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Transformation of Brainwave into Digital: How this will be beneficial

Abstract

This paper is about the neuroinformatics and transformation of brainwave into digital. Gives the basic information about human nervous system and how can we measure brainwave and its techniques. Also it describes the probably model for converting brainwave into digital. Also it lights on the benefits of it's and describes what we achieved and what remains.

Keywords: *Neurons, Signal Processing, Brainwave, EEG, Brain Machine Interface, nervous system, Digital*

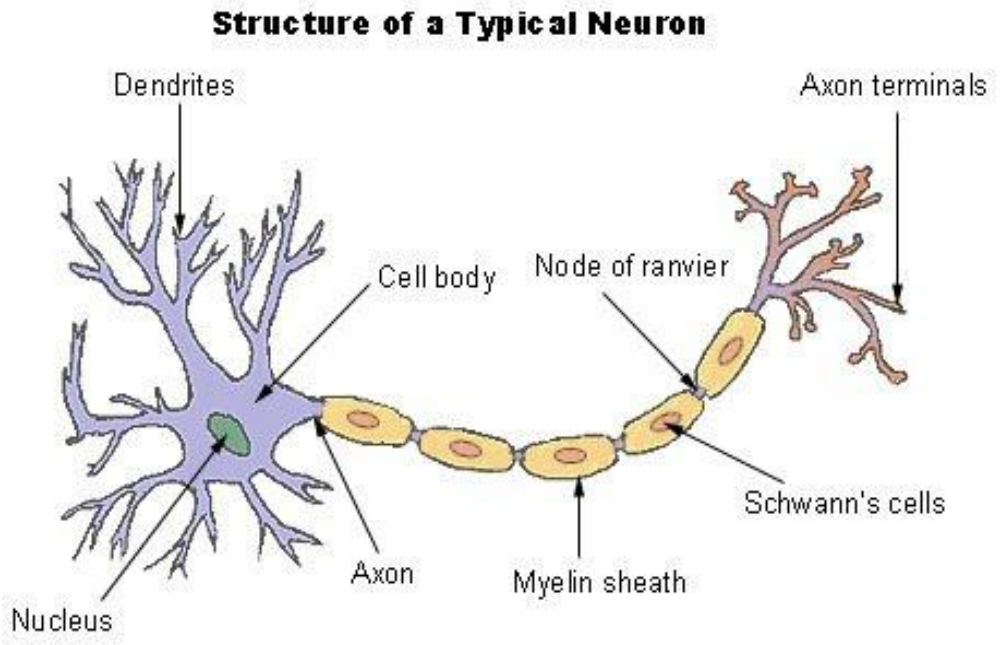
Introduction

Human brain is the most powerful thing in the world and movement of body is dependent on the nervous system. We can compare nervous system with the CPU of computer. The human nervous system can be dividing in two main parts

1) The central nervous system (CNS)
2) The peripheral nervous system (PNS).

The Central Nervous System are formed by the brain and spinal cord while the Peripheral Nervous System mainly formed by nerves (enclosed bundles of the long fibers or axons) connect the Central Nervous System with other part of the body. There are two types of nerves in nervous system 1) motor and 2) sensory. Nerves that transmit signals from the brain are known as motor or efferent nerves. Nerves which transmit information from the body to the CNS are known as sensory or afferent.

The Structure of a typical neuron as shown in figure below



Neurons in brain are transferring the data though the signal in some particular format which is known as brain wave. There are mainly **three ways** which is used by neuroscientist to capture brain waves [I]:

[1] Neuroscientists can use implanted electrodes that penetrate the cortex to record the activity of brain cells. This is riskiest method but as well provide clearest signal as of benefit [ii].

[2] Electroencephalography (EEG): This is an electrophysiological monitoring method to record electrical activity of the brain. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain. However this method contains no risk.

