The role of neuroimaging beyond T1-weighted MRI in the diagnosis and prediction of neuropsychiatric disorders

Esten H. Leonardsen

26.10.23

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The future of neuroimaging-based prediction

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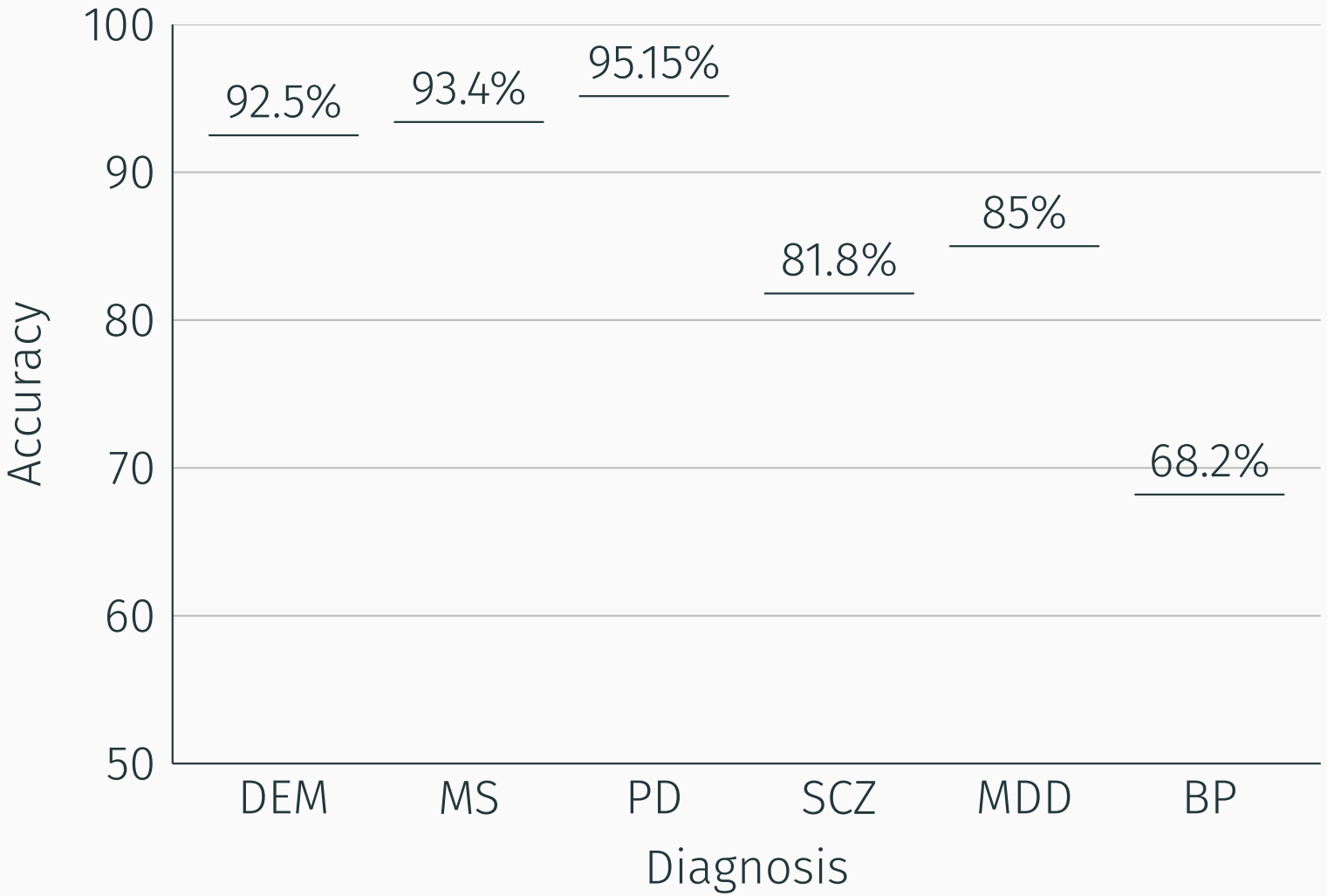
Challenges: Predictiveness



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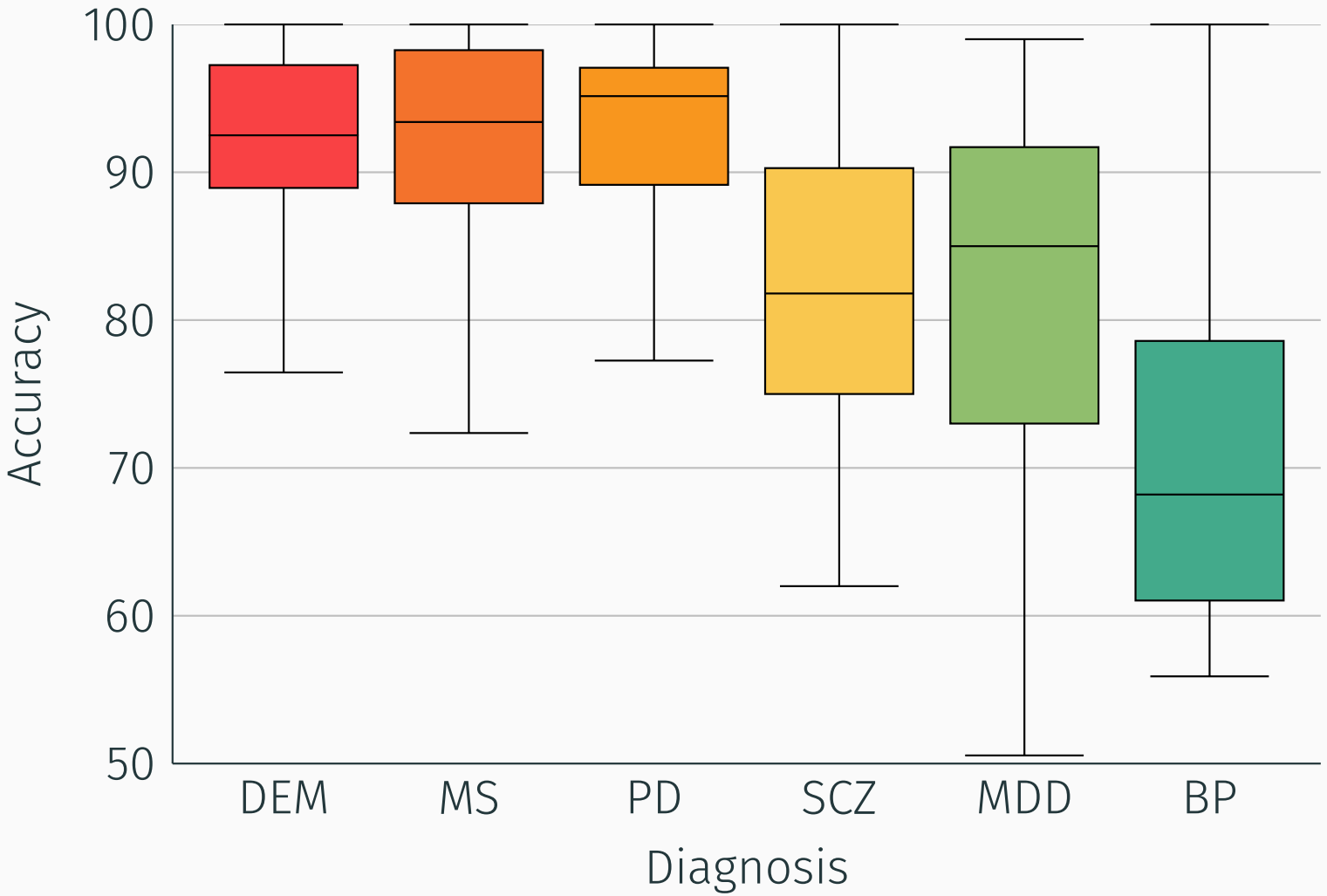

