. The number of data points in each epoch depends on the time duration of video clips. In our work process; the time slot of video clips varies from one another. The entire feature vector is divided into 75% for training the classifier and 25% for testing the system. The next stage is to train the neural network classifier for classifying the emotions. We found that, the 8 channel EEG data gives the maximum individual classification rate on five motions (happy, surprise, sad, fear and neutral) compared to other channel sets. Hence, the 8 channel EEG performs better over other channels sets for classification of human emotion .The trajectory was almost consistent with the true changes.

IV. CONCLUSIONS AND FUTURE WORK

This present work is aim to analyze the short time EEG to discrete emotion recognition based on the processing of EEG signal. Our research is that Here, the modified energy features classify the emotions better than the conventional features with higher classification rate. Simple classifiers KNN and LDA are used in proposed work. We also analyzed the EEG signals over different frequency bands for emotion classification.

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ACKNOWLEDGMENT

The author thanks **Dr. Narendra Bawane** and **Mr. Pravin Hajare** from S. B. Jain Institute of Technology Management & Research for technical discussion & processing support without whom this paper would never be completed.

REFERENCES

[1] Kevin C. Tseng, Bor-Shyh Lin, "Emotion Recognition of EEG Underlying Favorite Music by Support Vector machine", International Conference Orange Technologies (ICOT) 2013.

[2] Ram K. Nawasalkar1, Harshal R. Lawange2, Surajkumar D. Gupta3, Pradeep K. Butey4 "Study of comparison of human bio-signals for emotion detection using HCI" International journal of emerging trends and technology in computer science arch-April 2013.

[3] Maan M. Shaker, "EEG Waves Classifier using Wavelet Transform and Fourier Transform", International Journal of Biological, Biomedical and
Medical Sciences 2 Spring 2006.R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.

[4] M Murugappan ,"Human Emotion Recognition Through Short Time Electroencephalogram (EEG) Signals using Fast Fourier Transform" , 2013 IEEE 9th International Colloquium on Signal Processing and its Applications.

[5] Murugappan Murugappan, Nagarajan Ramachandran, Yaacob Sazali,"Classification of human emotion from EEG using discrete wavelet transform", Pattern.

[6] Tazrin Ahmed, Monira Islam, Mohiuddin Ahmad,"Human Emotion Modeling Based on Salient Global Features of EEG Signal" ,Proceedings of 2013 2nd International Conference on Advances in Electrical Engineering (ICAEE 2013) 19-2December, 2013.

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