Comparison of eeg in meditation for various wavelets

Health & Medicine, Mental Health

Statistical Feature Based Comparison of EEG in Meditation for Various Wavelets

The brain is most complicated framework which involves association of billions of nerve cells (neurons) which displays rich spatiotemporal flow. Among all techniques for inspecting human brain, an immediate measure of cortical movement with a resolution less than millisecond is only obtained with EEG. Brain and meditation have a connection for centuries. This study involves statistical analysis of EEG spectral power during meditation and non-meditation. This study also deals with regular meditators in two conditions first are during meditation and second is during normal condition. The EEG signal is recorded for 40 subjects in which 20 are regular meditators and 20 are non-meditators. This recorded data is pre-processed to remove the artifacts. After that wavelet transform is applied for different wavelet functions and then Fourier transform is performed to achieve power spectrum density. It was found that theta power increases during meditation and also haar wavelet provides better results than other wavelet functions. This study signifies that with meditation there is a considerable change in EEG of person is observed.

The Brain is largest and complex part of human body. It’s important to study this organ to gain sufficient physiological and psychological knowledge. The purpose behind the significance of brain in our body is that it oversees the greater part of beliefs, determination, behaviors and awareness. Meditation has been practically speaking for in excess of three thousand years. Its underlying foundations can be followed back to Hinduism and types of

meditation can be found in each significant religion. While contemplation styles, sources, and belief systems extraordinarily vary, its motivation is uniform: Individual change. In late decades, meditation has been thought to be a viable option and correlative treatment to mitigate push related psychosomatic syndromes Substantial confirmation has uncovered that contemplation can be utilized for checking cardiovascular diseases, stress, and mental disorders. EEG (Electroencephalography) measures electrical signals of brain by using non-invasive electrodes which are placed on scalp. EEG computes the fluctuations in voltages which results from currents due to ions within the brain.

Revati Shriram et al. presented comparison of multiple wavelet families depending on risk functions and measures of reconstruction to explore decomposition and reconstruction. They studied various statistical parameters to check the suitability of various wavelets in case of normal EEG and diseased EEG signal. Tapan Gandhi et al. proposed a study to find the most valuable wavelet function among the current members of wavelet families to analyse the EEG signal. The considered EEG for this study is normal and epileptic EEG. Dylan DeLosAngeles et al. calculated power of EEG in standard frequency bands. This study aimed to correlate EEG power in five states of Buddhist concentrative meditation. Fred Travis et al. proposed a meditation category automatic self transcending to give a contrast with focused attention and open monitoring. This study tells about the different cognitive activities involved with various meditation practices in EEG bands. Hafeez Ullah Amin et al. described a discrete wavelet based technique for

classification of EEG. In this paper EEG signal is discrete wavelet transformed and then relative energy for different wavelet coefficients with db4 wavelet had been calculated. Priyanka Khatwani et al. discussed various noise removal techniques for EEG signals.

The methods were: ICA, PCA, Wavelet Transform and Wavelet Packet Transform. Sivaramakrishnan Rajaraman et al. proposed a review on meditation that includes study of various kinds of meditation, acquisition of meditation data by researchers, various methodologies and purpose of meditation in well-being of humans. Ateke Goshvarpour et al. proposed bispectrum analysis of EEG signals during meditation. In this study eleven meditators and four non-meditators were asked to do meditation by the instructions of guide. Narendar Jadhav et al. [14] discussed the effect of meditation on emotional response. In this study they taught the focused attention their subjects. Meditation affects the cognitive processes of brain in many ways. To acquire the meditation effect on brain EEG is used to record brain responses. Meditation practices alter the mental state and also induce ever lasting effects. Marieke K. Van Vugt et al. proposed a way to use simulation methods to find the comparisons and differences between wavelets, multitapers and Pepisode that are all spectral processes. M. Akin et al. presented a study in which comparison between wavelet transform and FFT method for analysis of EEG signal is given. In this study wavelet transform is better than the FFT for the brain signals is examined.

Data was recorded for 40 healthy subjects in which two groups are participated. The first group consists of 20 number of regular meditators and

another group consists of 20 non-meditators. All the subjects involved in this study are healthy persons and essential details about their personal profile like age, gender, height and regular medication is collected before recording. The average age of subjects is 22 years. Recording was done for 30 minutes in which first five and last five minutes are given to subjects for relaxation. The subjects were asked to keep eyes close during recording to have minimal eye movement artifacts. The EEG was recorded for two conditions. The first condition in which subjects performed meditation and during that time EEG was recorded. The second condition in which subjects sit in quite relaxed position in normal condition.

The data was recorded from the Biopac ®MP 36 acquisition system using disposable electrodes and connecting leads. The EEG signal is sampled at 1000 Hz and digitized with the data Biopac BSL AcqKnowledge Ver. 4. 0 software. There are three red, white and black leads connected to disposable electrodes at positions Fp1, Fp2 and earlobe respectively. The data acquired is bandpass filtered between 0. 1-100 Hz and notch filtered at 50 Hz. The BIOPAC®MP 36 data acquisition system is the heart of all Core Packages. The MP36 unit has an internal microprocessor to control data acquisition and communication with the computer. It takes incoming signals and converts them into digital signals that can be processed with the computer.

Signal is acquired from brain through disposable electrodes placed on locations from where signal is required. The leads are connected to disposable electrodes. The MP 36 acquisition unit obtains signals through leads connected to it and communicates with computer to sore the data of

physiological signals. This data is then processed in matlab. The flowchart gives idea about the procedure followed for study. The first step involves the acquisition of signals from human brain. Then collected data was band pass filtered between 0. 1-100 Hz in matlab using bandpass filter toolbox.

Then collected data was band pass filtered between 0. 1-100 Hz in matlab using bandpass filter toolbox. The bandpass filter is designed using FIR filter using hamming window. Then data was notch filtered using notch filter toolbox in matlab. The notch filter is used to remove powerline artifacts. After that discrete wavelet transform was applied. DWT helps in decomposition of signal and denoising. Wavelet transform was applied with sampling frequency of 1000 Hz. DWT for different families were obtained to see the comparison. The family functions used were haar, db8, sym18, bior3. 7 and coif 5. Then FFT is applied to wavelet transformed data to get the power spectrum. The power spectrum density was calculated using FFT. Various statistical features were calculated using the power spectrum.