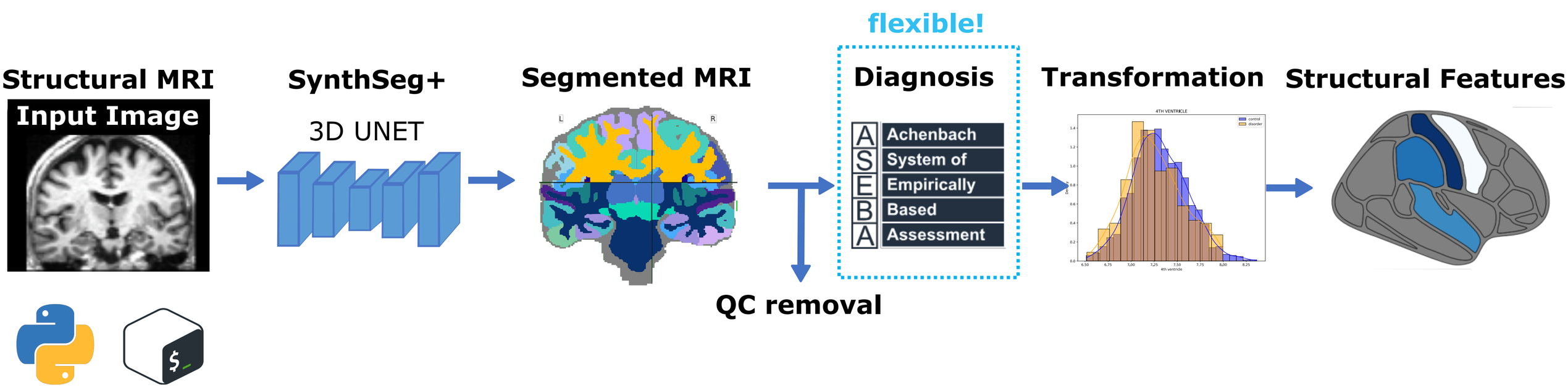
Automated Neuroimaging Pipeline for Structural Feature Selection using Deep Learning Segmentation Applied to Adolescent Mental Disorders

Margot Wagner[1], Brandon Liu[1], Alessandra Camassa[2], Gert Cauwenvberghs[1], Terry Sejnowski[1,2]

[1]University of California San Diego, [2]The Salk Institute for Biological Studies

A



Introduction

- MRI to identify structural differences as potential biomarkers
- **Neuroimaging processing** and analysis is **non-standardized** leading to unreliable scientific results
- **ASEBA Syndromes** and **DSM-5** are two alternatives for adolescent mental disorders, both without biological basis
- **If we have a standardized analysis method, are we able to uncover structural trends in these adolescent disorders using Big Data?**

Methods

Dataset: **ABCD Baseline sMRI**[1] (9-10)
Diagnostic Labels:

