Hermes Braindeck: A Brain-Computer Interface for Communication with Patients Initially Classified as Comatose or Vegetative

da Silva Borges, Luiz

The Glasgow Coma Scale was proposed in the 1970s to classify the level of awareness of patients who have suffered some sort of traumatic brain injury (TBI). This scale is still used in hospitals around the world and relies on voluntary motor control for the determination of awareness, and specifically voluntary eye motor control in the cases of patients in Locked-In State, which leads to patients in Completely Locked-In State (CLIS), who are unable to communicate and move at all, to be mistakenly classified as vegetative or comatose. As an attempt to solve this problem, I proposed and implemented a closed-loop brain-computer interface, based only on EEG real-time recordings, that is able to detect voluntary modulations in cerebral activity to establish a communication channel between the patient and the medical staff. My interface can create and apply, automatically, classifiers of motor and sensory brain signal modulations, allowing the creation of communication protocols according to each type of TBI, expanding its applicability. Once voluntary modulation of brain activity is detected, it can be used by the patient to answer yes/no questions with 80% of accuracy, within the presence of tactile or proprioceptive feedback. Moreover, through a logic based on a mental binary tree search. I made it possible for healthy volunteers to spell words through nothing but hearing stimuli and the modulation of their brain activity. I embedded my system in a briefcase containing program processing, EEG and feedback devices control units, making it a portable tool to detect awareness at the brain activity level and, in future tests, confirm communication with patients initially classified as comatose or vegetative.

Awards Won:

Second Award of $2,000

Association for the Advancement of Artificial Intelligence: Honorable Mention