

Mental State Evaluation by using Signal Processing

^[1] Mallikarjun H M ^[2] Dr. P Manimegalai ^[3] Dr. H N Suresh

^[1] Asst Prof, Dept. of EIE, RNS Institute of Technology [RNSIT], Bangalore Research Scholar, ECE Dept, Karpagam University, CBT, TN, ^[2] Prof, Dept. of ECE, Karpagam University Coimbatore, Tamilunadu, India ^[3] Prof, Dept. of EIE, Bangalore Institute of Technology [BIT], Bangalore
^[2] mallikarjunhm@gmail.com ^[2] manimegalai.vairavan@gmail.com ^[3] hn.suresh@rediffmail.com

Abstract— Emotion detection of the person by collecting the EGG data, signal from the brain by using “Mind wave Mobile”, which gives the raw EGG waves by the non invasive method only using single electrode. Person by watching the different emotional videos his emotion differs and also the electrical different EGG wave Alpha, Beta, Delta, Gama and theta varies, different waves having its nativity according to the emotional changes.

Lucid scribe application support to collection of data from the Mobile mind wave, the data exported to the excel and by finding the minimum and maximum value of every EGG wave, this is in the numerical values, trained to the Neural Network by using the (ANFIS) Adaptive Neuro Fuzzy Inference System. Data with a extension of .mat file is trained to the ANFIS, testing of the data with the already trained data, output will exist in which emotion the person is, evaluated output may be 0 neutral, 1 Happy, 2 Disgust, 3 Sad, 4 Angry.

In this work Fuzzy based Mental state evaluation using signal processing is carried by preparing 280 Samples are prepared by showing them different videos related to respective emotions. By using neuro sky’s mindwave kit brain waves are recorded at the forehead values are tabulated accordingly. 260 data samples trained and 20 are tested. The 3.2×10^{-3} error is observed after plotting test FIS against training data. As mindwave kit is wearable with Bluetooth support this work may be used in various applications.

Keywords—ANFIS, EGG

I. INTRODUCTION

Emotion is a psycho-physiological process it is often occurs with mood environment and personality. Our daily works are depends on our emotions that we felt and react with the situations and aspects of the day. As humans are leading the socialistic life they cannot escape from one’s own emotions, they can’t resist it. The emotions are human stems from natural inborn source; as we grow from child to adult emotions grow along. One can able to master of their own emotions if they are mentally strong. Emotions are sometimes complex and stalwart state of mind responses in crucial time. Some people are able to express their emotions and some people who are mastered over emotions they can able to control the expressing emotions. There are different kinds of emotions that humans are able to felt like happy, sad, neutral, fear, surprise, calm, alert, disgust, depress, stress and many others.

Electroencephalography (EGG) is the important and useful tool for measuring electrical activity of the brain by this we can classification and prediction of emotions. As one can able to control the emotion without expressing

but the signals which are developed in brain during the reactive emotion cannot be suppressed so the true emotion are detected using the variable different voltages, they are infra-low (<.5HZ) delta waves (.5 to 3 HZ) theta waves (3 to 8 HZ) theta waves (3 to 8 HZ) alpha waves(8-12 HZ) beta waves (12-38 HZ) can be recorded by using electrodes of two standards 10-10 and 10-20 electrodes available methods for the recording of EGG signals is invasive method, it is widely used, and non invasive method is also used rarely.

Data collection is difficult because of EGG data is confidential to overcome this we are using mobile mind wave instrument from the manufacturer neurosky, this instrument fetches the EGG signals by using a single electrode that should be place on the forehead of a person.

- ❖ Gama waves are playing important role in binding of our senses with perception leads to learn new thing, this is lower than average in the mentally challenged.
- ❖ Beta waves are high frequency with low amplitude, which occurred while awake, conscious and thinking. Higher beta arrives when drink of caffeine.

