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How Brain-Computer Interfaces Are Leading To Advances In Neuroscience

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ABSTRACT

BCI technologies have been instrumental in helping people overcome several neurological challenges and restore part of their independence. Read on to learn more.

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Introduction

Brain-computerized interface or **BCI** is a modern scientific technology that enables medical, particularly neurology experts, to use the brain's signals to convey command onto external devices. Our brain releases electric signals through its cells, called neurons, whenever it has to process something. These electrical charges then serve as commands to the relevant part/organ of the body and get it to work.

Simply put, a person's mind gives out electronic currents/waves that dictate the body's faculties to perform a particular function. Previously, these electrical impulses, aka brainwaves, couldn't be used directly as commands to operate an external device unless a person used their extremities. But now, thanks to brain-computerized interfaces, scientists can extract brainwaves and get them to command activity in external devices such as a wheelchair or prosthetic arm. Naturally, this ultramodern technology has been instrumental in helping patients with neurological limitations, especially those with motor impairments.

How Brain-Computerized Interface Detect and Pluck Brainwaves?

Brainwaves are produced when the neurons in a brain get to work. Once released, said electrical impulses could be picked up by a number of invasive and non-invasive techniques. The one most commonly used involves the use of electroencephalograms or EEGs.

EEGs are essentially tiny electrodes and wires attached to a cap. These electrodes are connected to an electrical system, known as the International 10-20 System, which uses two points on a person's scalp to identify brain signals. These two points of reference are called nasion and inion, respectively.

The International 10-20 system relies on the link between an electrode on the scalp and the underlying part of the cerebral cortex. Simply put, the EEGs (the electrodes and wires on a BCI cap) pick up the electrical impulses underneath the scalp, amplify them and in the end, record them as waves (think of the brain activity graph people receive when getting an EEG scan).

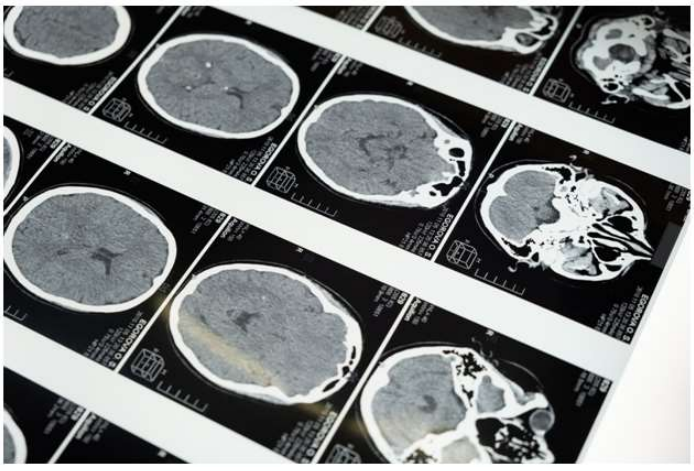

Figure 1.

A white and black board menu of a brain scan

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External Use of Brainwaves with BCI

As already explained above, the brain-computerized interface allows scientific experts to extract signals from the brain and use them for operating an external device. This external use of brainwaves is greatly beneficial for people with a damaged neuromuscular system, that is, individuals with motor impairments.

Neurological patients who don't have much or any control over their motor organs have become dependent on others to perform the most mundane tasks of everyday life, such as drinking water. Obviously, someone with paralysis cannot pick up a glass or cup because of the disrupted flow of electrical impulses from the brain to the person's hand. Or if somebody's leg had to be amputated and now they struggle to do routine activities, their life would be pretty challenging and understandably so.

For such people who lack independence in life, BCI technology is a lifesaver as it re-establishes some independence by allowing neurological patients to command external devices to perform necessary acts for them.

Prosthetics

People without a limb can now operate a prosthetic using state-of-the-art BCI-driven apps.

Word Processing

Individuals who cannot speak because of a stroke or paralysis can learn to communicate using BCI technologies and operate word processing software.

Restoring Motor Function

Brain-computerized interface systems can also help patients restore practical motor function using EEGs to learn the current brain activity level and subsequently fix it by guiding activity-dependent brain plasticity.

Conclusion

Looking at the incredible benefits of BCI-driven technologies, it's safe to deduce that treating people with neurological deficits is much more plausible now than it was before. Neurology experts can now help patients restore some of their brain and motor-neuron functions and conduct improved neuro rehabilitation.