Advances in Computer Science and Information Technology (ACSIT)
Print ISSN : 2393-9907; Online ISSN : 2393-9915; Volume 2, Number 7; April – June, 2015 pp 21 – 23
Krishi Sanskriti Publications
http://www.krishisanskriti.org/ACSIT.html

Analyzing EEG Signals for Detectionofeye and Mind Activities

Mukesh Choubisa[1] and Prakriti Trivedi[2]

[1,2]Govt. Engineering College, Ajmer
E-mail: mukesh24aspur@gmail.com, [2]inyuvidu@rediffmail.com

Abstract—*Human brains work has always Been attractive and challenging to researchers for a decade of time. Brain computer interface (BCI) is now an imperative area for brain research. Neurological singularities that are special features of brain activity .Various method are used to record the brain signals and analyse the mind signal. One of the method is EEG that recording of electrical activity along the surface of scalp. The EEG signal are usually polluted with artefacts due to noise and natural reasons like as eye open and close. In this paper, we study the problem of detecting close and open eyes, awake and sleep mind activity from EEG signals. There are a lot of eye blink detection research in the works but most of those study use EEG devices with several channel. In this study, we focus on analysingactivity using an EEG device with only one channel way method.*

Keyword: *EEG, brain computer interface, eye activitydetection*

1. INTRODUCTION

Human brain has been ainteresting area of research for many decade of years, and is one of the big challenges facing us today for researcher. BCI is enterprise set its long-term goal to better understanding, prevention, and improved treatment of brain diseases and brain injuries, and new emerging computer technologiesto interact with humans. Research on BCI is began in the year of 1970s. BCI technology enable communications between the brain and machine devices. The basic concept of BCI is to measure brain signals. Computer systems use that signal forProcessing of brain signal and then translated to control commands for the human with human health problem to manipulate environment, as Show in Fig. 1

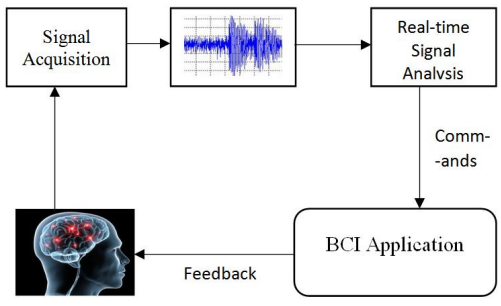


Fig. 1: Brain Computer Interface

BCI systems are divided into two categories: invasive system and non-invasive system. Invasive systems actually embed electrodes into the matter of human's brain to generate high quality signals but may cause problem in the brain such as infectionor nerve damage. Non-invasive electrodes place on the surface of the human head to measure the brain signals.

BCI depend onthe data collection about brain activity thatare generally recorded by device to generate signal.One of the most popular methods for recording brain signalsis electroencephalography (EEG), because EEG is non-invasive, affordable for the researcher and easy to use.

2. BACKGROUND

We first briefly introduce the related work in this paper, including the neuro-technology for brain signal processing, effect of environment on brain function.

2.1 Electroencephalography

Electroencephalography (EEG) is recording of brain activitytaken in brain signal on the surface of scalp. The EEG signal are used in BCI systems to analyse the brain activities. Since EEG provides greats temporal resolution and is less costly than other methods, it is commonly used techniques for study of brain function. There are several other recording techniques to record signal from a human's body.

- Electrocardiography (ECG) a transthoracic interpretation of the electric activity of the heart detected by electrodes attached to the body.
- Magnetoencephalography (MEG) recording magnetic fields produced by electrical current occurring naturally in the brain.
- Electronystagmography (ENG) record involuntary movement of the eye.
- Electrooculography (EOG) record eye movement for measure the resting potential of the retina.

2.2 Neuro-Musical Study

Neuro-musicology is an branch of neurology to study neuro-pedagogy of musician.

2.3 Eye Blink Detection

Eye blink is the most common artefact in the EEG signal analysis problem. Eye blink artefacts affect over 10% of average human EEG (average human eye blink once in 5s, & last for over 0.5s) and an important problem in EEG signal processing.

3. METHODOLOGY

Electroencephalography (EEG) is defined as the electric activity of an alternating type generated by brain structure and recorded from the scalp surface by metal electrodes and Conductive media. The electrical activity is generated by millions of nerve cells, called neurons. Every neuron is connected to other neurons. Some of the connections are known as excitatory while others are known as Inhibitory. The electrical activity of a neuronsingle cannot be measured with EEG scalp. However, EEG can measure the combined electrical activity of billions of neurons. EEG involves the recording of scalp electrical activity generated by brain structures.

