TRANSMISION OF COMMANDS AT DISTANCE IN INTEGRATED TECHNICAL SYSTEMS

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Abstract

A brain-computer interface (BCI) is a communication and control channel that is not dependent on output normal brain pathways of peripheral nerves and muscles. Currently, the main impetus for development and BCI research is the hope that this technology will be valuable for those suffering from neuromuscular disorders.

BCI operation depends on the interaction of two adaptive control, user brain that produces the input data, and the system itself, which translates into output data activity.

The success of the operation BCI requires the user to acquire and maintain a new skill, a skill that is not in the muscle, but rather in EEG activity control.

1. Defining brain computer interface used in the transmission of thought away

Systems Brain Computer Interface (BCI) are devices that allow people to communicate without moving, being a direct communication channel between the brain and an external device. Instead, people can perform simple tasks only by thinking.

BCI systems allowed people to write, surf the Internet, to control a robotic arm or wheelchair. The user must wear a helmet on his head EEG electrodes. Some systems use electrodes implanted in the brain through surgery, but most systems do not require such procedures.

They are used primarily by people who have severe difficulties that do not allow them to speak or to use conventional interfaces. There are people with certain types of brain injuries, Lou Gehrig's disease, concussions etc. who can not communicate without using a CAD system.

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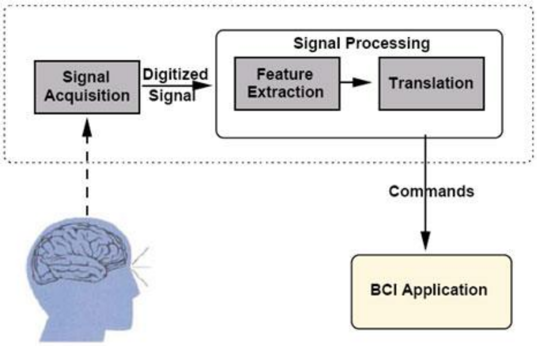
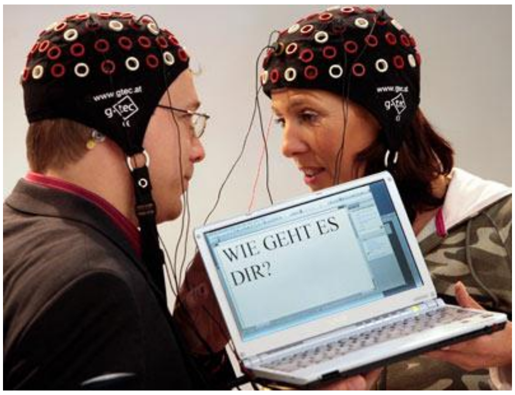
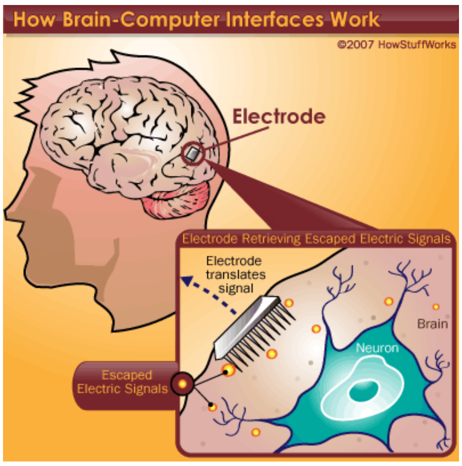


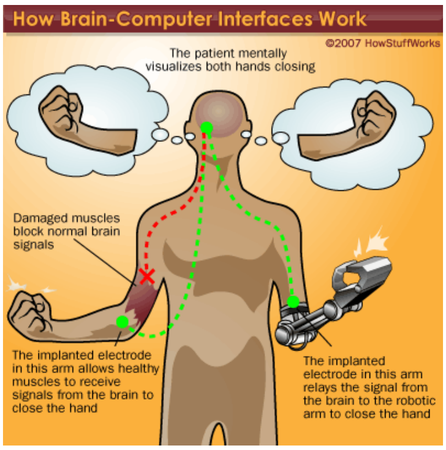


BCI goal is to translate human intentions - represented by appropriate signals - the control signals to an output device such as a computer or a neuroproteza. A BCI should not depend on the normal exit routes of peripheral nerves and muscles. Total paralyzed people can not benefit from conventional communication technologies all of which involve some measure of control muscles. In the last two decades, many studies have been conducted that evaluated the possibility that the signals recorded from the scalp or inside the brain to be used for a new technology that does not require muscle control.