- ❖ Alpha waves are between beta and theta, it arrives when in deep relaxation, it is blocked when in stress of in sleepy.
- ❖ Theta occurs while sleeping and day dreaming also with feeling, high theta is signature of depression.
- ❖ Delta waves present mainly in the young children and after the deep sleep, lesser in the deep sleep also present while digestion and regulation of heart beats.

Signal for any emotions EGG signals are varies according to their emotional response; EGG data is collected from the “mind wave mobile” that is non invasive type method with single electrode for collection of the different range of wave for different emotions .bluetooth is in built for data transmit to external device, data is accessed by the system visualized in the “lucid scribe” software tool. Log base waves are stored in the software, by exporting the waves to the excel format by crop of the required minute, it is in numerical and by finding the minimum, maximum and average value of all waves. using neuro-fuzzy(ansif) logic in the mat lab, by training the collected data in ansif(adaptive neuro-fuzzy inference system) and comparing the test data with the trained data, according to the data emotion is assigned normal=0, happy=1, disgust=2, sad=3, fear=4.

II. LITERATURE SURVEY

Idea to control robot by EGG signal, from the brain, in this paper explained about the assistant robots controlled to help the handicap and physically disabled people by measuring and detecting their support to action by using biosensor. [1] Including emotion in to the human-computer interaction (hci), while emotion due to watching emotional videos the difference in the brain electrical signals. Feature algorithm is for performing optimized sequential forward floating. [2] The data which is already pre-processed and obtained it from DEAP database collected. Considered only alpha and theta were the subjects of interest neural network used for the emotion classification into negative/excited, positive/calm, negative/calm and positive/excited is considered db4 wavelet coefficients for feature extraction and signal decomposed to different EGG bands. [3] brain electrical signals is of different types, which are occurs for an different types of emotion in different ranges, these are collecting from the electrode we are going to use “mind wave mobile” that helps to get the raw EGG signals. in previous papers they discussed about detection and prediction of emotions, idea that to get identifying the different emotions of a person easily by using the NEURO-fuzzy logic in the mat lab, helps to get the mental state evaluation using ANFIS processing.

III. FUNCTIONAL MODEL

The functional model of this project is as shown in the figure 1. Electroencephalogram (EGG) signals are obtained from the mobile mind wave standard database for emotion analysis using physiological signals, data from the pre-processed signals are obtained and features are extracted using mat lab, classification into five emotion classes is done from the inbuilt tools of the mat lab.

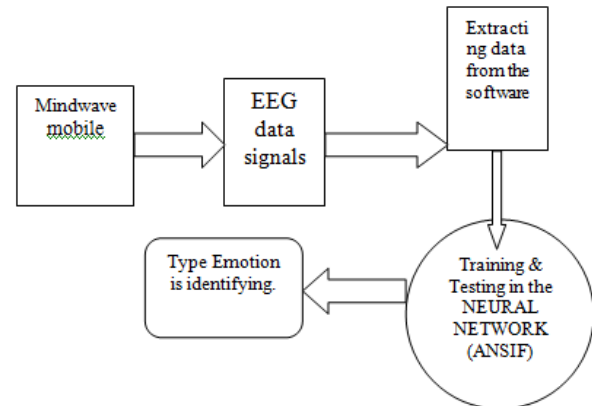


Fig.1 Functional Block Diagram

Standard EGG database signals are used to classify the different emotions, obtained the brain waves from the database for emotion recognition using physiological signals that collected from the instrument is transmitted to the system by Bluetooth. mind wave mobile is manufactured from the neurosky, works in the frequency range of 512-HZ, shown in figure 2 ground clip pin for the reference and single electrode should be touch on the forehead, if the led indication is red it is not connected to the system as the blue light indicates the connectivity is good. neural networks are the kind of logical network which are providing the artificial neural network for the input as many number of nodes and input output functions. Adaptive neuro fuzzy inference system is a type of neural network, it is a good learning algorithm for modeling data, toolbox which is inbuilt in mat lab, uses combination of two different algorithms for modelling data. anfis editor in mat lab is able to adjust its parameters concerned to the data modelling though it adjust the parameters according to the data sheet and the fuzzy inference system rules and, or functions are altered to get a better data model. neurosky manufacturer out come with the “mind wave mobile” instrument work in 512-HZ of frequency consisting of only sing electrode, the raw signals is transmitted from the instrument via bluetooth to the system, by the support of “lucid scribe” software which hold he log of the overall time, EGG data from the instrument is shown in figure 3.3.waves for every micro second is stored with the data sheet of every days,

time, minute and seconds, by exporting this to the excel format we can get the numerical output.



