Densifying Optodes Montage to Enhance Cerebellar fNIRS

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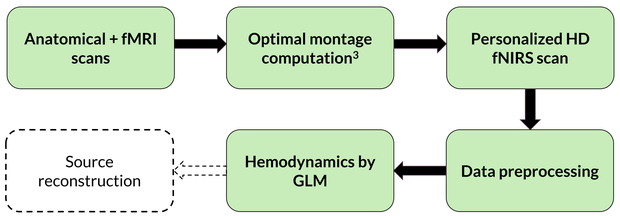
FRAMEWORK

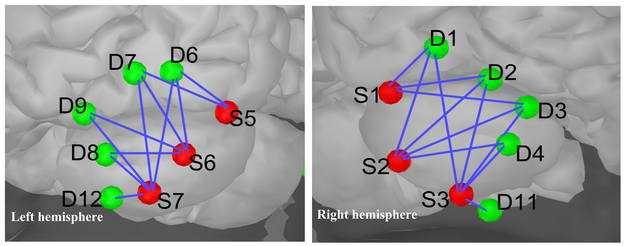
- Novel & flexible techniques for **cerebellar neuroscience**
- **Pioneered** the feasibility of fNIRS for cerebellar hemodynamics[1] and further validated with fMRI[2]

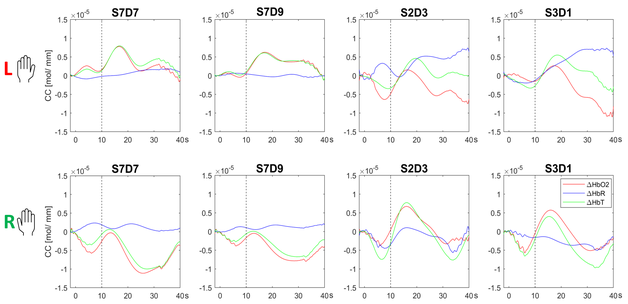
Can a **personalized high-density montage** help to increase the sensitivity and better access the cerebellum?

METHODS & RESULTS

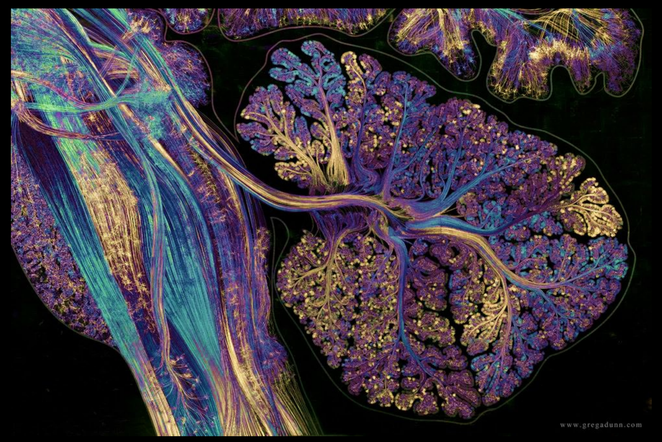
- One subject performed a block-design finger tapping task consecutively with fMRI and fNIRS

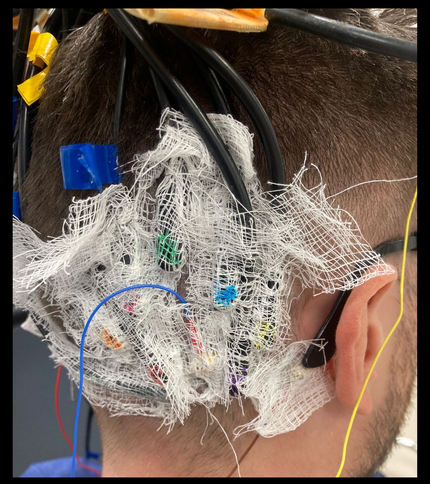






- ✓ Bilateral activations in Crus I, Lobules VIIB of the cerebellum, **consistent for fNIRS & fMRI results**
- ✓ Good match on **hemodynamics for fMRI & fNIRS**
- × Working on better denoising from the confounds

