

Evaluating Accuracy and Reliability of Brain-Behavior Models Using Diffusion MRI

McKenzie Paige Hagen^{1, }, John Kruper¹, Keshav Motwani², Eardi Lila², Jason Yeatman³, Ariel Rokem¹

¹ Department of Psychology, University of Washington ² Department of Biostatistics, University of Washington ³ Graduate School of Education, Stanford University

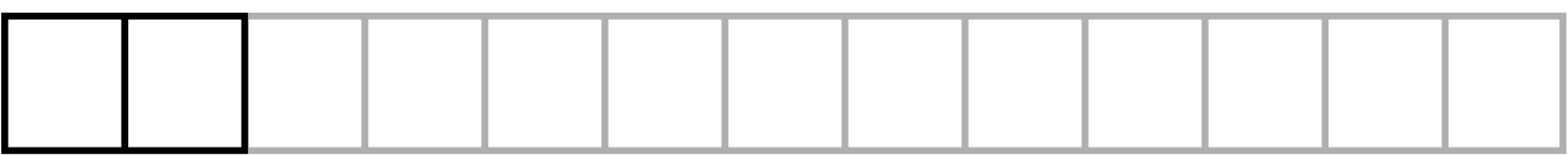
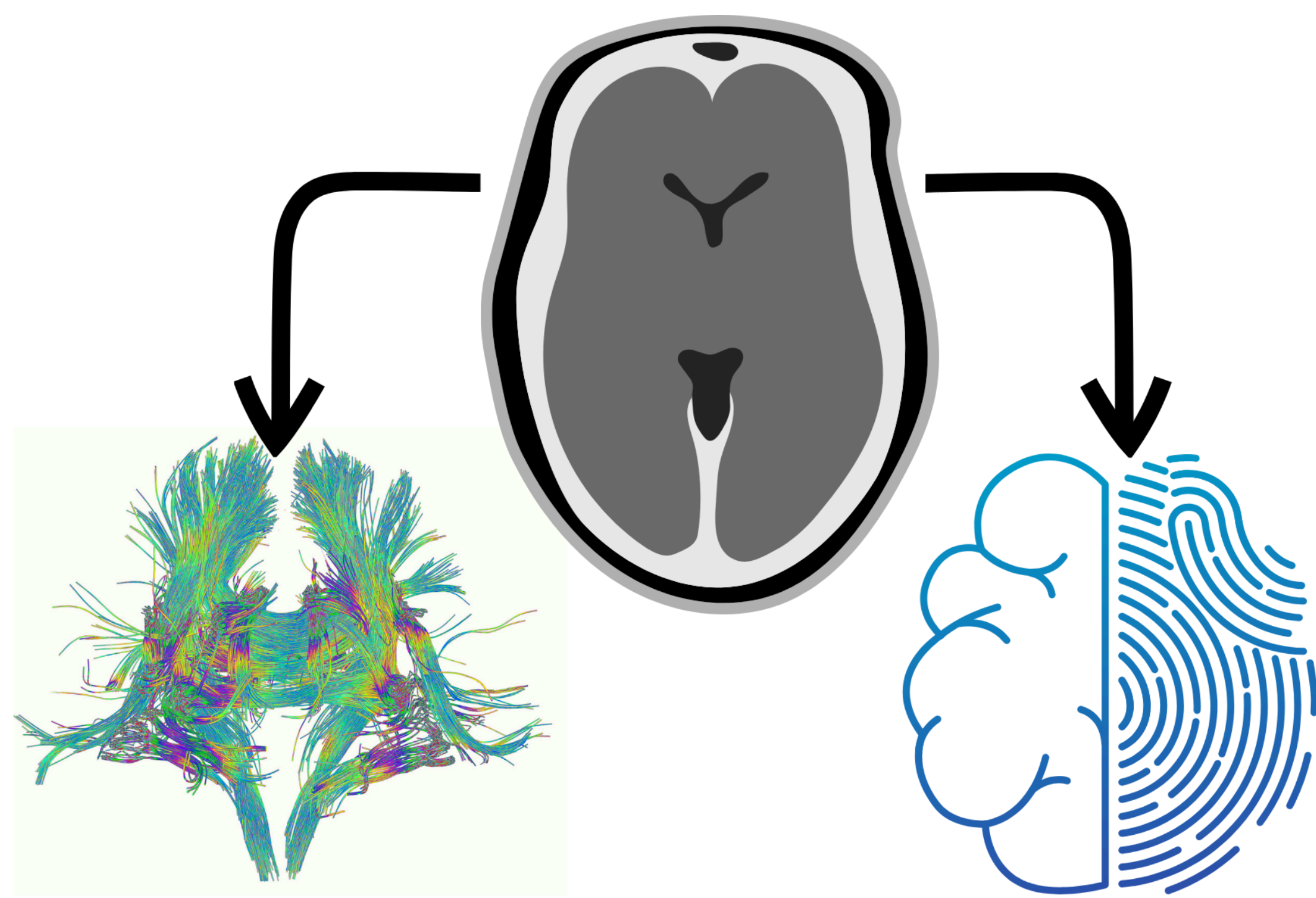
Background

- Diffusion MRI (dMRI) measures tissue properties of white matter, which contains long-range connections between different brain regions.
- Brain-behavior models can be used link neuroimaging features and phenotypes.
- Researchers have several options to process dMRI data into input features for brain-behavior modeling.
- Characteristics of feature sets determine which regularization methods are suitable for modeling fitting.
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Question: How do sets of features derived from different dMRI processing methods compare in model accuracy and variability?

