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Main Characteristics of Brain-Computer Interface

Brain – Computer interface (thereafter BCI) started with the development of electroencephalography (EEG). In 1924 Hans Berger's recorded an EEG signals from a human brain for the first time. By analyzing that signals Berger was able to identify activity in the brain, such as the alpha wave, also known as Berger's wave. The first recording device used by Berger was elementary, which was in the early stages of development, and was required to insert silver wires under the scalp of the patient. Sure it was not the best way for recording. In later stages, those were replaced by silver foils that were attached to the patients head by rubber bandages later on

Berger connected these sensors to a Lippmann capillary electrometer, with disappointing results. More sophisticated measuring devices such as the Siemens double-coil recording galvanometer, which displayed electric voltages as small as one ten thousandth of a volt, led to success. Berger analyzed the interrelation of alternations in his EEG wave diagrams with brain diseases. EEGs permitted completely new possibilities for the research of human brain activities.

At the moment we have 2 main types of BCI's. It's invasive BCI and non-invasive BCI.

Invasive Brain Computer Interface devices are those implanted directly into the brain and have the highest quality signals. These devices are used to provide functionality to paralyzed people. Invasive BCIs are also used to restore vision by connecting the brain with external cameras and to restore the use of limbs by using brain controlled robotic arms and legs.

Partially invasive BCI devices are implanted inside the skull but rest outside the brain rather than within the grey matter. Signal strength using this type of BCI is bit weaker when it compares to Invasive BCI. They produce better resolution signals than non-invasive BCIs. Partially invasive BCIs have less risk of scar tissue formation when compared to Invasive BCI.

Non invasive brain computer interface has the least signal clarity when it comes to communicating with the brain (skull distorts signal) but it is considered to be very safest when compared to other types. This type of device has been found to be successful in giving a patient the ability to move muscle implants and restore partial movement.

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BCI is one of the exiting areas of research. This device has been developed to control the thoughts of the different users. Some of the applications of this technology may seem interesting such as the ability to control a video game by thought. If you think a remote control is convenient, channels could be controlled by our mind. The use of EEG signals as a vector of communication between man and machines represents one of the current challenges in signal theory research. The principal element of such a communication system is known as "Brain Computer Interface". BCI is the interpretation of the EEG signals related to the characteristic parameters of brain electrical activity. This is the new emerging area which is mainly for the patients in the treatment bed (those have lost their speech due to accident or with any reason). Over the past few years, numerous proof-of-concept experiments have shown that people unable to move can use simple EEG-based BCI systems for point-and-click, robot control, and even spelling at rates as fast as 20 words per minute.

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