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Bimodal EEG-fMRI Neurofeedback for Stroke Rehabilitation

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BACKGROUND

Neurofeedback (NF) has potential to be applied for stroke rehabilitation [1,2] however the effectiveness of NF for stroke has not been thoroughly assessed yet.

Bimodal EEG-MRI NF [3,4] is a promising technique to achieve a more efficient and specific self-regulation, which may be crucial for clinical application.

AIMS

Within the project HEMISFER (Hybrid Eeg-Mri and Simultaneous neuro-FEedback for brain Rehabilitation), the aims of this preliminary study are to:

- Test the feasibility of applying bimodal EEG-MRI NF for stroke rehabilitation in two chronic patients affected by left hemiplegia (subcortical lesion).
- Identify problematics and guidelines in view of a clinical study on stroke patients.

PRELIMINARY RESULTS

Figure 3a. Lesion and cortico-spinal tract (CST) of patient 1 (Right ischemic stroke). The CST was estimated from tractography of diffusion weighted images [6].

Figure 3b. Lesion and CST of patient 2 (Right hemorrhagic stroke)

![Calibration and NF scores](image)

Figure 4. EEG and fMRI NF scores during a NF session. Example from one patient (1). The left column shows the filter and the ROI selected for NF computation during calibration.

![Average BOLD activations maps over the two NF sessions for patient 1 and 2 (TASK–REST, k > 10 voxels).](image)

Figure 5. Average BOLD activations maps over the two NF sessions for patient 1 (left) and 2 (right) (TASK–REST, k > 10 voxels).

![Electroencephalogram (EEG) signal regulation as a function of the selected ROI](image)

Figure 6. BOLD activity in the selected ROI with respect to background (mean±std). The bar plots represent BOLD activity in the selected ROI with respect to background during rest and NF. Relative statistics are showed (Wilcoxon tests, * p<0.05, ** p<0.01)

CURRENT AND FUTURE WORKS

- Improve performances and simplify the workflow of the bimodal NF platform.
- Clinical study on Stroke patients to test the efficacy of multisession bimodal NF for rehabilitation.

REFERENCES


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