Methods

- Diffusion MRI from 1041 Human Connectome Project participants.
- Processed into “tract profiles” ([1](#)) using pyAFQ and “local connectome fingerprint” (100,000 features) using DSI-Studio ([2](#)).
- LASSO regularized models fit to tract profiles and local connectomes separately.
- Sparse Group LASSO (SGL) models fit to tract profiles, grouped by tract.
- Prediction targets were various cognitive phenotypes.
- Models implemented in [R](#) and trained using nested cross-validation and bootstrap resampling.
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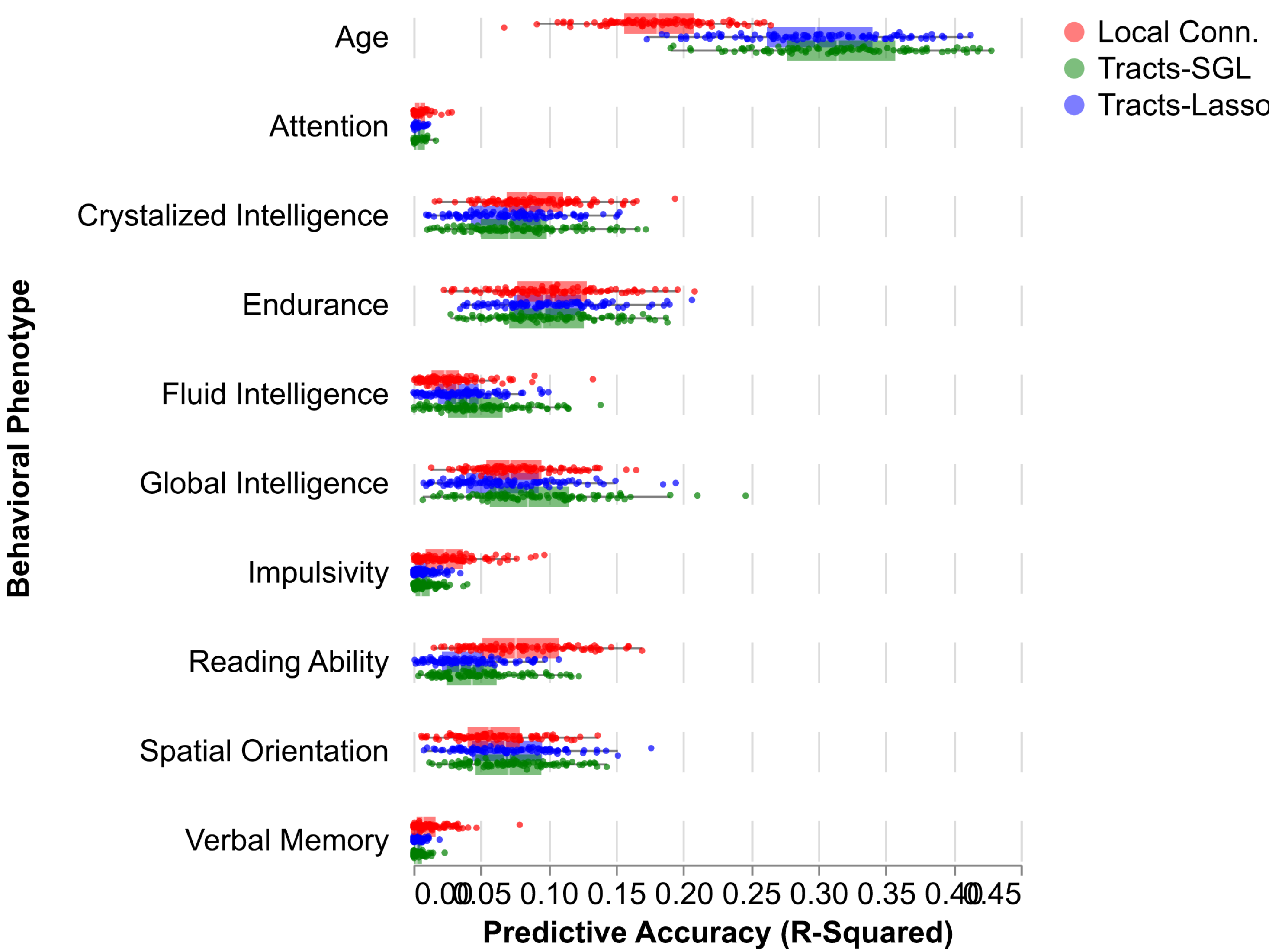


