Surface-based preprocessing

Basic concepts and practical applications

Jae-Joong Lee
Ph.D. Student

Computational Cognitive Affective Neuroscience Lab (Cocoan Lab) https://cocoanlab.github.io

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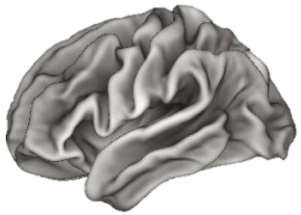
An introduction to the custom preprocessing pipeline built for surfaced-based analysis

1. Motivation – Why surface?
2. Overall scheme – Covering multiple softwares (e.g., FSL, AFNI, ANTs, Freesurfer)
3. Pipeline details – Comparison with existing preprocessing pipelines
4. Practical applications – Not limited to surface analysis

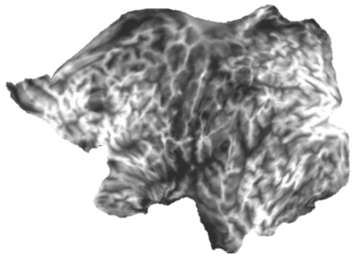
1. Why surface?

Surface-based analysis is more neurobiologically relevant than volume-based analysis.



Volume
3D Euclidean

vs.

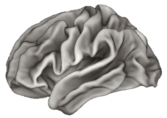


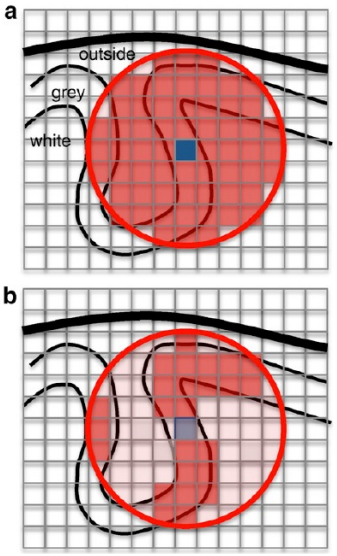
Surface
2D geodesic

1. Why surface?

Surface-based analysis is more neurobiologically relevant than volume-based analysis.

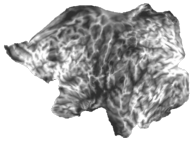
e.g., searchlight analysis

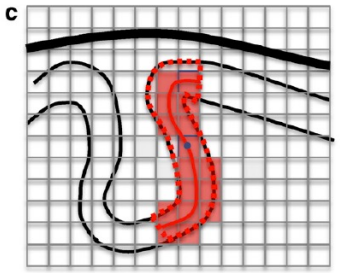




GM (proximal + distant)
+ WM + CSF

Despite segmentation,
distant GM still exists





Only proximal GM!

Oosterhof et al., 2011

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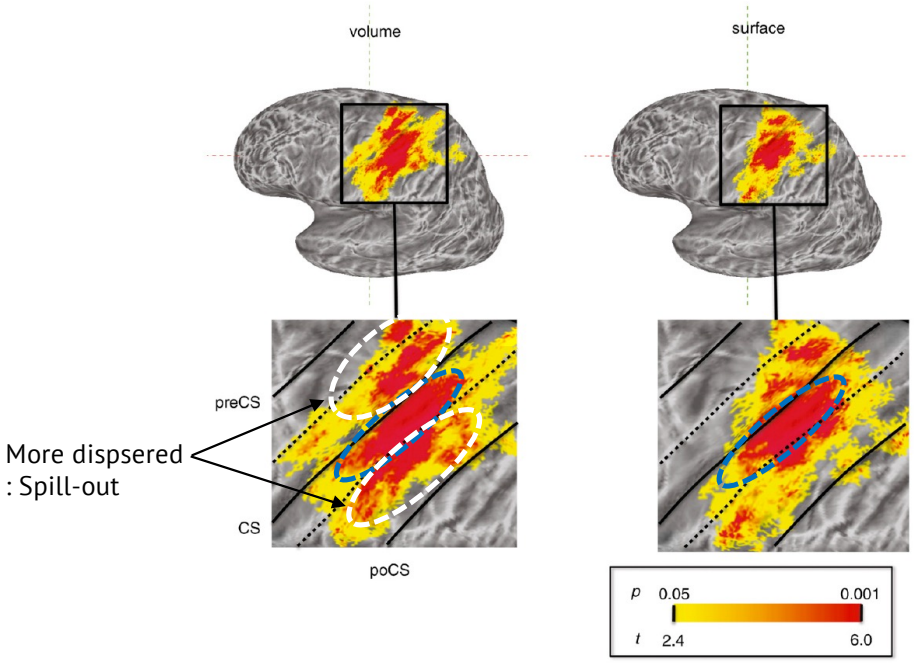
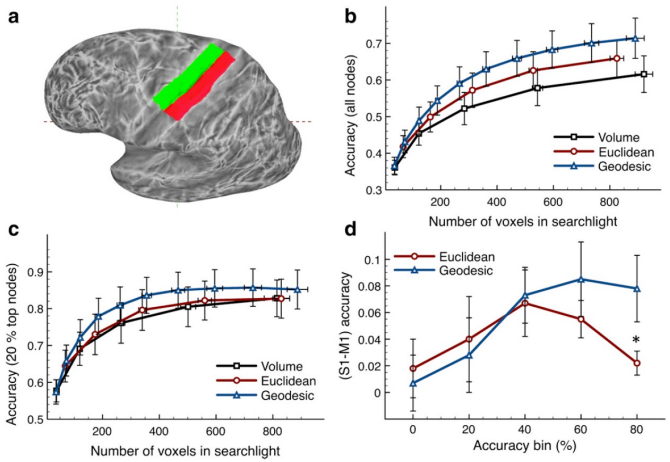
e.g., searchlight analysis