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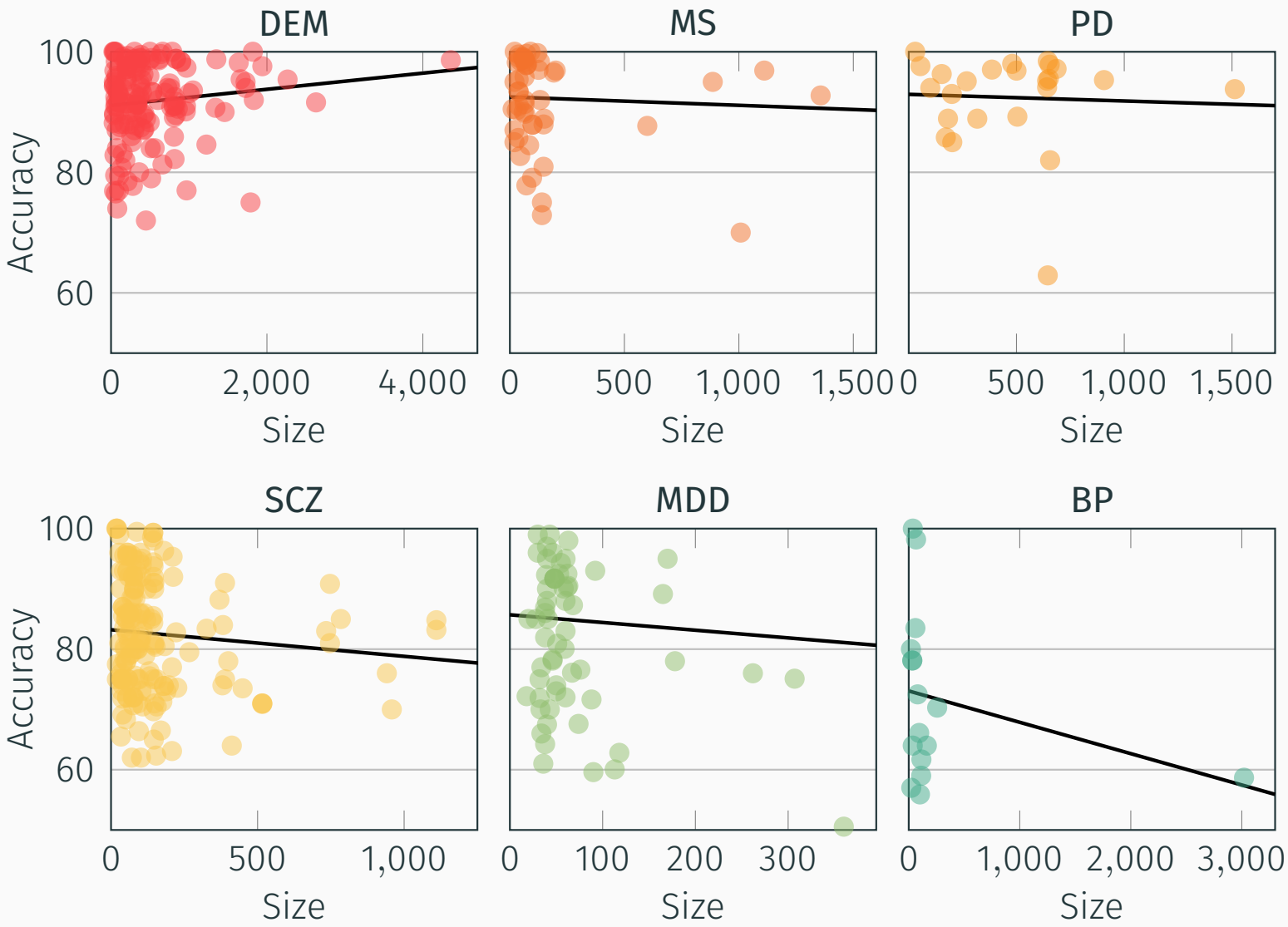

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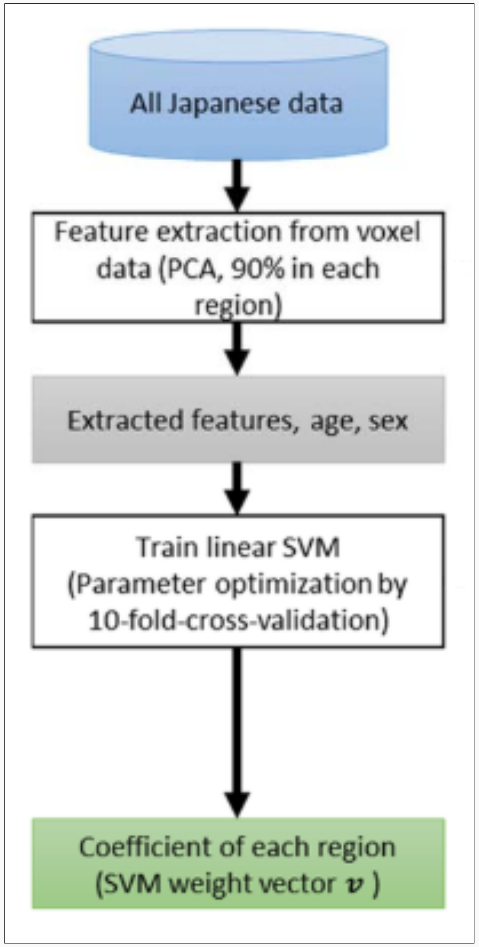

Matsuo et al., 2019

Matsuo, K., Harada, K., Fujita, Y., Okamoto, Y., Ota, M., Narita, H., ... & Watanabe, Y. (2019). Distinctive neuroanatomical substrates for depression in bipolar disorder versus major depressive disorder. Cerebral Cortex, 29(1), 202-214

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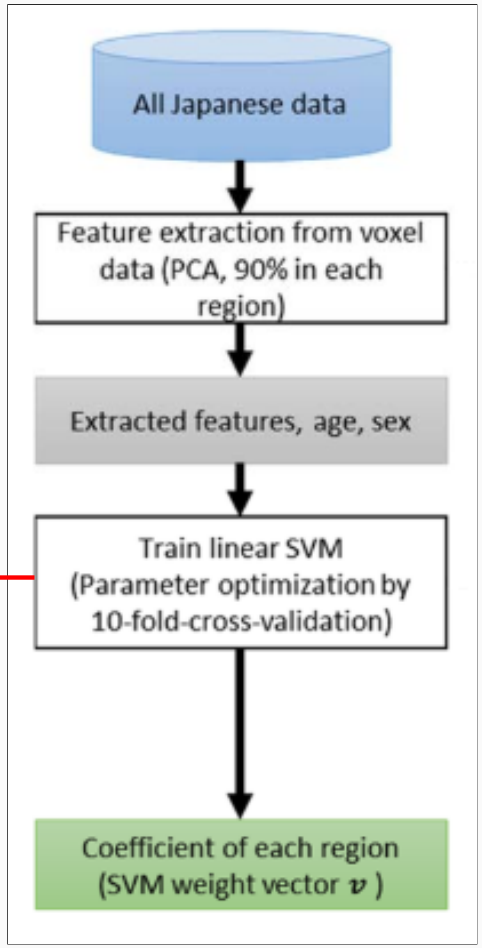

