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BACKGROUND METHODS

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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-fMRI 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 1](image1.png)  Bimal EEG-fMRI NF platform [5] (Neurinfo, CHU Pontchaillou, Rennes). The platform integrates and synchronizes EEG and fMRI subsystems and signal flow for the computation and visualization of the bimodal NF.

![Figure 2](image2.png)  Schematic of the experimental protocol. Each session consisted of 8 blocks of 40 s (20 s rest, 20s task). MI-Motor Imagery (without NF display). MI_PRE-preliminary session used for calibration (ROI, EEG filter). MI_POST-transfer session.

![Figure 3a](image3a.png)  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](image3b.png)  Lesion and CST of patient 2 (Right hemorrhagic stroke)

![Figure 4](image4.png)  Eeg and IMRI 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.

![Figure 5](image5.png)  Average BOLD activations maps over the two NF sessions for patient 1 (left) and 2 (right) (TASK>REST, k > 10 voxels).

![Figure 6](image6.png)  BOLD activity in the selected ROI with respect to background (ROI, EEG filter). The bar plots represent BOLD activity in the selected ROI with respect to background (mean+std across blocks) 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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