Fig. 2. Mind wave mobile

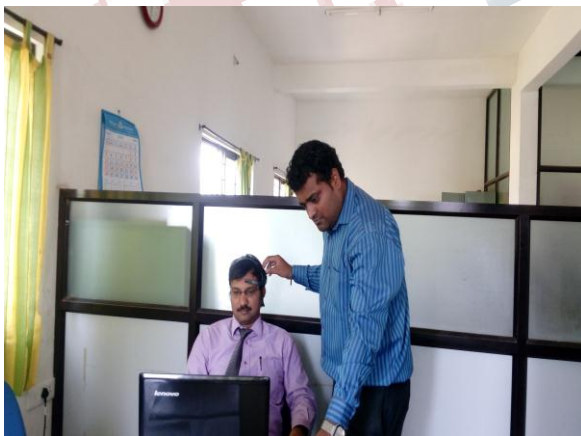
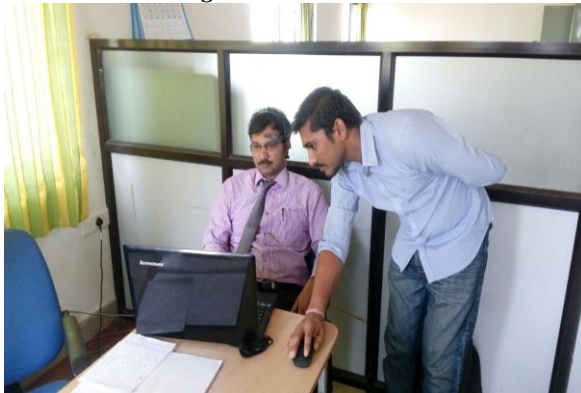


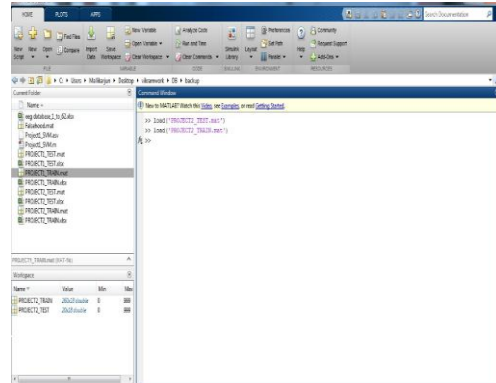
Fig 3. Data collection

Brain signals are taken by utilizing neuro sky's mindwave kit. data's of different age group and different gender are taken. lucid scribe software gives different brain wave signals with respect to time. in lucid scribe brain signals are collected. the data is tabulated for age, gender, alpha, gamma, theta, and delta for max, min and average values.

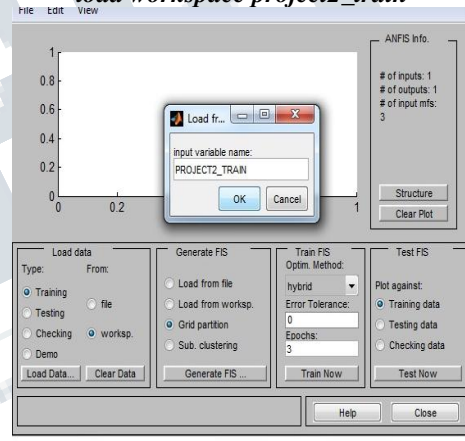
IV. RESULTS

The work is implemented by classifying data sets in anfis.

