Thresholding strategies for estimating extent of activated cortex in magnetoencephalography

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Résumé

Magnetoencephalography allows defining non-invasively the spatio-temporal activation of brain networks thanks to source localization algorithms. A major difficulty of MNE and Beamforming methods, two classically used techniques, is the definition of proper thresholds that allow deciding the extent of activated cortex.
We investigated two stategies for computing a threshold, taking into account the difficult multiple comparison issue. The strategies were based either on parametric statistics (Bonferroni, fFDR correction) or on empirical estimates (local FDR and a custom measure based on the survival function).
We found thanks to the simulations that parametric methods based on the sole estimation of H0 (Bonferroni, FDR) performed poorly, in particular in high SNR situations. This is due to the spatial leakage originating from the source localization methods, which give a "'blurred"' reconstruction of the patch extension : the higher the SNR, the more this effect is visible.
Adaptive methods such as local FDR or our proposed "concavity threshold" performed much better than Bonferroni or classical FDR. We present an application to real data originating from auditory stimulation in MEG.
In order to estimate source extent, adaptive strategies should be preferred to parametric statistics when dealing with 'leaking' source reconstruction algorithms.

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