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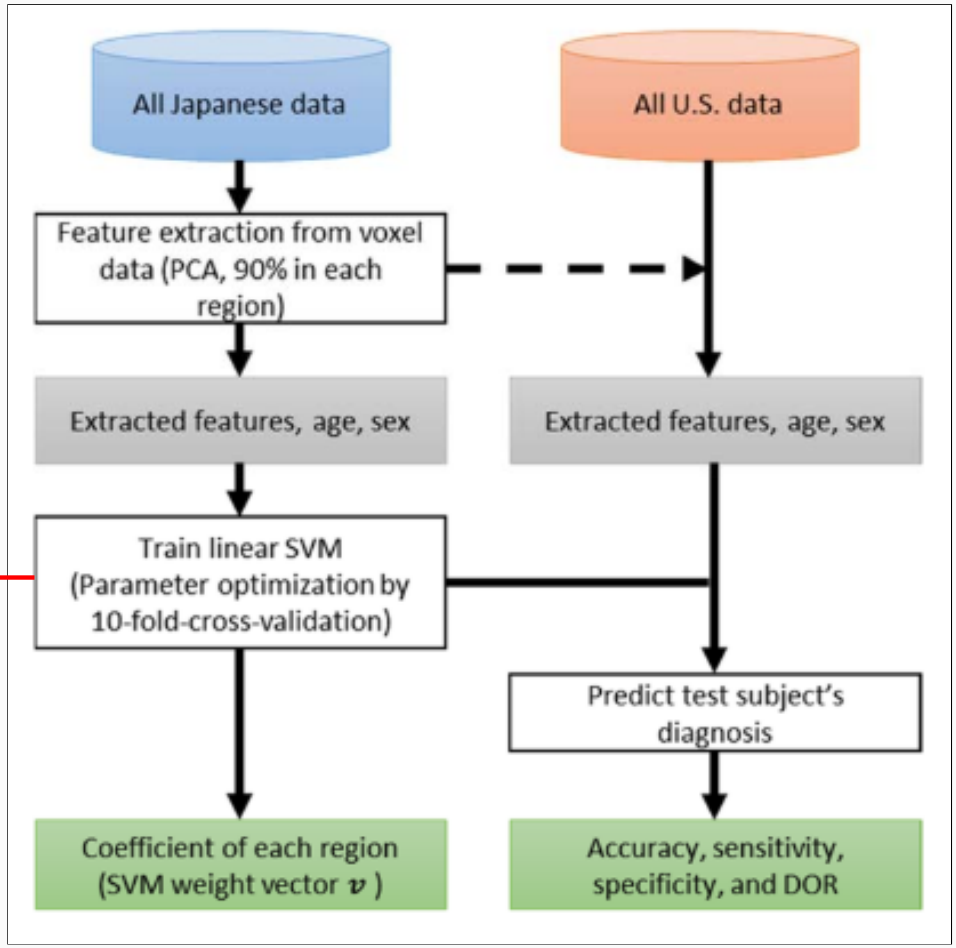

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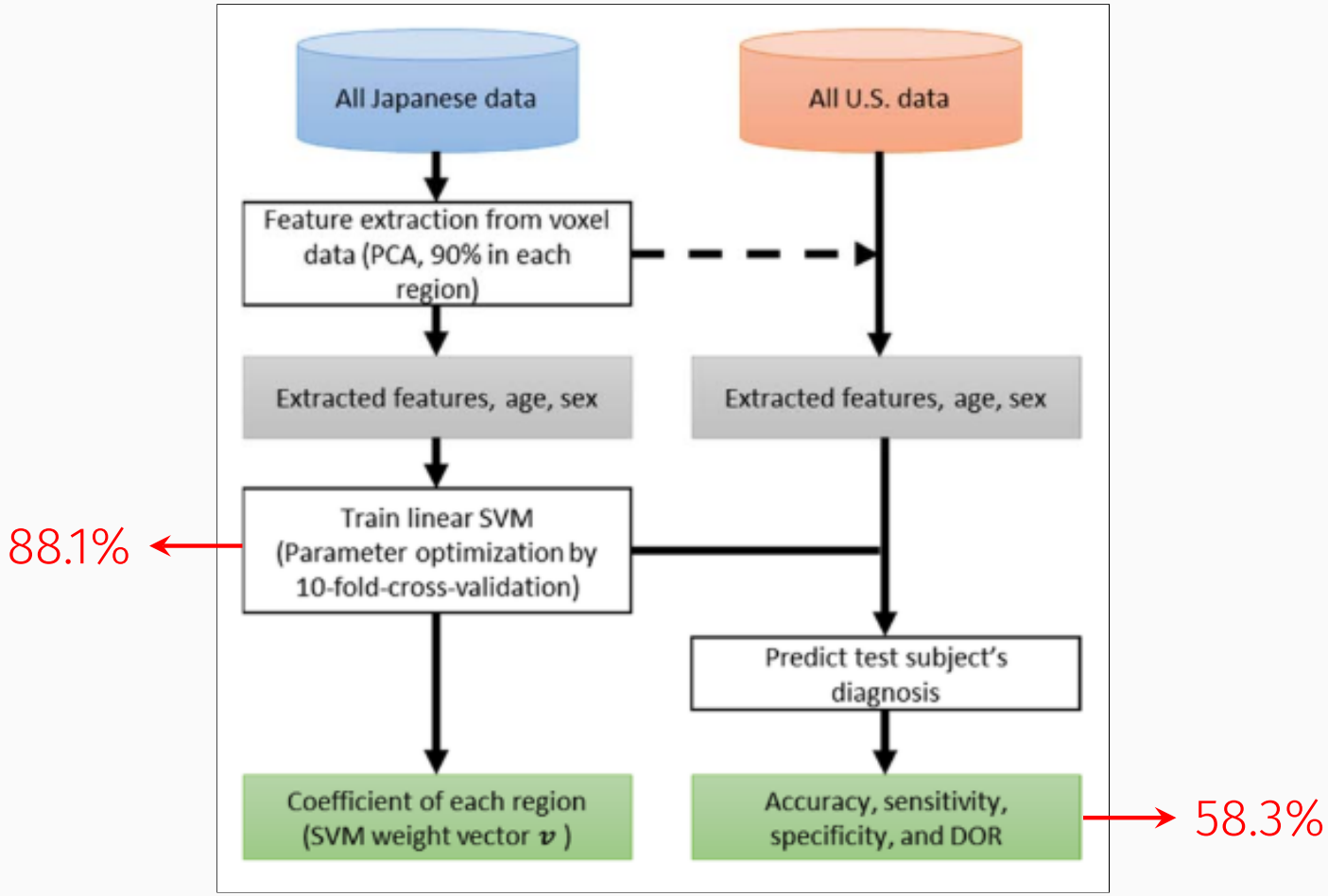

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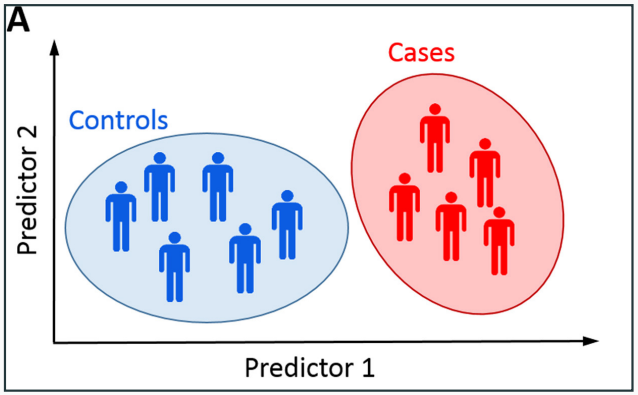
Challenges: Predictive targets



Marquand et al., 2016

Marquand, A. F., Rezek, I., Buitelaar, J., & Beckmann, C. F. (2016). Understanding heterogeneity in clinical cohorts using normative models: beyond case-control studies. Biological psychiatry, 80(7), 552-561

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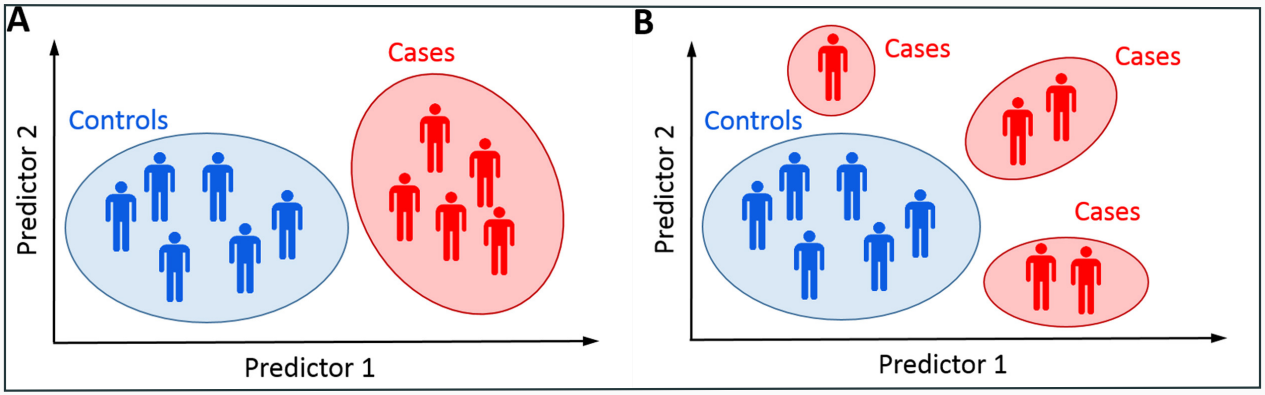

