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A Survey on Effect of Meditation on Attention Level Using EEG

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Abstract - *In today's world, the parents are worried about their Children's performance, emotions, and social behaviors. Attention concentration is the indispensable basis for learning. It is seen that the student's attention is reducing according to many teacher's professional researches and experience sharing. The similar cases of attention decreasing can be found not only within students but also in adults. Attention Deficit Hyperactivity Disorder is define as the lack of attention and focus and it is one of the most spread cognitive disorders. Hence, the concentration and stress management is essential for the student. The meditation is considered as a promising technique for body and mind regulation. The meditation plays an important role at physical, mental, and spiritual levels. EEG measures the brain activity useful to recognize the attention states. In this review paper, the effect of meditation on attention level using EEG data analysis is investigated.*

***Key Words*: ADHD, EEG, CFS, KNN**

1. INTRODUCTION

Our brain is constantly processing information and it is paying attention and also it reacted accordingly, to all sensory inputs i.e. audial or visual, etc. So the need to accurately measure a person's level of attention to monitor and detect sport person's performance, and also ADHD in children, etc. Meditation has been used as self-mastery and self-help technique. Meditation helps us to control our own mind and consequently our own life**.** Daily Meditation helps to reduce stress and improve concentration. In this paper, we are discussing the effect of meditation on Attention level using EEG.

An electroencephalogram is a recording of brains spontaneous electrical activity. This is controlled by billions of neurons. These neurons continually send messages to each other which can be picked up as electrical impulses from the scalp. The process of picking up and recording the impulses is known as EEG. An EEG can be divided into following basic frequency bands.

Table -1: brain waves classification

Sr. no.	Type of waves	Frequency range	Human mental stages
1.	Alpha waves	8-13 Hz	Relaxed
2.	Beta waves	13-30Hz	Thinking , aware of self and surrounding , alertness
3.	Delta waves	0.5- 4Hz	Deep, dreamless sleep
4	Theta waves	4-8Hz	Fantasy, dreaming

2. LITERATURE SURVEY

Various work has been done of EEG data analysis on various platform and with various assumption. Some related proposed work has been discuss below.

Bin Hu, Xiaowei Li, Shuting Sun, Martyn Ratcliffe [1] presented paper on the processing of EEG data to identify attention during the learning process. The authors propose a classification procedure that combines correlation-based feature selection (CFS) and a k-nearest-neighbour (KNN) data mining algorithm. A self-assessment model of self-report was used with a single valence to evaluate attention on 3 levels (high, neutral, low). It was found that CFS+KNN had a much better performance, giving the highest correct classification rate (CCR) of 80.84+3.0% for the valence dimension divided into 3 classes.

Laxmi Shaw, Aurobinda Routray [2] presented technique which was undertaken to study the specific statistical features of EEG data collected during meditation and normal conditions. The meditation practice changes the attentional allocation in the human brain to visualize this; statistical features are carefully calculated from different wavelet coefficients to categorize two diverse groups i.e. Meditators and Non-Meditators.

Brahim Hamadicharef, Haihong Zhang, Cuntai Guan et.al. [3] Proposed new approach in which spectral-spatial features from multichannel EEG are extracted by a two filtering stages: a filter-bank (FB) and common spatial patterns (CSP) filters. The most important features are selected by a Mutual Information (MI) based feature selection procedure and then classified using Fisher linear discriminant (FLD). The outcome is a measure of the attention level.

Alaa Eddin Alchalabi, Mohamed Elsharnouby, Shervin Shirmohammadi, and Amer Nour Eddin [4] presented paper in which, they put the two things together and investigate the integration of an EEG-controlled serious game that trains

and strengthens patients' attention ability while using machine learning to detect their attention level.

Esmeralda C. Djamal, Dewi P Pangestu, Dea A. Dewi [5] proposed a technique for recognition of attention state using wavelet filter and support vector machine. Evaluation of students learning process divided by two states, that attention and inattention. EEG was extracted using wavelet that filterd in the frequency range of 5-30 Hz.

