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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 | NF SCORES
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EEG | MI PRE | MI POST

Figure 4. EGG 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.

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

Figure 6. MI signal regulation as a function of the selected ROI. 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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