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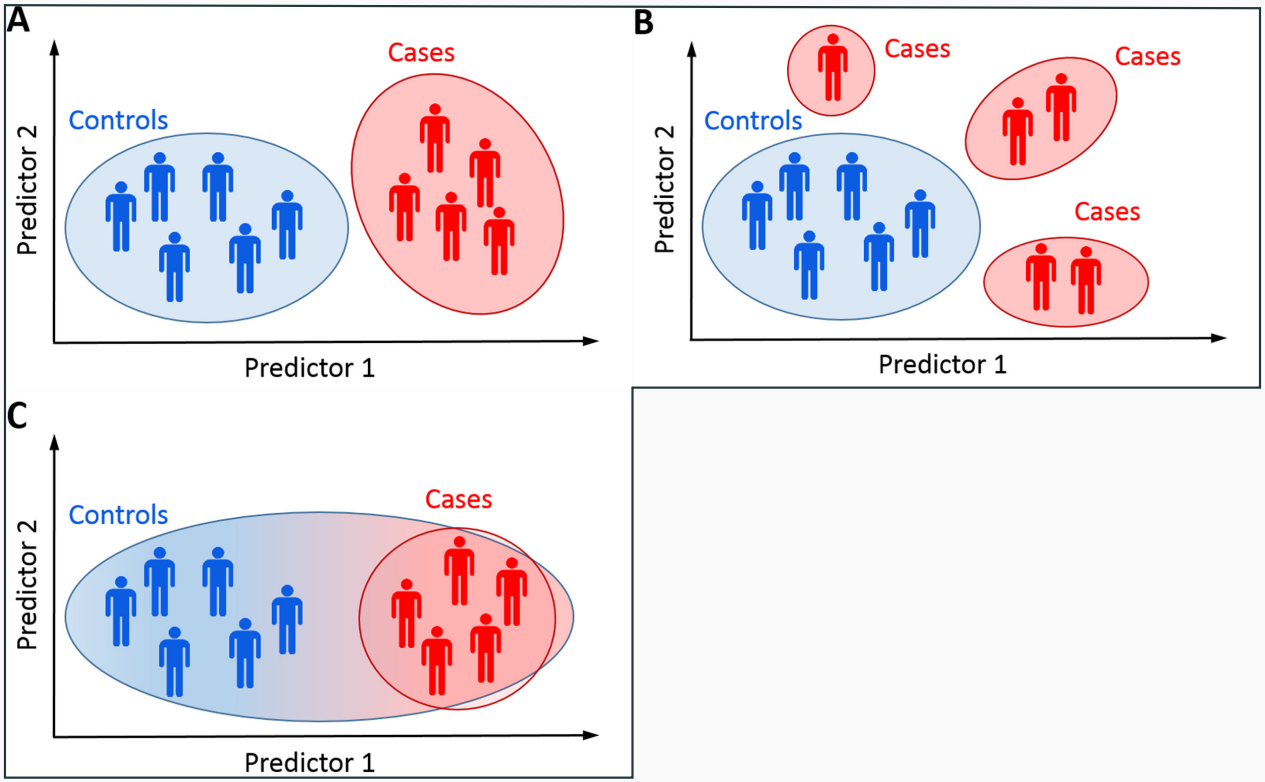

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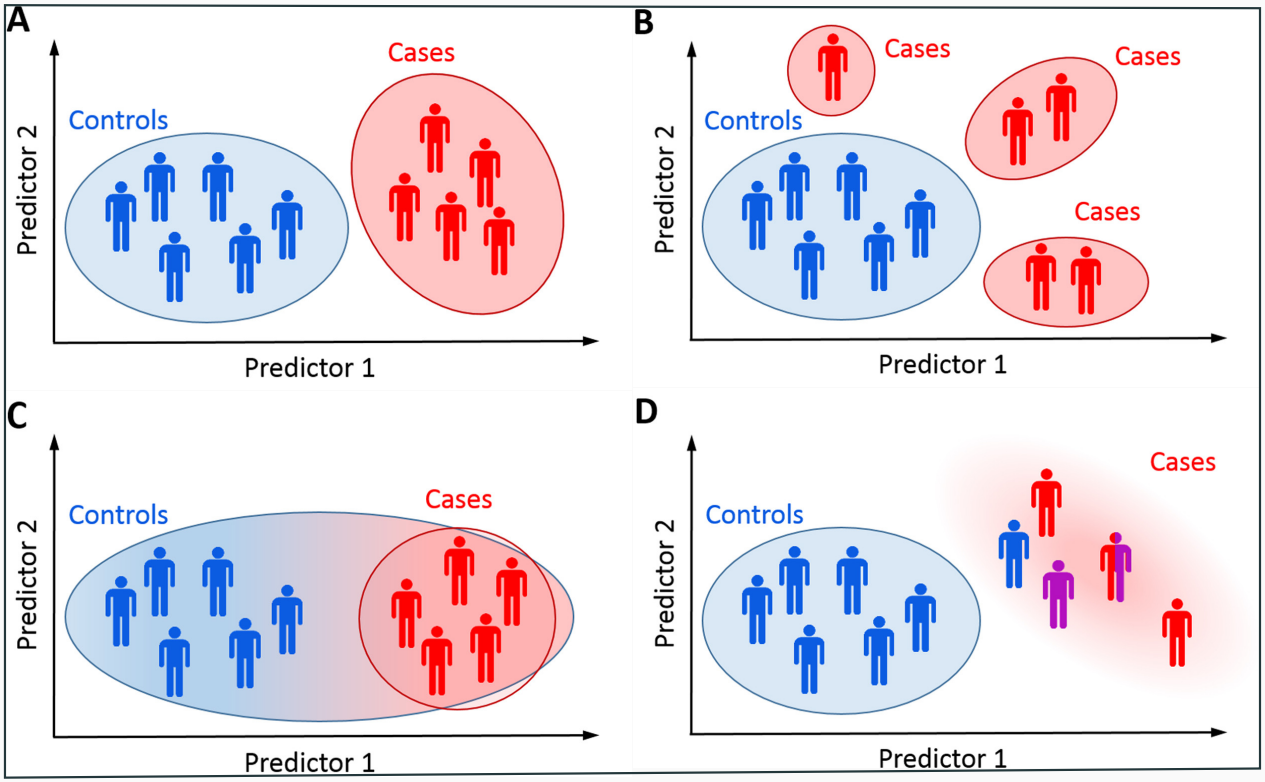

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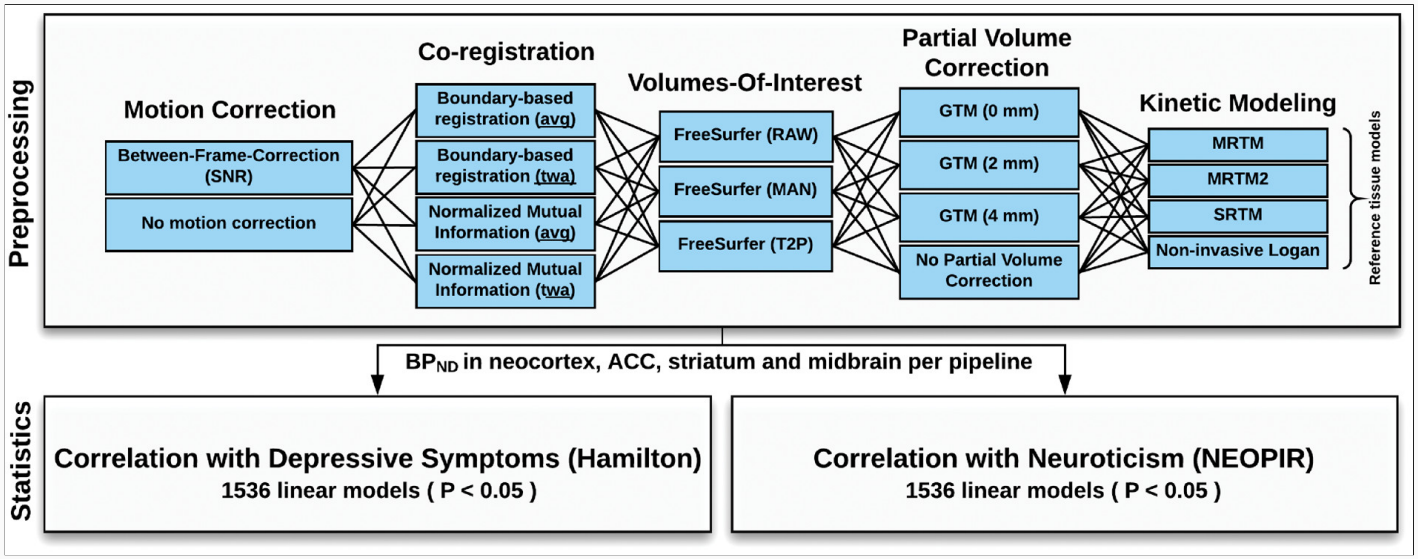
Challenges: Predictive targets

