Rehabilitation Neuroscience and MATLAB

Junichi USHIBA
Department of Biosciences and Informatics,
Faculty of Science and Technology,
Keio Univeristy

Abstract

In stroke rehabilitation, it has been suggested that practicing or observing movements that are highly similar to normal movements help improve motor functions and guide newly developing axons to the appropriate cortical regions. Since Brain-Computer Interface (BCI) involving neural recording by scalp electroencephalography can estimate patients' motor intention directly from cortical activity, BCI is expected to be a novel neurorehabilitatioin device for patients with severe impairment after stroke, who cannot use ordinary rehabilitation strategies owing to the lack of volitional muscle activity. Our research group has been tested BCI in three rehabilitation hospitals, and found its feasibility for functional recovery of volitional finger movement (Shindo et al. J Rehabil Med 2011, in press).

We have used MATLAB/Simulink for rapid prototyping of BCI system, and shared the code among the research team under site license condition. We have also utilized various MATLAB toolboxes (e.x. Statistical Parametric Mapping, Variation Bayesian Multimodal Encephalography by ATR, EEGLAB, and so on) for off-line analysis of data obtained in order to reveal the mechanism of plastic neuronal changes by BCI. Such research platform facilitates efficient collaboration between fundamental neuroscientific study at the Faculty of Science and Technology and clinical trial at the School of Medicine. In this talk, I will introduce how MATLAB/Simulink have been using in our research.