Narendra Jadhav, Ramchandra Manthalkar, Yashwant Joshi [6] proposed a system in which the effect of meditation on emotional response using EEG is investigated. The simple meditative technique such as focused attention on breathing is taught to the subjects. EEG is recorded at the beginning of meditation experiment and after eight weeks of regular meditation. The asymmetry of band power (theta, alpha and beta band) and Hjorth features are used as emotion-specific EEG features. The average effect of these features is more on frontal asymmetry. EEG functional connectivity of selected brain regions during four emotions (Happy, Angry, Sad, and Relax) in pre and post-meditation state is examined. The results revealed that more coherence in the post-meditation is found for all emotions. The K-Nearest Neighbours (K-NN) classifier is used and emotion classification accuracy after 8 weeks of meditation is decreased.

3. PROPOSED WORK

It has been study that EEG signals contain considerable information for attention recognition, and give effective and objective solutions to detect attention in learning process. Based on these results, objectives of this work are defined as focusing on the processing of EEG data to identify effect of meditation on attention level.

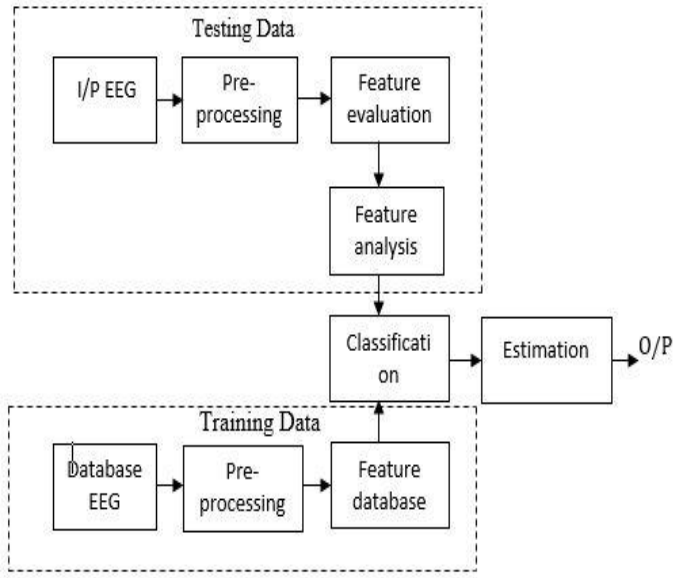

Fig -1: Proposed block diagram

3.1 Data Acquisition

The EEG signal acquisition is very important in biomedical field because it detect problems in the electrical activity of the brain for signal analysis. In this paper we will take the data by using the 10-20 system. The 10-20 system the placement of the electrodes is based on the relationship between area of cerebral cortex (the 10 and 20 refers to the 10% and 20% inter-electrode distance) and location of electrode. It is the standard system for placement of the electrodes on the human scalp.

F: frontal lobe

C: central lobe

T: temporal lobe

P: parietal lobe

O: Occipital lobe

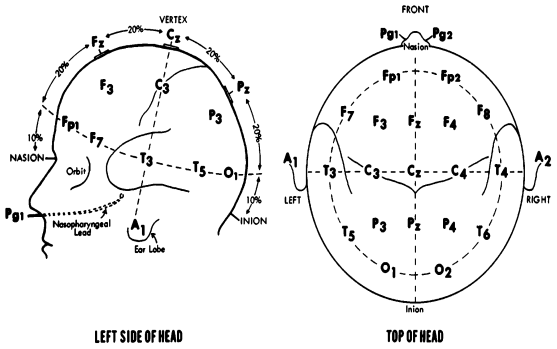

Fig -2: 10-20 system for electrode placement

3.2 Pre-Processing

EEG signal is contains the low range of the frequency components and amplitude. The critical problem in analyzing the EEG signal is because of detection of the different types of noise signal mixed with the EEG signal during the recording process. These Sources of noise in EEG may be due to static electricity and EMF produced by surrounding devices. With these external noises, the EEG signal influenced by artifacts that originate from our body movement or eye blinks during recording process. To remove these noises from signal various filters are available basically IIR and FIR filter. IIR filters are designed to provide the non-linear phase response and FIR filters are designed to provide the linear phase response.

