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A Prognostic Measure on EEG-based Motor Imagery Brain-Computer Interface for Stroke

Kai Keng Ang[1*], Cuntai Guan[1], Kok Soon Phua[1], Karen Sui Geok Chua[2], Effie Chew[3]

*[1]Institute for Infocomm Research, Agency for Science, Technology and Research (A*STAR), Singapore;*
[2]Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore;
[3]National University Health System, 1E Kent Ridge Road, Singapore.

*Institute for Infocomm Research, A*STAR, 1 Fusionopolis Way, #21-01, Connexis, Singapore 138632. E-mail: kkang@i2r.a-star.edu.sg

Introduction: Several clinical trials using Electroencephalograpy-based (EEG) Motor Imagery Brain-Computer Interface (MI-BCI) had yielded clinically significant motor improvements in stroke rehabilitation [1]. Recent results had revealed that the revised Brain Symmetry Index (rBSI) computed using EEG from 11 stroke patients who received MI-BCI intervention were negatively correlated with their motor improvements measured by Fugl Meyer Motor Assessment (FMMA) scores [2].

Material, Methods and Results: This paper investigates the correlation of rBSI with FMMA improvements on a larger population of 26 stroke patients that underwent BCI for stroke rehabilitation, which includes 9 patients of the 2nd trial [3] we conducted from 1 January 2011 to 1 January 2014, and 6 from the 3rd trial we conducted from 1 January 2011to 31 June2013 [4], in addition to the 11 patients from the 1st trial [2] we conducted from 1 April 2007 to 30 October 2009.

The result of using the temporal parameter of 8-25 Hz on the time segment 0.5 to 2.5 relative to the instruction cue to perform motor imagery using all the channels of the EEG data collected from the therapy sessions yielded a significant negative correlation of r=-0.412 (p=0.036) between the revised Brain Symmetry Index (rBSI) computed from the EEG and the motor improvements measured by FMMA scores as shown in Figure 1.

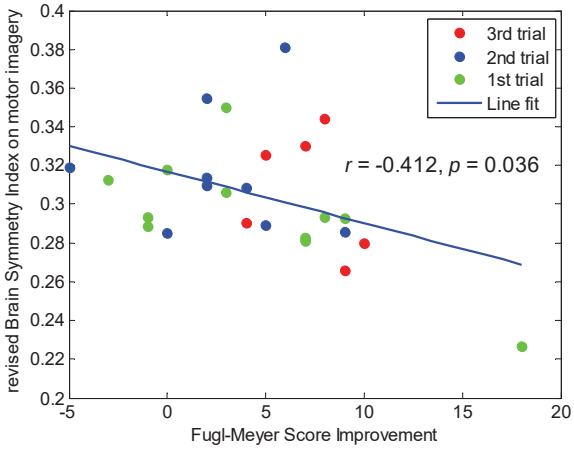

Figure 1. *Plot of rBSI using the temporal parameter of 8-25 Hz on all the channels of the EEG data collected from the therapy sessions of the 26 stroke patients (11 from the 1st trial, 9 from the 2nd trial, and 6 from the 3rd trial) against the FMMA score improvement*

Discussion: The rBSI captures the asymmetry in spectral power between the two cerebral hemispheres, and the result indicates that the asymmetry in spectral power from 8-25 is related to the motor improvements of the 26 patients who underwent MI-BCI stroke rehabilitation.

Significance: The result suggests a promising direction to investigate further on the use of rBSI as a prognostic measure to predict the motor recovery of using MI-BCI in stroke rehabilitation.

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