Diagnostic labels vs prognosis, treatment, differential

Challenges: Preprocessing and degrees of freedom



Nørgaard et al., 2020

Nørgaard, M., Ganz, M., Svarer, C., Frokjaer, V. G., Greve, D. N., Strother, S. C., & Knudsen, G. M. (2020). Different preprocessing strategies lead to different conclusions: a [11C] DASB-PET reproducibility study. Journal of Cerebral Blood Flow & Metabolism, 40(9), 1902-1911

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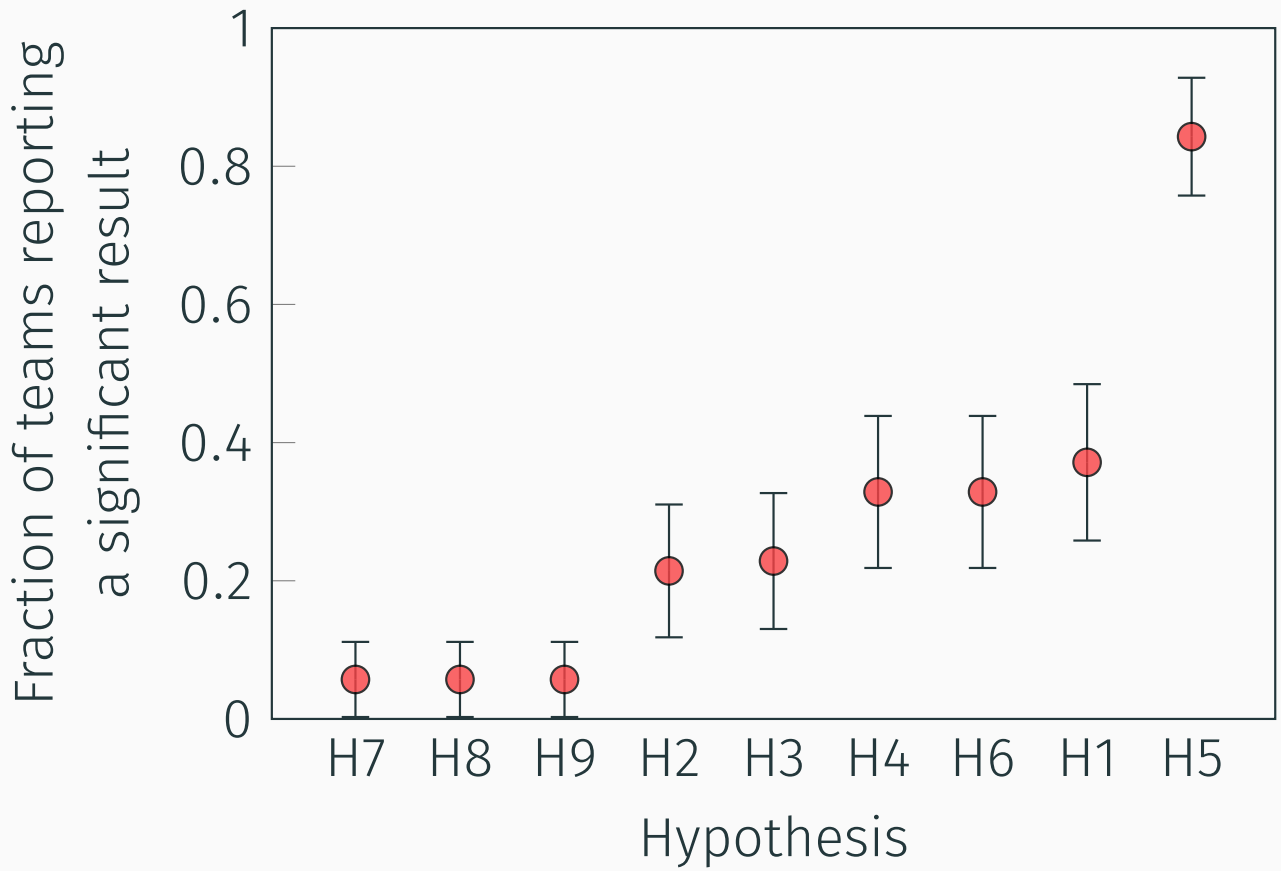

Adapted from Botvinik-Nezer et al., 2020

Botvinik-Nezer, R., Holzmeister, F., Camerer, C. F., Dreber, A., Huber, J., Johannesson, M., ... & Rieck, J. R. (2020). Variability in the analysis of a single neuroimaging dataset by many teams. Nature, 582(7810), 84-88

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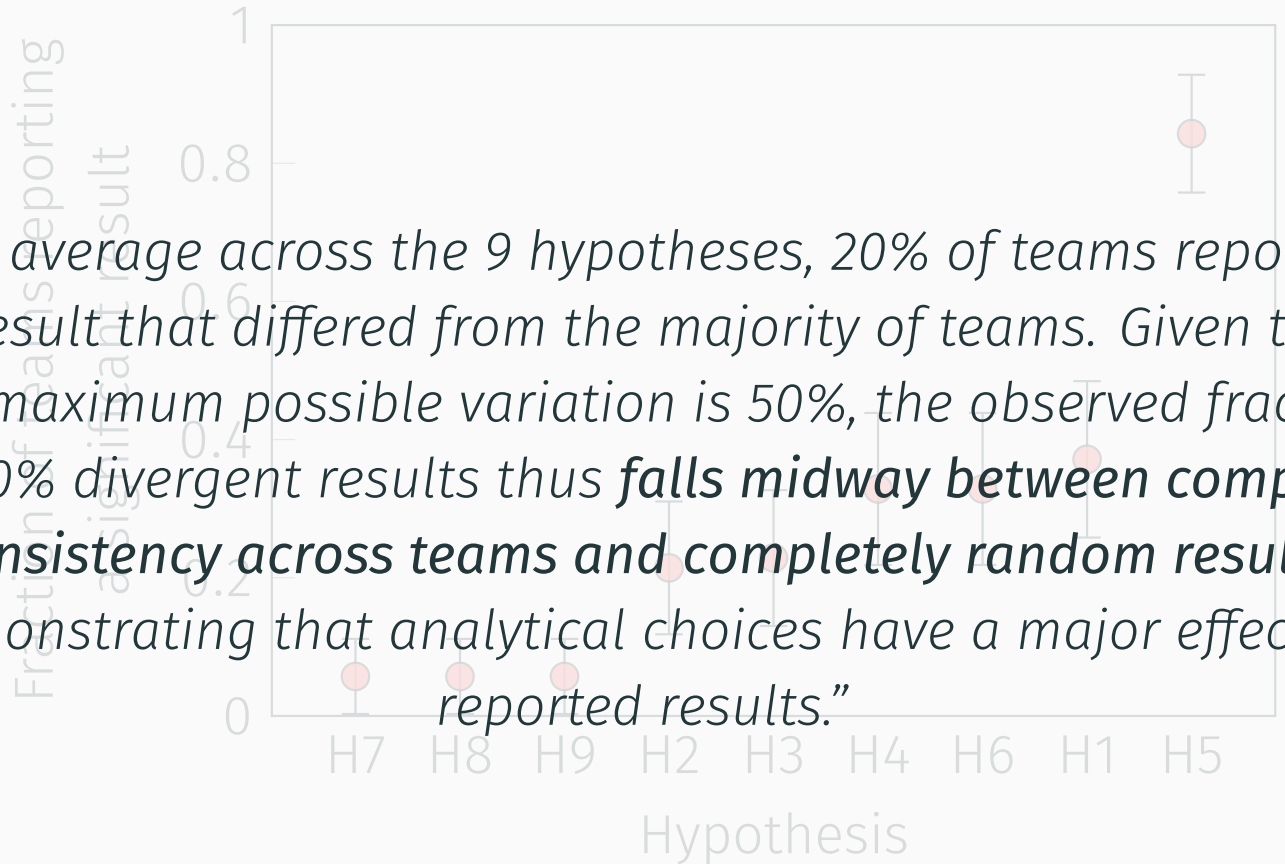