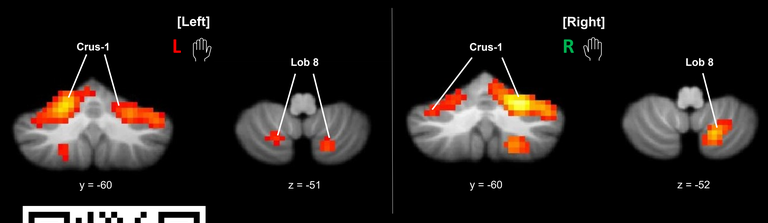




Personalized high-density optodes montage to enhance **cerebellar** fNIRS towards source reconstruction

Are you sure you are measuring cerebellum activation ? How ?

- Subject-specific ROI-based montage
- **No** occipital confounds in the protocol
- Consistent with fMRI BOLD



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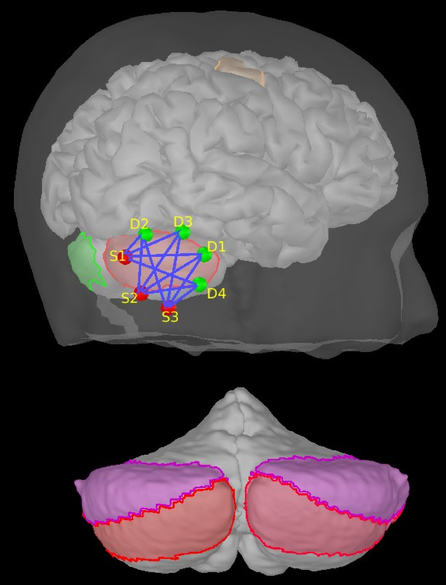

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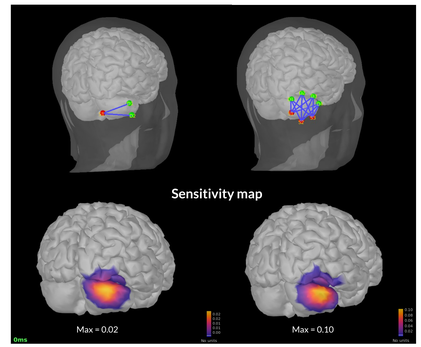
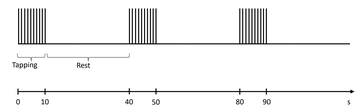
EXTRA FIGURES & MORE

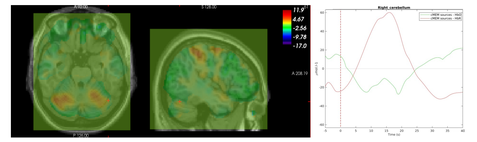
- The sensitivity is 5 times higher!



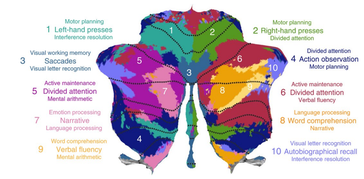
- Protocol: 20 trials (left + right hands) + random rest interval 30-40 s



- fNIRS processing : Intensity to OD, Motion correction (TDDR), Detrending, Band-pass filtering (IIR filter order = 5 with f_{cut} = 0.01 – 0.09 Hz, OD to concentration without correction (DPF = 1), GLM subject level (OLS, Gaussians with [σ Δt] = [0.5 0.5], regression of the average of all SS)
- fMRI processing : Realignment, Coregistration, Normalization, Smoothing, GLM subject level (canonical HRF, p < 0.001 FWE corrected at peak level)
- Source reconstruction (on-going …)



Cerebellum involved also in cognition and emotion …



REFERENCES

1. Rocco et al., IEEE EMBC, (2021).
2. Rocco et al., IEEE ISBI, (2022).
3. Machado et al., J. Neurosci. Methods 309(1), (2018).