These BCI systems are very simple and can be used to control people's thoughts. BCI systems research attempts to use brain activity to help people to send messages, not change brain activity "writing" information in the brain.

There is a fairly high interest to provide people with a high degree of disability a way to communicate. These systems will become practical and patients with a lower level of disability but will not come to replace traditional communication interfaces (keyboard, mouse). However in certain circumstances BCI systems can be useful for healthy people when they have come into effect some operations that take your hands full. BCI systems will be able to help not only communication but also to "repair" (healing) certain brain disorders.





2. How does the brain-computer interface

The reason it works is because of BCI systems how our brain works. The brains are filled with neouroni, the individual nerve cells connected to each other through epithelia, the axons and dendrites. Every time you think, move, or we feel Amin something, our neurons work. This "work" is performed by small electrical signals that move from one neuron to another. The signals are generated by electric potential differences carried out by the ions from the membrane of each neuron.

Although the paths that go signals are insulated by something called myelin, gets some of the electrical signals. Scientists can detect these signals, interpret what they mean and use them to direct a device of some kind. For example, researchers have been able realize what signals are transmitted to the brain through the optic nerve when someone sees red. They could install a device that would send those signals into one's brain exactly when the unit saw red, allowing a blind person to "see" without eyes.

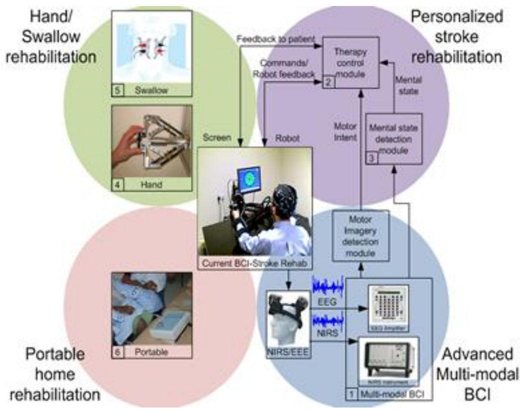
3. BCI input and output

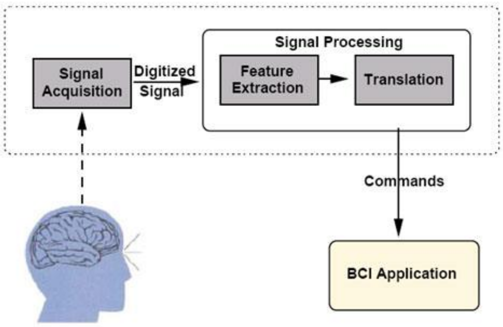
One of the biggest challenges for researchers facing brain-computer interface is basic mechanics of the interface itself. The easiest and least invasive is a set of electrodes - a device known as an electroencephalograph (EEG) - attached to the scalp. The electrodes can read brain signals. However, the skull blocks a lot of electrical signals, and distorts what passes through it.

To obtain a higher resolution signal, scientists can implant electrodes directly into the gray matter of the brain itself, or brain area under the skull. This allows more direct reception of electric signals and allows electrode placement in the specific area of the brain where the appropriate signals are generated. This approach has many problems, however it requires invasive surgery to implant electrodes in the brain and the remaining devices in the long term tend to cause the formation of scar tissue in the gray matter, and this scar tissue blocks the signals the latter.

Regardless of the location of the electrodes, the basic mechanism is the same: the electrodes measures the voltage difference between neurons minutes. The signal is then amplified and filtered. The current BCI systems, it is then interpreted by a computer program. If the input BCI, the function happens in reverse. A computer transforms a signal such as one from a camcorder, the voltages necessary to trigger neurons. Signals are sent to a corresponding area of the brain implant, and if everything is working properly, neurons act and the subject receives a visual image corresponding to what the camera sees.

Another way to measure brain activity is with a Magnetic Resonance Imaging (RMN). An RMN machine is a solid device, complicated. It produces high resolution images of brain activity, but can not be used as part of a permanent or semipermanent BCI. Researchers use it to get benchmarks for certain functions of his brain to map where in the brain should be placed electrodes to measure a specific function. For example, if researchers are trying to implant electrodes that allow a person to control a robotic arm with the power of their mind, first you could put the subject in an RMN and would ask you to think about the actual relocation their arm. RMN will show which part of the brain is active during arm movement, giving them a clearer target for electrode placement.