ASEBA 814 control subjects
294 +/- 35 disorder subjects

DSM 1156 control subjects
247 +/- 64 disorder subjects

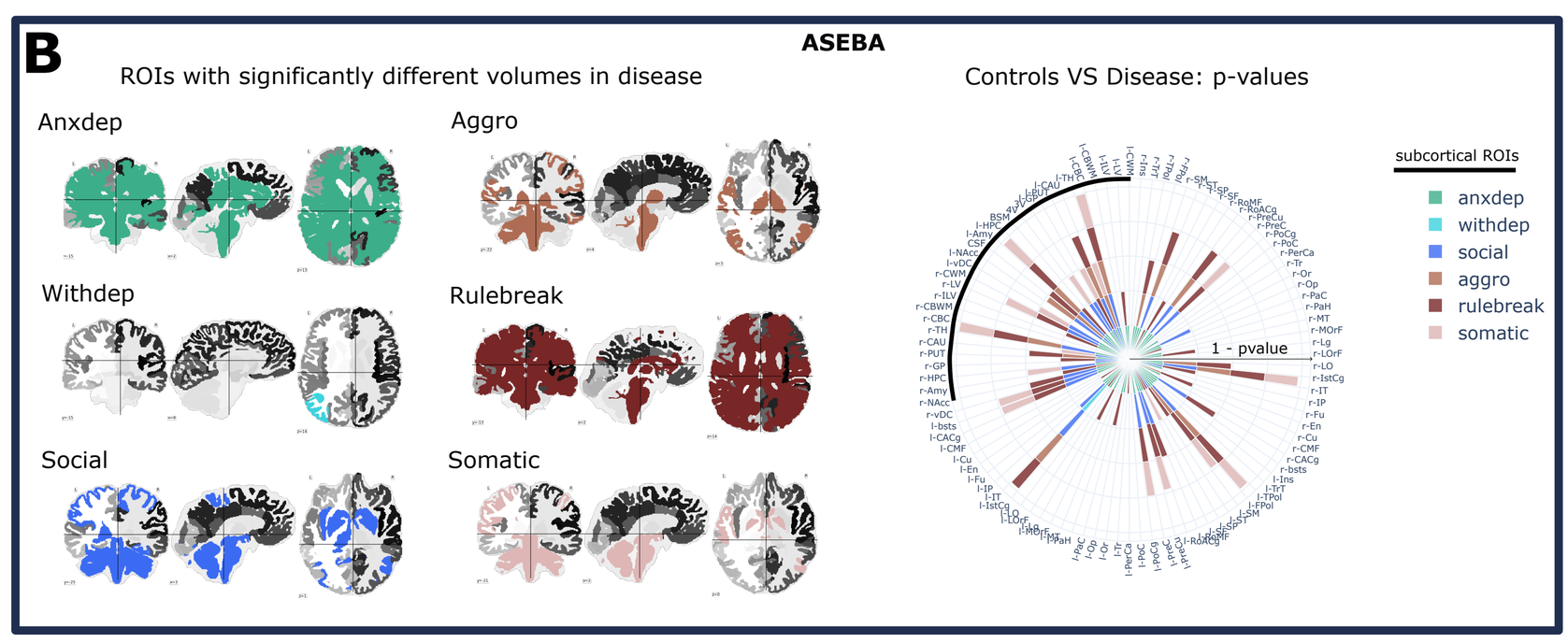
QC removal: avg 20% +/- 1.5% loss

Segmentation using hierarchical U-Nets[2]

Results

- SynthSeg+ showed higher volume estimations compared to FreeSurfer where underestimation is a FreeSurfer limitation[3]
- SynthSeg+ was more robust to different scanner types (Siemens v GE v Philips)[D]
- Most disorders showed volumetric differences compared to the control population, except for Withdrawn/ Depressed (ASEBA) [E]
- ASEBA disorders generally saw more structural differences between populations
- SuggestS disorder separability [B/C]

B



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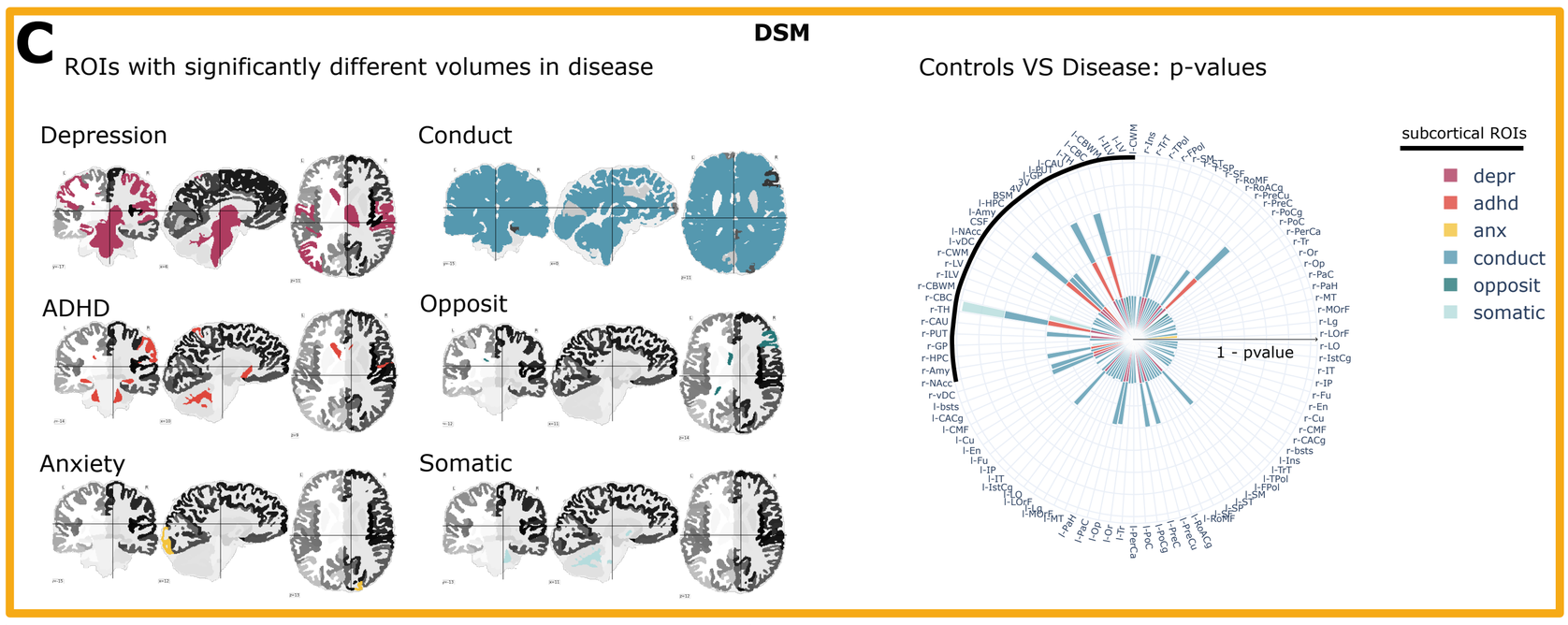

D

E

[1] Volkow, Nora D., et al. "The conception of the ABCD study: From substance use to a broad NIH collaboration." Developmental cognitive neuroscience 32 (2018): 4-7.

[2] Billot, Benjamin, et al. "Robust machine learning segmentation for large-scale analysis of heterogeneous clinical brain MRI datasets." Proceedings of the National Academy of Sciences 120.9 (2023): e2216399120.

[3] Hagler, Donald J., et al. "Image processing and analysis methods for the Adolescent Brain Cogntive Development Study." Neuroimage 202 (2019): 116091.

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