3.1 EEG System

The EEG recording machine consists of:

a) Electric Electrode pole with conductive media.
b) Amplifiers and Filters.
c) An A/D convertor
d) Recording device to store the data

Electrodes with the electrode gel, intellect the signal from the EEG scalp surface; amplifierfetch the microvolt andNano volt signal for the digitized correctly.Analog to digital converter changes signals from analogy to digital form that can be used to stored or viewed on a computer screen for the reseacher.

Using small electrode metal plate which is recording signal from mind using either reference electrode or bipolar linkages. Number of electrode are used to various study they are typically placed on scalp location. Figure 2 shows electrode placement system

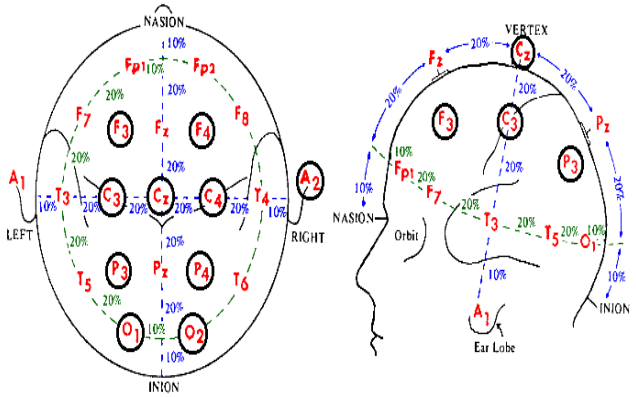


Fig. 2: Electrode system: side and top views

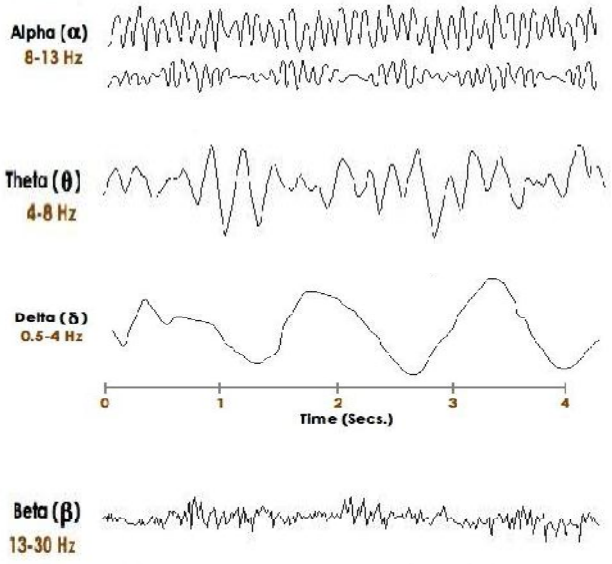
3.2 Brain rhythmic activity

An individual's brain wave patterns are unique. In few cases, it is possible to decide a person according to their characteristic brain activity. A large amount of data received from Even one single EEG channel presents a difficulty for interpretation. The EEG recorded brain waves originate from a multitude of different neural communities from various regions of the brain. Depending on the level of consciousness, normal people's brain waves show different rhythmic activity. For instance, the different sleep stages can be seen in EEG. Different rhythmic waves also occur during the waking state. These rhythms are affected by different actions and thoughts, for example the planning of a movement can block or attenuate a particular rhythm. The fact that mere thoughts affect the brain rhythms can be used as the basis for the BCI.

The EEG several frequency ranges as displayed in Table 1.

Brain rhythm	Frequency (Hz)	Where it can be found
Delta (δ)	0– 4	deep sleep states
Theta (θ)	4 – 8	relaxed state and during light sleep and meditation
Alpha (á)	8 – 13	associated with awake state
Mu (μ)	10 – 12	Open of eye
Beta (β)	14 – 22	Relatedto Excitement State
Gamma (γ)	22 –30	related subjective awareness / abnormal state

Wave Representation



4. EYE BLINK ELECTRICAL ACTIVITIES

Eye blink are basically classified into 3 categories:one is a spontaneous eye blink which is occurred frequently, another activity is a reflexive eye blinks which is induced by an externalstimulus, and another is a voluntary eye blink whichis triggered by intentional eye close action. An eye blink

generateselectrical signal in the vertical signal and horizontal signal EOG.In my study, electrical signal are sensed by using 4 electrodes put on the upper part and lower part of theeye, and left and right side of eye. The vertical and horizontal signal were calculated by subtracting lower part signal from upper part signal,and no dominant side signal from dominant side signal respectively. EOG signals were recorded with 1000Hz sampling interval of time.

4.1 Eye blink characteristics

Figure show the EOG signal detected from two subject during each task. Fig.1 (a)(b)and (c) show vertical EOG signal and (d)(e)and (f) are horizontal signal each signal has positive top in vertical amplitude, they can be differentfrom signals during the resting state. DOUBLE blinks aredifferent from other eye blink because they have twoheights in verticalamplitude. WINK signals are uniquefrom other eye blink signal because horizontal signal of larger amplitude.The duration of normal blink and wink blinkwere Around 400ms, and that of double blink werearound600ms. The amplitude of EOG signals hadindividual difference between signals.