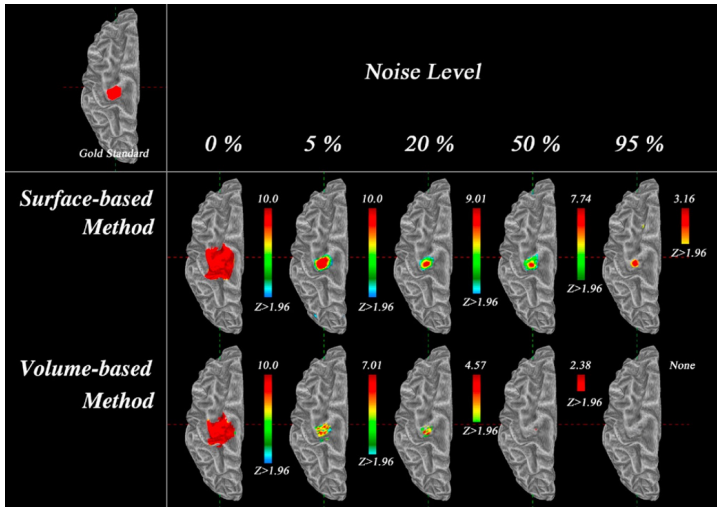
Concentrated, high accuracy!

Oosterhof et al., 2011

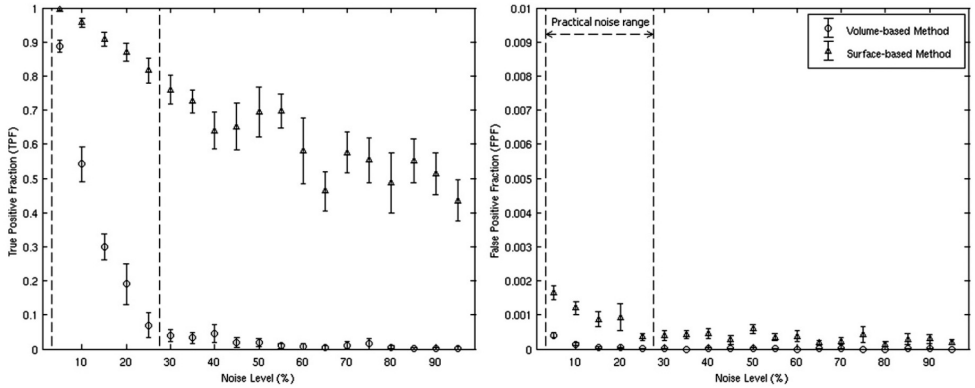
1. Why surface?