"On average across the 9 hypotheses, 20% of teams reported a result that differed from the majority of teams. Given that the maximum possible variation is 50%, the observed fraction of 20% divergent results thus ***falls midway between complete consistency across teams and completely random results****, demonstrating that analytical choices have a major effect on reported results."*

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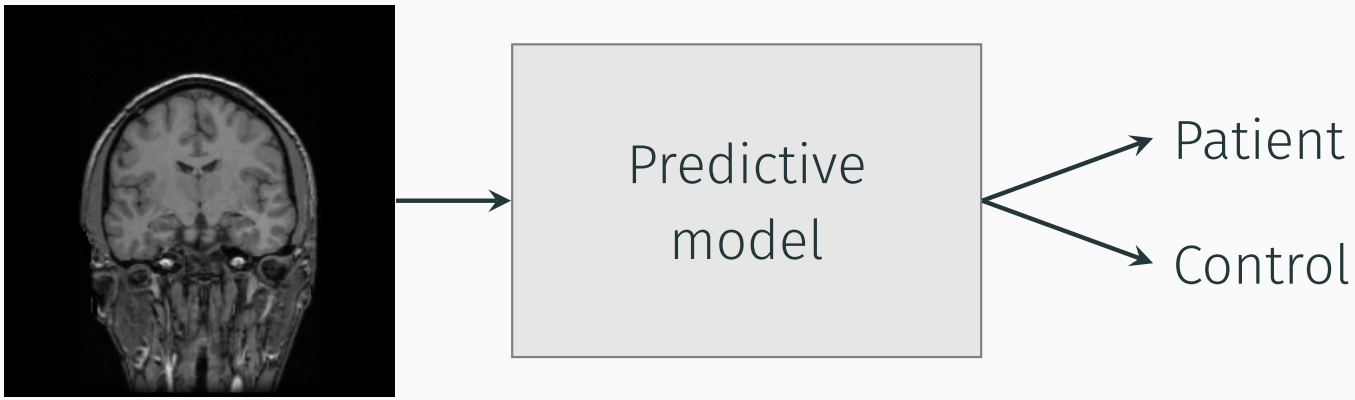
Challenges: Interpretability



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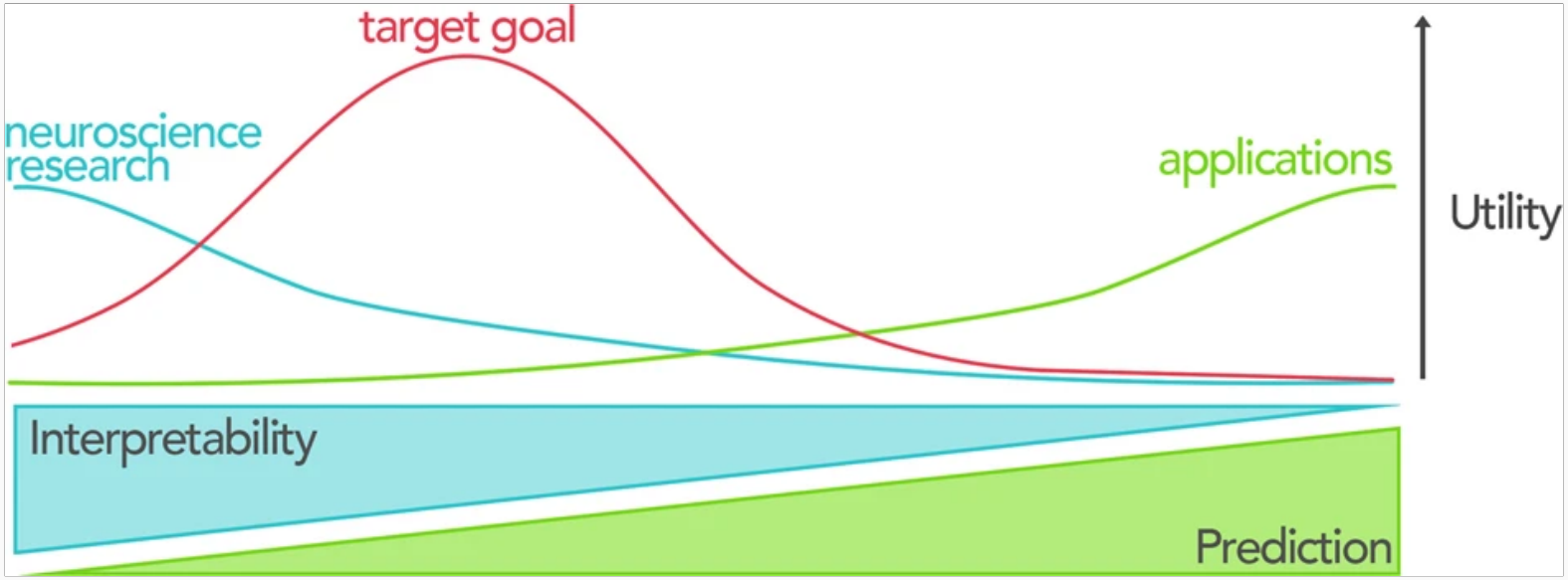

Vogel & Black (2024)

Vogel, A. C., & Black, K. J. (2024). Brain Imaging in Routine Psychiatric Practice. Missouri Medicine, 121(1), 37

Challenges: Interpretability

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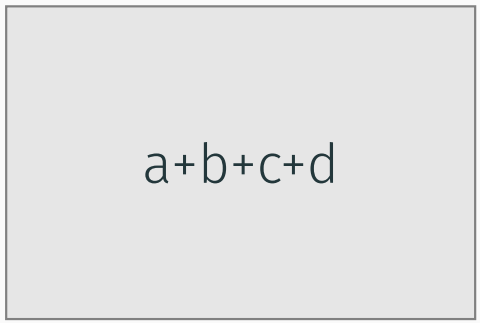

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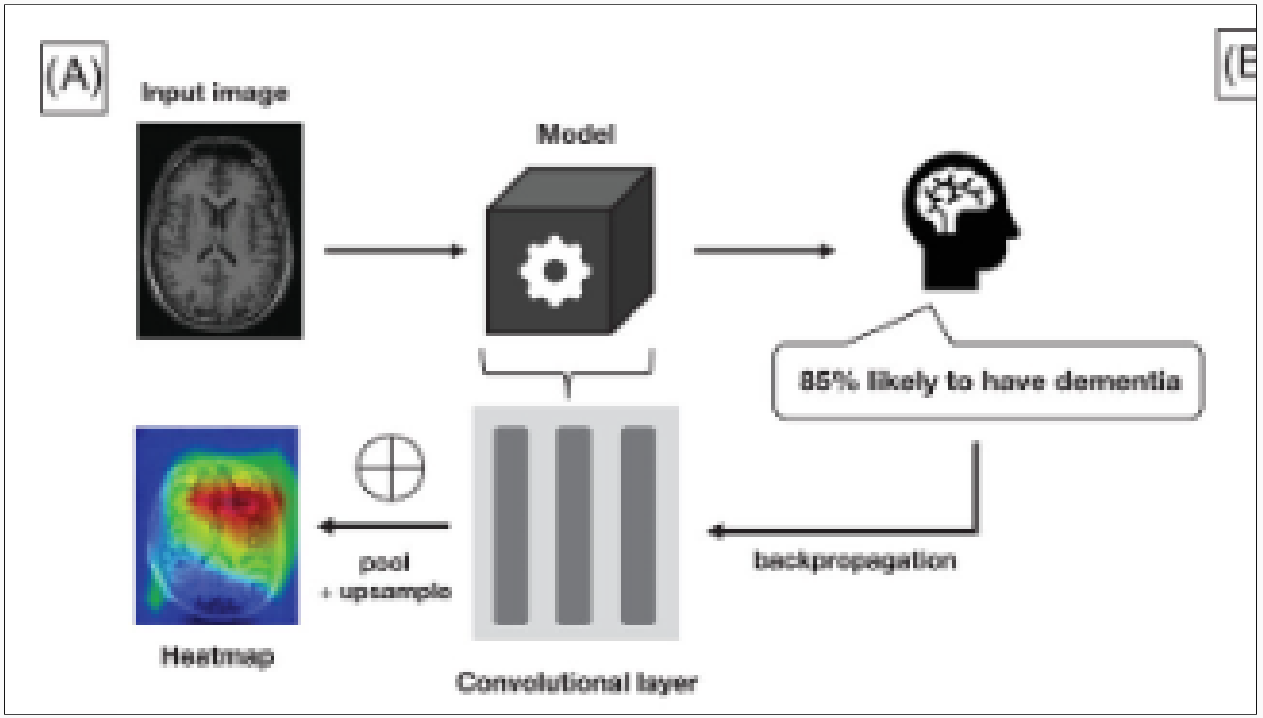

