Feedback-regulated mental imagery in BCI applications: using non-invasive EEG and NIRS signals

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An important issue of brain-computer interface (BCI) development is to detect changes in brain signals that are related to specific intentions or thought processes. For example, mental motor imagery modulates the sensorimotor brain activity, and the detected changes can be used to operate a computer-controlled device. Clinical applications of this technology include the restoration of movement, such as control of grasping with the help of a neuroprosthesis, in severely paralyzed individuals. The motor imagery based BCI training may further be useful as a complementary therapeutic tool to facilitate functional recovery after stroke.

To date, the majority of BCI systems rely on EEG recordings. However, near-infrared spectroscopy (NIRS) has recently attracted attention of BCI researchers due to its noninvasiveness, portability, short preparation time, and relatively low cost. In this talk I will shortly introduce the NIRS technique for BCI development and present data on how characteristic hemodynamic responses during motor imagery can be modulated by real-time NIRS feedback. Based on recent results I will finally discuss how simultaneous NIRS and EEG recordings might combine advantages of both approaches.