Brain-machine interface for personalized stroke motor rehabilitation

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The brain-machine interface (BMI), a technology that gives recognizable feedback to a user depending on his/her specific brain activity, is one of the most promising therapies for retraining the motor pathway of stroke patients with hemiplegia. In BMI rehabilitation, patients are encouraged to activate their motor cortices in their affected hemisphere and a successful cortical activation will give them immediate sensory feedback such as an assisted movement of their paralyzed limb via prosthetic devices. Since BMI can give actual sensory feedback depending on their brain activity, patients can quickly learn the appropriate brain activity pattern to restore their motor function that may boost restoring the motor pathway. I will introduce our BMI rehabilitation system called 'Digital Mirror Box' (DMB), a robotic assistive device operated by motor intent of a user, and present the recent progress in our clinical study applying this system to stroke patients with hemiplegia in various recovery stages. Results suggest that neurorehabilitation using DMB could ease spasticity and improve hand function via increasing motor-related cortical activity in patients at both recovery (up to 6 months from stroke onset) and chronic stages. The physiologically congruent proprioceptive feedback plays a significant role to facilitate the functional recovery of patients by stimulating the persisting sensorimotor loop in the affected hemisphere. Being combined with AI and wearable brain-sensing devices, BMI could be utilized as a personalized and home-based rehabilitation to improve the quality of life of stroke survivors.