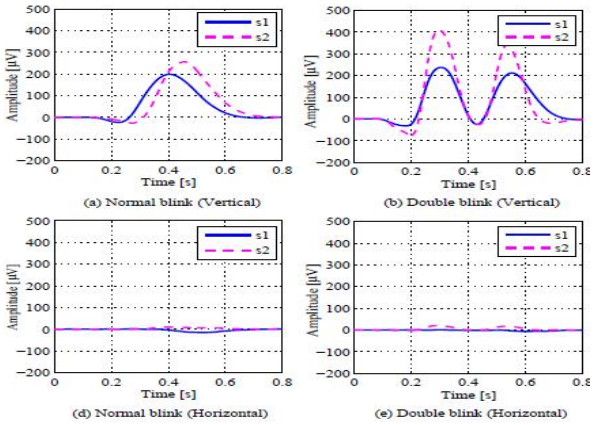


Fig. 1: Vertical and horizontal EOG signals

5. CONCUSSION

In this study we are trying to develop a method to analyze eye movements and mind activity with a one channel EEG data. We Shell be using two cycles of open and closed eyes activity and awake and sleep mind activity tests to collect data.. BCI is an advancing technology promising further research in machine control, virtual reality, and human enhancement. EEG signal consists of different –different brain waves reproducing brain electrical activity according to electrode placements and functioning in the adjacent brain regions.EEG is a complicated data type. It is noisy and composedfrom different waves which are different frequency bands.These frequency bands are associated with several activitiesand they are active in different parts of the brain. We shell select the most relevant features to eye activity. First ofall, we fit a linear model to our data.By applying ANOVA, we shall be founding Deltawave is the most significant feature (High Alpha and LowAlpha are also significant bands). TheData with the selectedfeatures were normalized and smoothed, and then analysed

Using the moving averages and double moving averages. In ourpreliminaryExperiments with two subjects of about 460 datapoints each, eye movement signals were

Not clearly identifiedbut it will be appearing that the variant of the moving average methodmay provide some clues of the patterns in the signal.We are currently conducting more experiments with 5-10subjects with multiple eyes open-close setting parameters.And, we are also working on outlier's detection and clusteringof the outliers that may be useful for the detection of eyeactivities.

REFERENCE

[1] Henry Markram,et al. The Human Brain Project:Report to European Commission. http://www.humanbrainproject.eu/ file HSP

[2] Masaki Nakanishi, Yasue Mitsukura, YijunWang, Yu-Te Wang, andTzyy-Ping Jung. Online voluntary eye blink detection Usingelectrooculogram. In International Symposium on Nonlinear Theoryandits's Applications, pages 114–117, 2012.

[3] The White House. BRAIN Initiative. http://www.whitehouse.gov/infographics/brain-initiative, April 2013.

[4] BrijilChambayil, Rajesh Singla, and RameshwarJha.EEG eye open & close classification using neural network. In Proceedings of the World Congress on Engineering, pages 63–66, 2010.

[5] Amarasinghe, D.Wijayasekara, M.Manic University ofIdaho IdahoFalls, Idaho, USA: *EEG Based Brain Activitymoniter using Artificial NeuralNetworks*, 978-1-4799-4714-0/14/, 2014

[6] Jonathan R. Wolpaw et al. Brain-computer interface technology: A review of the first international meeting. *IEEE Transactions onRehabilitation Engineering*, 8(2):164–173,2000

[7] Baikun Wan, Dong Ming, Hongzhi Qi, ZhaojunXue, and Yong Yin.Linear and nonlinear quantitative EEG analysis. IEEE Engineering inMedicine and BiologyMa gazine, 27(5):58–63, 2008.

[8] MehrdadFatourechi, Ali Bashashati, Rabab K. Ward, and Gary E. Birch.Emg and eog artifacts in brain computer interface System A survey.Clinical Neurophysiology, 118:480–494, 2007.

[9] Mohammad NayeeemTeli. Dimensionality reduction and classification of time embed.

[10] David A. Peterson, James N. Knight, James N. Knight, James N. Knight, and Michael H. Thaut. FeatureSelection and blind source separation in an EEG-based brain-computer interface. EURASIP Journal on Advanced Signal Processing, 2005:3128–3140, 2005

[11] Carrie A. Joyce, Irina F. Gorodnitsky and Marta Kutas. Automatic removal of eye movement and blink artifacts From EEG data using blind component separation. Psychophysiology, 41:313–325, 2004.