3.3 Feature Evaluation

Here we are using multilevel wavelet transform decomposition for feature extraction. The brain wave is extracted from signal into frequency bands, as Delta (0.5–4 Hz), Theta (4–8 Hz), Alpha (8–13 Hz), Beta (13–30 Hz) and Gamma (30-100 Hz). We will consider parameters as mean, EEG signal amplitude, standard deviation and Entropy etc.

3.4 Classification Method

Classification algorithms help to predict the qualitative features of a subject's mental state by extracting useful information from the EEG data. Here we will consider Random forest method for classification.

Random Forest classifiers are the ensemble classifier introduced by Leo Breiman and Adele Cutler. Random Forest is a combination of many Decision Tree classifiers. Random Forest generates n number of random trees, with the help of bootstrap of training dataset and generating trees. The objective to use Random Forest classification method is it makes use of random data hence no dependence between the data, it is also good with dealing with the outliers. It has an effective method for predicting missing data and also maintains accuracy when the proportion of missing data is more. The other advantage of random forest it handles high dimensional data very effectively without affecting performance and the accuracy results. Along with effective process of Random forest the only disadvantage is it is time consuming.

4. CONCLUSION:

Students who are anxious, angry or depressed don't learn and take information efficiently, so there is need to measure the attention level. The meditation plays an important role at physical, mental, and spiritual levels. So with the help EEG we are measuring the brain activity useful to recognize the attentional states and effect of meditation on attention level.

REFERENCES

[1] Bin Hu, Xiaowei Li, Shuting Sun, Martyn Ratcliffe, "Attention Recognition in EEG-Based Affective Learning Research Using CFS+KNN Algorithm," in Journal of LATEX files, vol 11, IEEE 2016.

[2] Laxmi Shaw, Aurobinda Routray, "Statistical Features Extraction for Multivariate Pattern Analysis in Meditation EEG using PCA," IEEE 2016

[3] B. Hamadicharef, H. Zhang, C. Guan, C. Wang, K. S. Phua, K. P. Tee, and K. K. Ang, "Learning eeg-based spectral-spatial patterns for attention level measurement," in Circuits and Systems, 2009. ISCAS 2009. IEEE International Symposium on. IEEE, 2009, pp. 1465–1468

[4] Alaa Eddin Alchalabi, Mohamed Elsharnouby, Shervin Shirmohammadi, and Amer Nour Eddin, " Feasibility of Detecting ADHD Patient's Attention Levels by Classifying Their EEG Signals," IEEE 2017

[5] Esmeralda C. Djamal, Dewi P Pangestu, Dea A. Dewi, "EEG Based Recognition of Attention State Using Wavelet and Support Vector Machine," International seminar on Intelligent technology and its application, IEEE 2016.

[6] Narendra Jadhav, Ramchandra Manthalkar, Yashwant Joshi, "Effect of meditation on emotional response: An EEG-based study," Biomedical Signal Processing and Control 34 (2017) 101–113

[7] Mandeep Singh, Mooninder Singh, Ankita Sandel, "Data Acquisition Technique for EEG based Emotion Classification," IJITKM Volume 7, June 2014 pp. 133-142

[8] Anita Patil, Chinmayee Deshmukh , Dr. A.R.Panat, "Feature extraction of EEG for emotion recognition using Hjorth features and higher order crossings," in Conference on advances in signal processing(CASP), IEEE, Jun 9-11, 2016

[9] Pascal Ackermann, Christian Kohlschein, Klaus Wehrle, " EEG-based Automatic Emotion Recognition: Feature Extraction, Selection and Classification Methods," 18th International Conference on e-Health Networking, Applications and Services, IEEE 2016