Opportunities: New modalities

DEBBIE

Opportunities: New modalities

QSM

Opportunities: Multimodality

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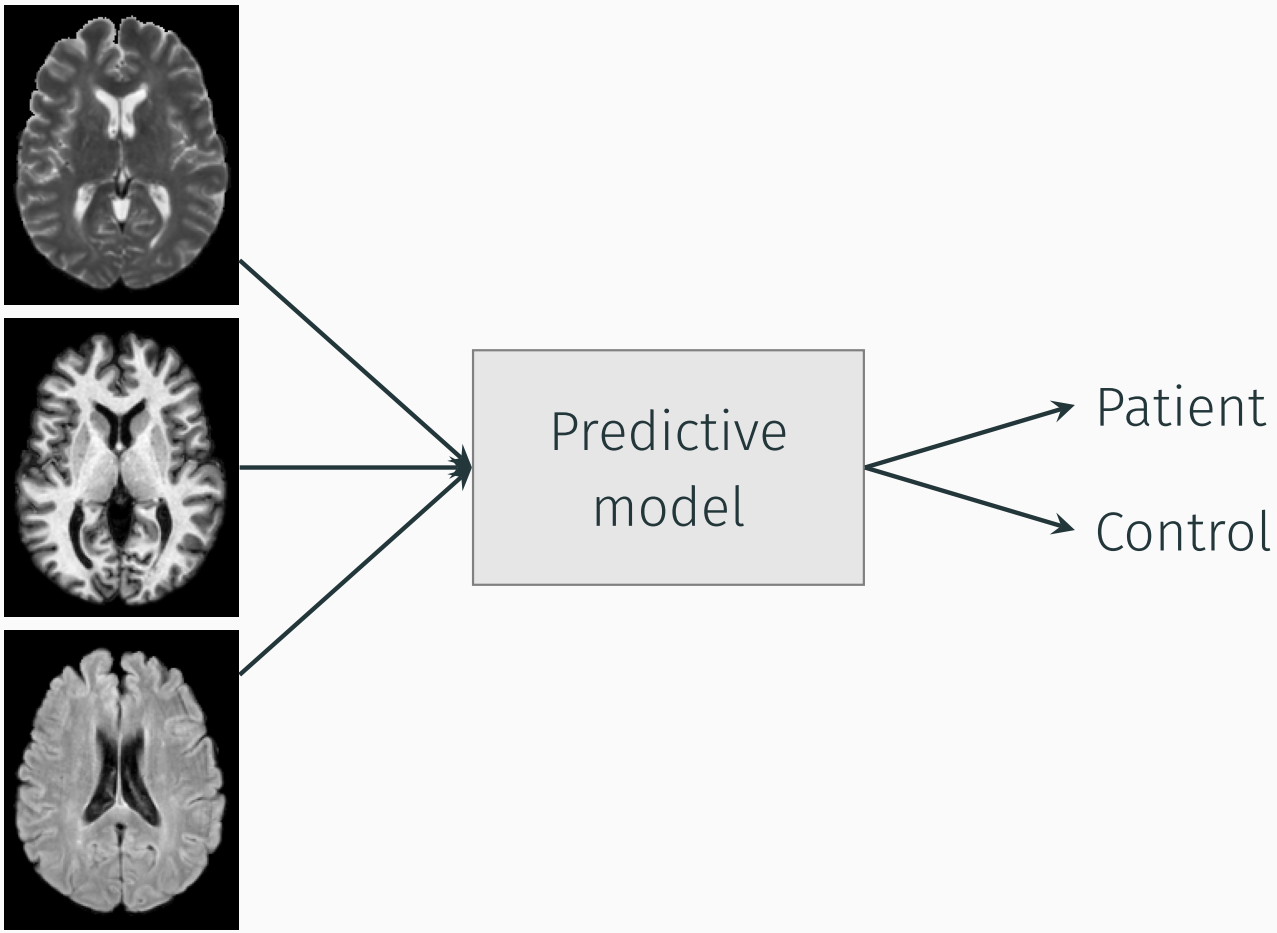

