Motor imagery brain-computer interface

Motor imagery brain-computer interface (BCI) is a technology that enables individuals to control devices or computers using their thoughts. In this type of BCI, the user imagines performing a particular movement, and the electrical signals generated by their brain are captured using electroencephalography (EEG) or other neuroimaging techniques. These signals are then decoded by a computer, which translates them into commands that control the device or computer.

Motor imagery BCIs have many potential applications, including assistive technology for individuals with physical disabilities, training and rehabilitation for athletes or patients with neurological injuries or diseases, and control of robotic devices in manufacturing or other industries.

However, there are some challenges associated with motor imagery BCIs, including the need for extensive training to achieve effective control, the susceptibility to noise and artifacts in the EEG signal, and the potential for interference from other mental processes or distractions. Nonetheless, ongoing research is exploring ways to overcome these challenges and improve the accuracy and reliability of motor imagery BCIs.

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study compared the efficacy of Motor Imagery brain-computer interface (MI-BCI) combined with physiotherapy and physiotherapy alone in ischemic stroke before and after rehabilitation training. We wanted to explore whether the rehabilitation effect of MI-BCI is affected by the severity of the patient's condition and whether MI-BCI was effective for all patients. Forty hospitalized patients with ischemic stroke with motor deficits participated in this study. The patients were divided into MI and control groups. Functional assessments were performed before and after rehabilitation training. The Fugl-Meyer Assessment (FMA) was used as the primary outcome measure, and its shoulder and elbow scores and wrist scores served as secondary outcome measures. The motor assessment scale (MAS) was used to assess motor function recovery. We used non-contrast CT (NCCT) to investigate the influence of different types of middle cerebral artery high-density signs on the prognosis of ischemic stroke. Brain topographic maps can directly reflect the neural activity of the brain, so we used them to detect changes in brain function and brain topological power response after stroke. Compared the MI group and control group after rehabilitation training, better functional outcome was observed after MI-BCI rehabilitation, including a significantly higher probability of achieving a relevant increase in the Total FMA scores (MI = 16.70 ± 12.79, control = 5.34 ± 10.48), FMA shoulder and elbow scores (MI = 12.56 ± 6.37, control = 2.45 ± 7.91), FMA wrist scores (MI = 11.01 ± 3.48, control = 3.36 ± 5.79), the MAS scores (MI = 3.62 ± 2.48, control = 1.85 ± 2.89), the NCCT (MI = 21.94 ± 2.37, control = 17.86 ± 3.55). The findings demonstrate that MI-BCI rehabilitation training could more effectively improve motor function after upper limb motor dysfunction after stroke compared with routine rehabilitation training, which verifies the feasibility of active induction of neural rehabilitation. The severity of the patient's condition may affect the rehabilitation effect of the MI-BCI system [1)]

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Liao W, Li J, Zhang X, Li C. Motor imagery brain-computer interface rehabilitation system enhances upper limb performance and improves brain activity in stroke patients: A clinical study. Front Hum Neurosci. 2023 Mar 14;17:1117670. doi: 10.3389/fnhum.2023.1117670. PMID: 36999132; PMCID: PMC10043218.