Experimental External Neural Pathway for Motion in Stroke Victims

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Stroke is the leading cause of severe disabilities in the developed world, often leaving people physically shut out from society despite their functional minds. Current solutions for rehabilitation, such as intensive physiotherapy, are costly and often ineffective. Recent findings in the areas of neuroplasticity and embodiment of thought have opened up new avenues for rehabilitation. Using this knowledge, we designed an experimental device using an external neural pathway to drive a neuromuscular electrical stimulator (NMES) to move the limb to restore neural connections. This device is composed of a brain-computer interface (BCI) to sense thoughts of motion, integrated with a NMES device and an addictive video game. To develop the most efficient experimental prototype, we collected data from an OpenBCI electroencephalogram headset and ran a series of classifiers, including Common Spatial Patterns (CSP), Riemannian Geometry classifiers and Linear Discriminant Analysis. In our prototypes, we manipulated sensor setup of the headset and analysis processes to increase classification accuracy. Our most accurate prototype used a setup that clustered sensors near the motor cortex and performed CSP on two separate frequency bands. After selecting the best prototype, we ran the BCI analysis in real-time to allow the subject to play Tetris. We connected the BCI to a NMES machine through an Arduino that allowed stimulation of the intended muscle based on the thoughts of motion. Our experimental prototype opens up a new method to test an exciting new therapy to restore motion for stroke victims through an external neural pathway.

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