Step 1: project2_train and project2_test mat files are loaded.

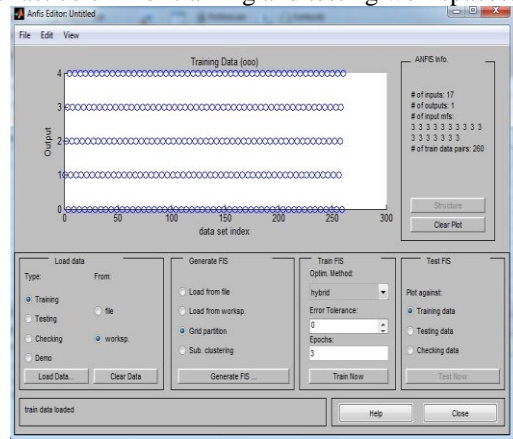


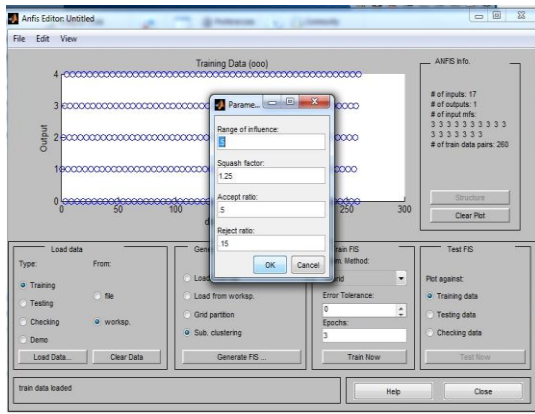
Step 2: the command anfis edit should run in mat lab. load workspace project2_train



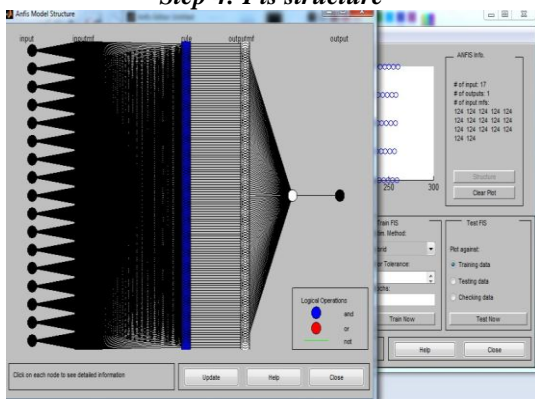
Step 3: 260 samples are trained by choosing 3 epochs

Data which collected is trained with respect to the emotions 0, 1, 2, 3, 4. the result if 0 is neutral, 1=happy, 2=disgust, 3=sad, 4=fear. this is given by entering values in the last column of training and testing workspaces.

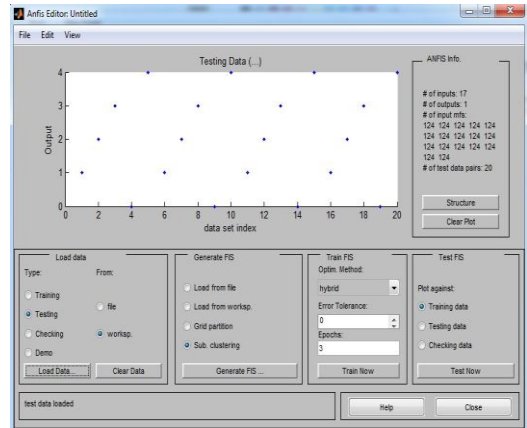
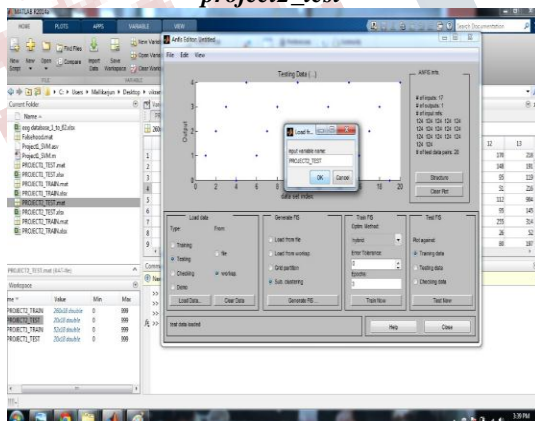




