

Concentration level detection for left/right brain dominance using electroencephalogram signal

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Abstract: Some features of left and right brained people can be determined using the left and right brain dominance theories. It can assist in the development of training syllabus for brain-balancing education topics. When performing any action, human focus or concentration is essential. This paper will examine the concentration levels of patients with left and right brain dominance using electroencephalogram (EEG) data. Brain activity may be tracked and recorded using EEG waves. The human brain's thinking and attention cause brain waves to alter in distinct frequency bands. A frequency-based EEG signal can be cleaned up and characteristics can be extracted using the baseline correction method. As a result, the EEG Topographical Power Spectral Density Value is created. The main objective of this paper is to compare the concentration levels of people with different brain dominance. Inversely, EEG signal can be used to predict whether a person has a left or a right brain dominance.

Keywords: Brain dominance, concentration, electroencephalogram, power spectral density, topographical value.

1. Introduction

Human brain is the most complex organ of the body, which controls human body and memory. Left and right hemispheres of the human brain are separated by corpus callosum (Sim et al., 2016; Cherry, 2020). Corpus callosum controls the exchange of information from the left hemisphere to the right hemisphere and vice versa. The movements of the right side of the body are controlled by the left hemisphere and vice versa (Trafton, 2014). Left and right hemispheres of human brain carry different functions. The left hemisphere is responsible for sequential and logical thinking, solving mathematical problems, while the right hemisphere is responsible for creative thinking and imagination, including music, art etc. (Alady, 2019; Oflaz, 2020). Most people use one side of the brain predominantly, so, based on this reality, people are divided into two categories: people with left brain dominance and people with right brain dominance (Daud et al., 2015; Wang et al., 2015). Left-brained people have a greater ability in mathematics and science that involve analytical and logical thinking, whereas, a right-brained person has a better talent in art and music that involve a higher level of imagination and creativity (Sim et al., 2016; Sudha et al., 2017). A few of the greatest minds (Albert Einstein, Leonardo DaVinci, Samuel Morse, and others) were whole-brain thinkers who achieved great things in all fields, such as inventions in scientific research as well as art or music (Ali et al., 2017).

EGG signal recognizes not only the human brain dominance, but also the concentration level of the human brain. The brain activity information can be acquired by different techniques like: magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI), positron emission tomography (PET) and electroencephalogram (EEG) (Sim et al., 2019, Ashraf et al., 2017). EEG has now become a scientific field as by using EEG signal researchers can examine and estimate the fluctuation of human brainwaves. In human brain, the ionic current flows in neurons and generate the voltage (in a range from 10 to 100 microvolts) in the scalp (measurable electromagnetic waves). These waves are named EEG signals and need to be amplified by a computer system in order to be analyzed. EEG is a method which has high sampling frequency and it can measure the voltage emitted in the scalp (Sim et al., 2016). The raw EEG waveform is interfered by different sources of noise. Noise minimization can be done by means of the baseline removal method (Sim et al., 2019; Fawaz et al., 2020). Electroencephalography (EEG) is a process