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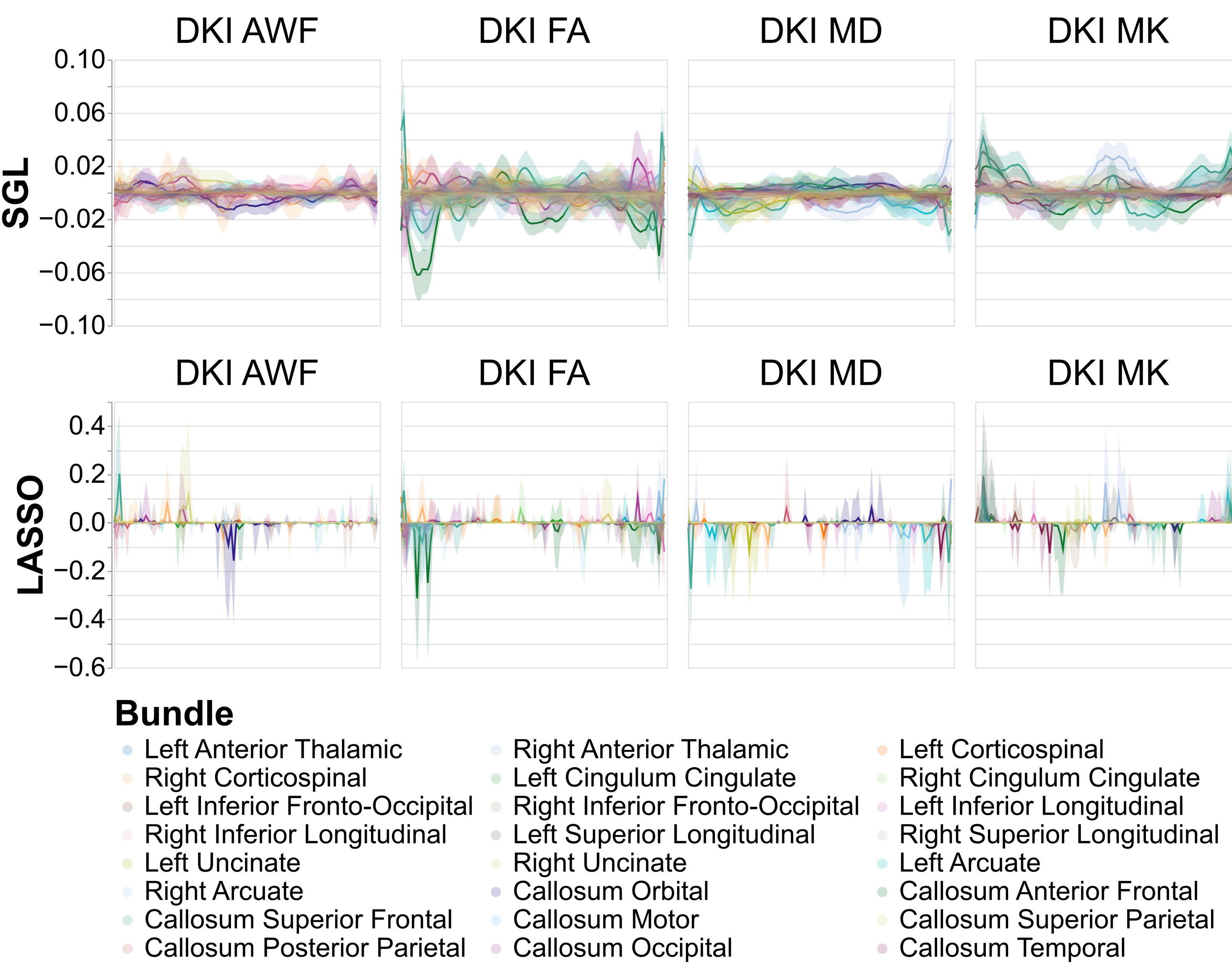
Conclusions

- Tractometry contains equivalent predictive information as compared to local connectome, with much fewer features.
- Utilizing a variety of regularization methods and feature engineering can maximize interpretability of models.
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- This will be replaced with an insightful comment about the results
- Lots of space for conclusions
- Placeholder

Results



Model accuracies for behavioral phenotypes. All models, regardless of regularization method or feature set performed statistically equivalently.



“Age” prediction model weights across tracts for SGL and LASSO. Solid lines show the mean model weight across bootstraps for every tract, across every node, and the shaded areas show the 95% confidence intervals of the model weights. Note the reduced y-axis range for SGL.

Acknowledgements and Funding



HCP Boilerplate text

References

1. J. Kruper *et al.*, *Apert Neuro*. **1** (2021).
2. F.-C. Yeh *et al.*, *PLoS Comput. Biol.* **12** (2016).