[3]Electrocorticography (ECoG): In this method electrodes draped over the surface of the cortex, it may represent the "sweet spot," also it may represent a compromise between risk and clarity. ECoG or intracranial electroencephalography (iEEG), is a type of electrophysiological monitoring that uses electrodes placed directly on the exposed surface of the brain to record electrical activity from the cerebral cortex

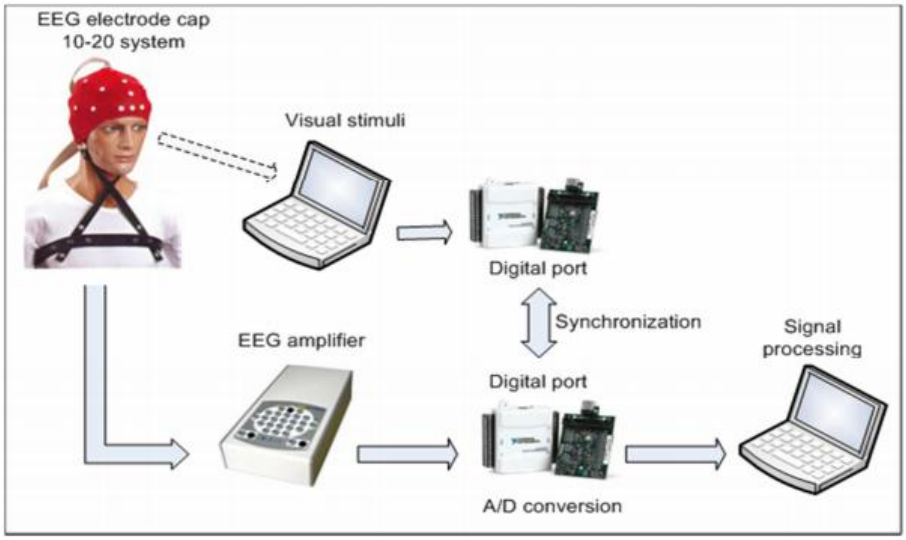
Types of EEG Signals [IV]

- Beta waves are in the frequency range of 12 and 30 Hz, but are often divided into β1 and β2 to get a more specific range. The waves are associated with focused concentration. It can be best define in central and frontal areas. The waves are small and fast.
- Alpha waves are slower. Rang of alpha are from 7.5 to 12 Hz and its associated with relaxation and disengagement. When we thinking of something peaceful and our eyes closed should give an increase of alpha activity.
- Delta waves, rang of delta wave from 0.5 to 3.5 Hz, this is the slowest waves. It occurs when sleeping. If these waves occur in the awake state, it thought to indicate physical defects in the brain.
- Theta waves, rang of theta wave from 3.5 to 7.5 Hz, theta waves are linked to daydreaming. The very lowest waves of theta represent the fine line between being awake or in a sleep state. Theta arises from emotional stress, especially frustration or disappointment.
- Gamma waves are in the frequency range of 31Hz to 100 Hz.

Possible method for converting in digital

The different types of EEG signals are there as given so far. Now based on the understanding of that signals it is possible to transfer these gentle information into digital form. For Example: - Eye movements: The eyeball acts as a dipole with a negative pole oriented posteriorly (retina) and a positive pole oriented anteriorly (cornea). When the globe rotates about its axis, it generates a large amplitude alternate current field detectable by any of the electrodes positioned near the eye. A blink causes the positive pole (the cornea) to move closer to front polar FP1, FP2 electrodes, producing symmetric downward deflections.

But this is not actually we want this is bit of information we can transform only. Consider below diagram for the possibility of conversation of Brainwave into Digital Form.



Advantages

- Able to control artificial robotics body parts
  - Brain-machine interfaces (BMIs) measure electrical activity from the brain and use the signal to control something. Brain-machine interfaces available in different sizes and shape but working of all BMI are fundamentally same: it used to detect the smallest voltage changes in the brain which generally occur when neurons fire to trigger a thought or an action, and they translate those signals into digital information that is conveyed to the machine.
- Able to Programs Neurons(Memory loss)
  - If the transformation of brainwave into digital vise versa can be possible than we can program the neuron and also put the digital information into the brain from the outside
- Defense
  - Robotic defense machinery can be control from the long distance using internet of thing and human can control them using their mind from remote location
- New Vision
  - It can also possible to give a vision to blind people using camera and converting this digital images into mind understandable form and providing these directly to the brain. Like a artificial eye or vision.

Also so many advantages could be possible by this transformation. This will bring a new era in field of neuro-medical science and artificial intelligence.

Conclusion

Neuroinformatics is very vast field and lots of things and mystery is unsolved in this field. Here, this paper discussed about the basic neuroscience and informatics types of brain signals and the how can we convert them into digital. The paper also include possibility of method with diagram and also include that what revolutionary benefit we will achieved if we done this transformation successfully. if we achieve this than it will be proved as a new revolution in the history of medical science and also in as artificial intelligence field.

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