4. Applications BCI

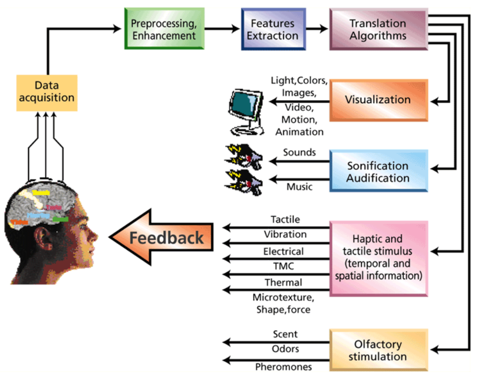
One of the most exciting areas of BCI research is the development of devices that can be controlled by thoughts. Devices that would allow people with severe disabilities to function independently.

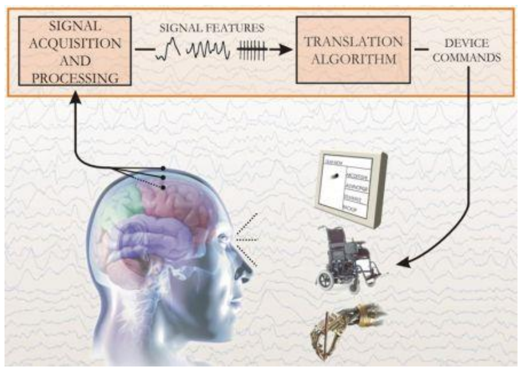
The first research used monkeys with electrodes implanted. The monkeys used a joystick to control a robotic arm. The researchers have measured the signals from the electrodes. Finally, they changed the controls so robotic arm to be controlled only by signals from the electrodes and not the joystick.

A more difficult task is interpreting the brain signals for movement to a person who physically can not move their arm. With such a task, the subject must "train" to use the device. With an EEG or implant, the subject would visualize closing his hand. After several attempts, the software can learn the signals associated with the thought of closing the hand. Software connected to a robotic arm is scheduled to receive the signal "close hand" and understand that the robotic hand should close. At that moment, when the subject thinks about closing the hand, signals are sent and the robotic hand closes.

A similar method is used to manipulate a computer cursor, with the subject thinking towards moving forward, left, right and back of the slider. With some practice, users can get enough control over the cursor to draw a circle, to access the computer program and control a TV. It could in theory be extended to allow users to "write" with their thoughts.

Once the basic mechanism of converting thoughts to computerized or robotic action is perfected, the potential uses for the technology are almost limitless. Instead of a robotic hand, disabled users could have robotic arms attached to their limbs, allowing them to move SIS directly interact with the environment. This could be accomplished without the "robotic" device. Signals could be sent to the nearest motor control of the hand nerves, bypassing the damaged section of the spinal cord allow SIS actual movement of the subject's own hand.





5. Conclusions

A brain-computer interface is a communication and control channel that is not dependent on output normal brain pathways of peripheral nerves and muscles. Currently, the main impetus for development and BCI research is the hope that this technology will be valuable for those suffering from neuromuscular disorders.

BCI operation depends on the interaction of two adaptive control, user brain that produces the input data, and the system itself, which translates into output data activity. The success of the operation BCI requires the user to acquire and maintain a new skill, a skill that is not in the muscle, but rather in EEG activity control.

The development of BCI depends on interdisciplinary cooperation between neuroscientists, psychologists, engineers, computer scientists and specialists in the field of rehabilitation. This would benefit from general acceptance and applying objective evaluation of the translation algorithms and other key ascpecte specific BCI operations.

Ratings in terms of: information transfer rate and in terms of usability in specific applications are important. Utilizatoriloe needs to be identified and applied BCI must be configured to meet the needs. The needs assessment should focus more on the real desires of each user, rather than the preconceived notions about what these users want. Similarly, evaluation of specific applications, based ultimately on the extent to which people utilizeazeaza in everyday life.

In conclusion BCI systems represent a potential therapeutic tool. It is an advanced technology, which promises paradigm shift in areas such as machine control, virtual reality etc, is a technology with potentially high impact.

More apps potentional promise BCI system rehabilitation and performance improvement, such as treating emotional disorders (for exemple, depression or anxiety), chronic aches and overcoming disability from strokes.

Also, this system will allow to reach the singularity soon. An intense research and development in the future will help achieve efficiency.

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