Surface-based analysis is more neurobiologically relevant than volume-based analysis.

e.g., Smoothing



Signal loss in volumetric smoothing



Surface smoothing shows higher sensitivity and lower but comparable specificity than volumetric smoothing for data with practical-level noises

Jo et al., 2007

1. Why surface?

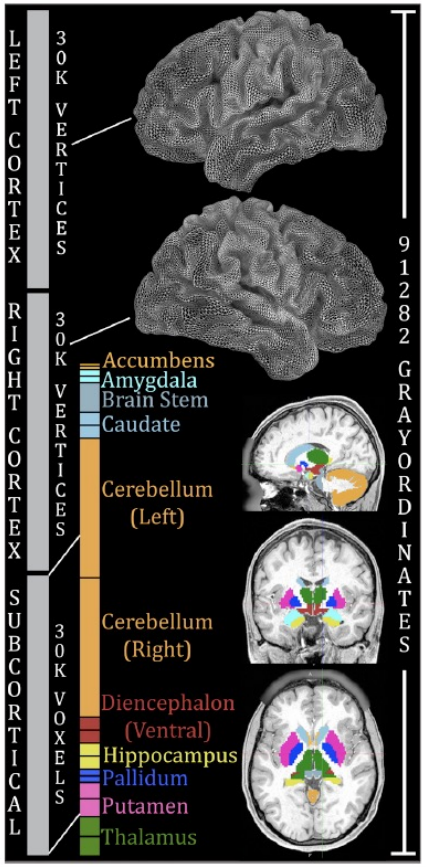
CONNECTOME
COORDINATION FACILITY

CIFTI format

- Surface for cortex, volume for subcortex
- Volumetric data is projected to Conte69 32k surface, with cortical ribbon-constrained way
- 91282 Gray-ordinates
- Useful HCP datasets and parcellations are based on this format (HCP-MMP atlas, Gordon's atlas, …)
- Connectome Workbench toolbox can help easy analyses on CIFTI data

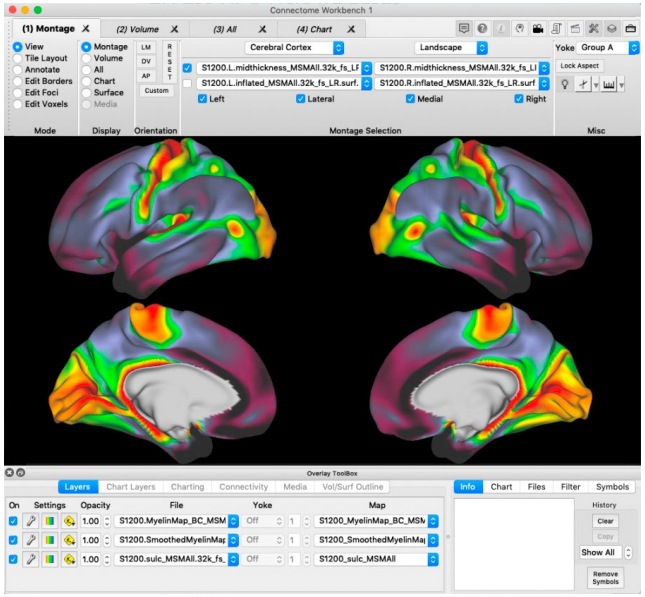
CIFTIFY

- Easy conversion of nifti dataset to CIFTI!

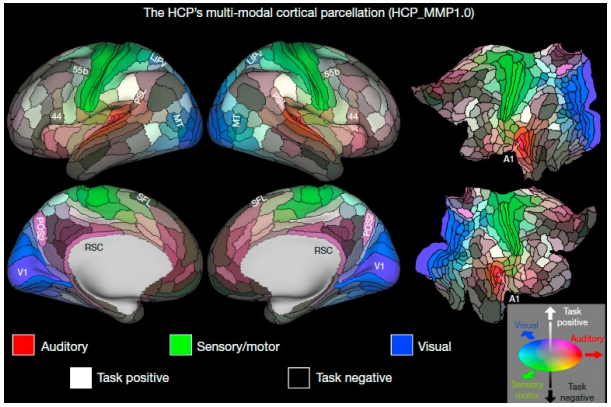


1. Why surface?

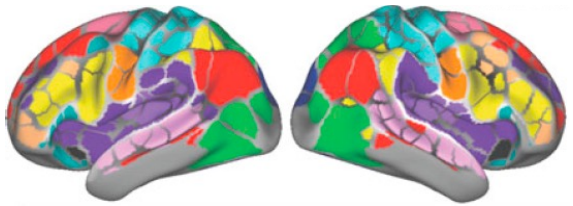
CONNECTOME
COORDINATION FACILITY



Connectome Workbench



HCP-MMP 1.0 (Glasser et al., 2016)



RSFC-based atlas (Gordon et al., 2016)