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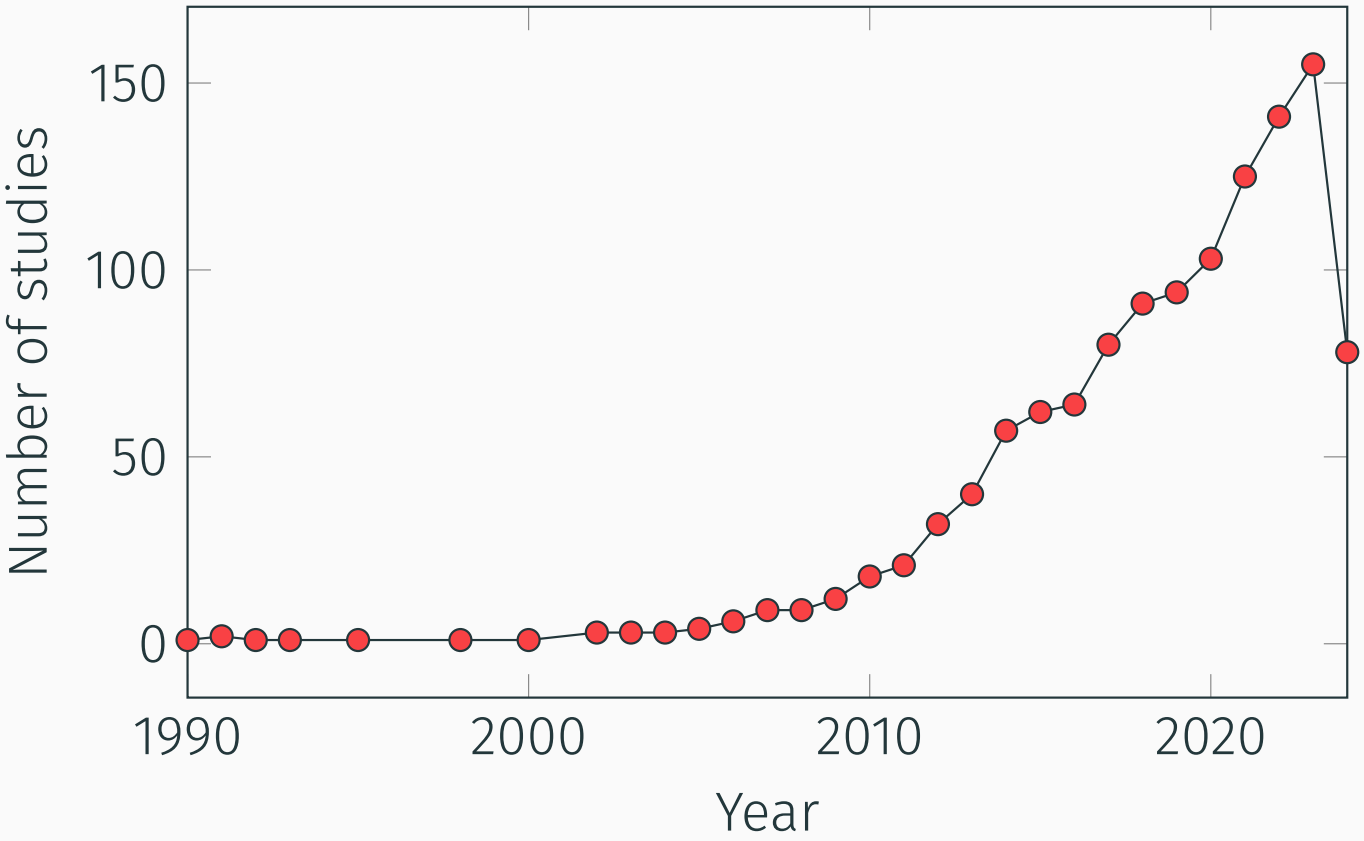
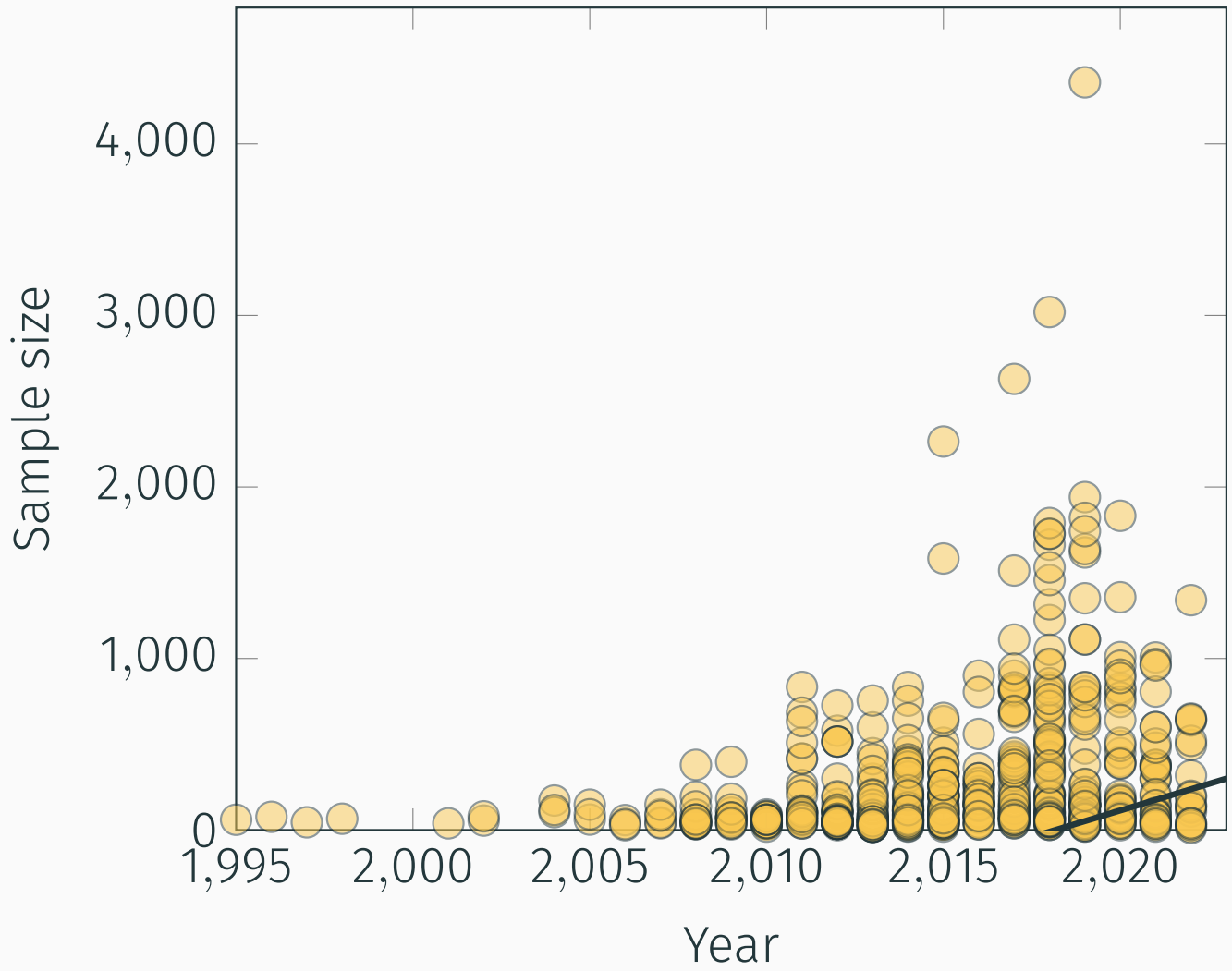
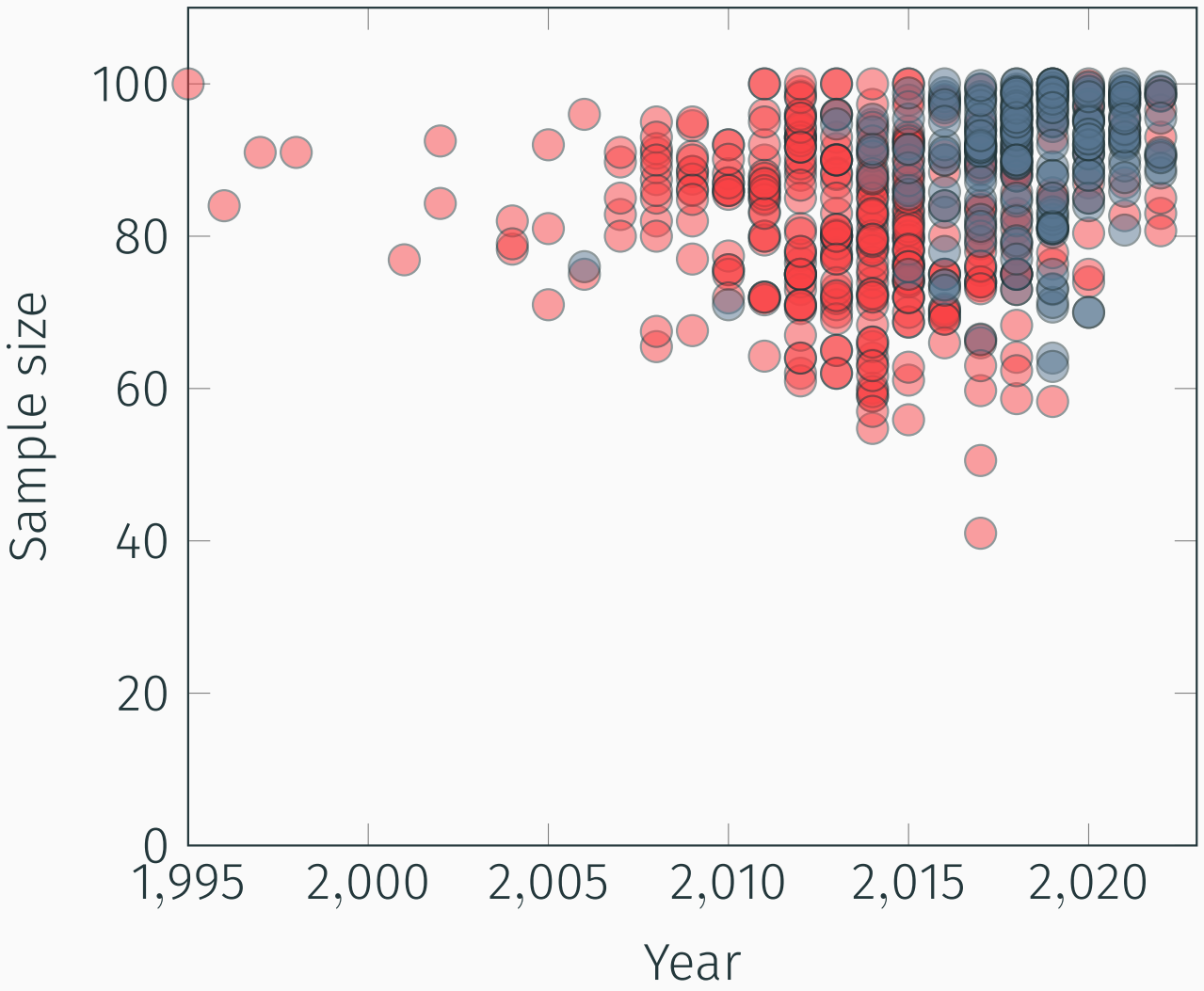


Pubmed search: multimodal[Title] AND (neuroimaging[Title] or MRI[Title])

Opportunities: Larger datasets



Opportunities: Better methods



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