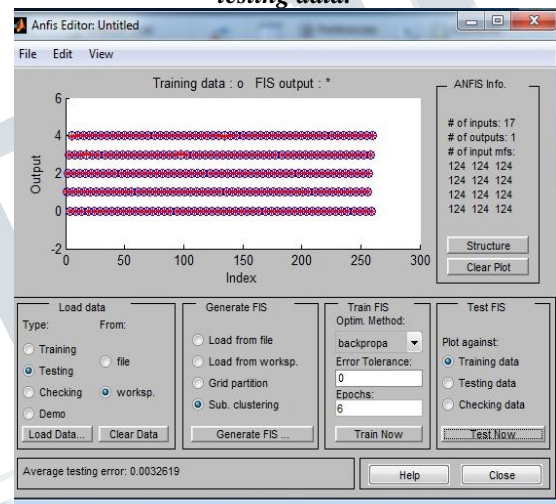
Step 4: Fis structure



Step 5: by loading test workspace 20 samples are tested - project2_test



Step 6: 3.2×10^{-3} error is observed after generating fis testing data.



V. CONCLUSION

In this work fuzzy based mental state evaluation using signal processing is carried by preparing 280 samples are prepared by showing them different videos related to respective emotions. by using neuro sky's mindwave kit brain waves are recorded at the forehead values are tabulated accordingly. 260 data samples trained and 20 are tested. the 3.2×10^{-3} error is observed after plotting test fis against training data. as mindwave kit is wearable with bluetooth support this work may be used in various applications.

VI. FUTURE WORK

Mental state evaluation using signal processing is having wide range of applications in society. this work may be further carried by preparing more number of samples and training them in the anfis.

REFERENCE

- [1] apeksha rani h. m, prathibha kiran international journal of soft computing and engineering (ijsce) issn: 2231-2307, volume-5 issue-2, may 2015.
- [2] jukka kortelainen, member, ieee, and tapio seppänen 35th annual international conference of the ieee embs osaka, japan, 3 - 7 july, 2013
- [3] taciaana saad rached and angelo perkusich an article of intech open science, open mind, <http://dx.doi.org/10.5772/56227>.
- [4] s.hatamikia and a.m nasrabadi, "recognition of emotional states induced by music videos based on nonlinear feature extraction and som classification", 21st iranian conference on biomedical engineering, ieee 2014.
- [5] mr. a. anbumani and a. sathishkumar, "emotion analysis from physiological signal using EGG", international journal of engineering sciences & management research, 1(2): issn: 2349-6193 july, 2014.



medical signal processing and adaptive neural network systems.

Dr. H. N. Suresh is currently working as a prof. in dept. of eie, bit, bangalore. he has good exposure in the field of signal processing, wavelet transforms, neural networks modeling, sensors and transducers, electronics circuit design, bio

ACKNOWLEDGMENT

The authors would like to thank the management of rns institute of technology- principal dr. m k venkatesha, director dr. h n shivashankar for the encouragement. authors extend thanks to vikram s p, mtech 4th sem, ie branch, rnsit for his continuous support in database preparation.

BIOGRAPHICAL NOTES



First author Mallikarjun h m is currently working as an assistant prof in dept. of eie, rnsit, bangalore. his area of interest is EGG signal processing and vlsi applications. he is presently working on brain disorders, depression behaviour by using EGG signals. he published papers in different conferences on emotional classification, sleep disorders and alcoholism by using brain waves.



Dr. P Manimegalai professor, dept. of ece, karpagam university. her area of interest is bio signal processing, wavelet transforms, biomedical instrumentation and applied electronics.