Utrecht University

13-5-2026

AI application in Medicine

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Background: AI in medicine

Applications of AI techniques in healthcare have skyrocketed over the past decade

- E.g. AI tools to develop new medicines
- AI tools to analyze wearables data
- AI tools to diagnose patients
- AI tools to investigate (neuro)biological underpinnings of disorders

Background: methods today

Classification & Stratification

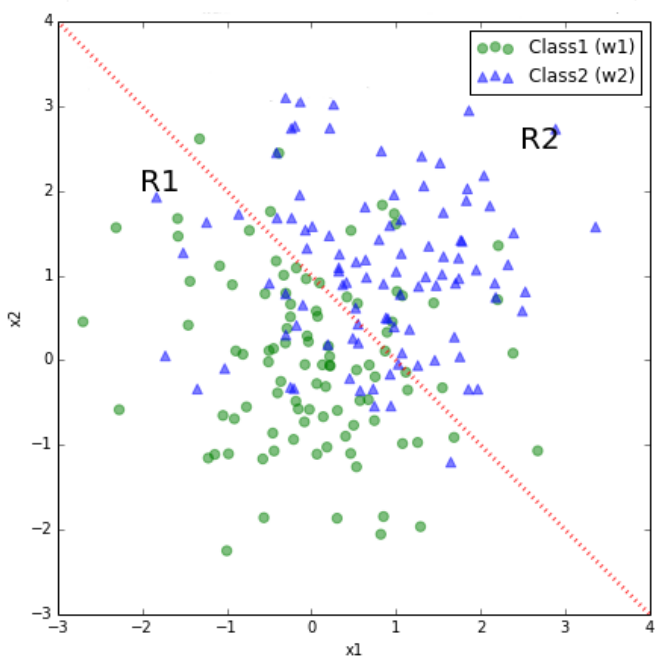
- Diagnosis: Classification of subjects: patient or not? -> supervised

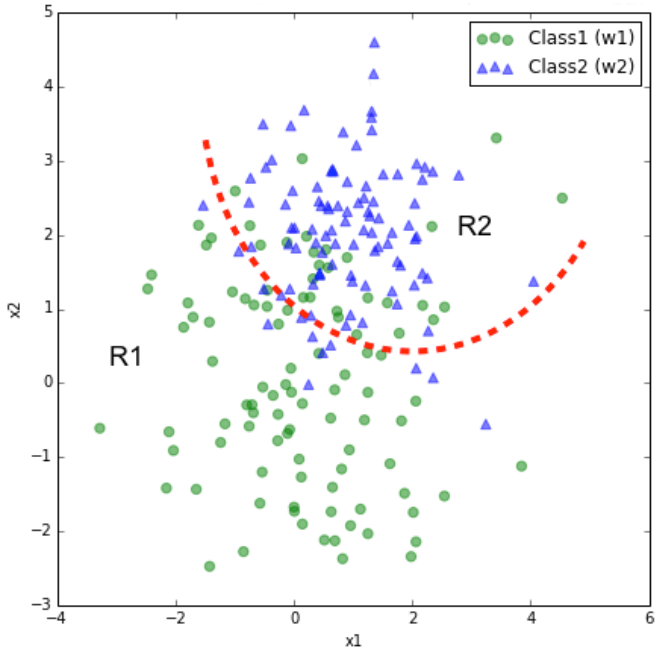
- Etiology: Stratification of patients: data driven subgroups -> unsupervised

Background: methods today

Classification & Stratification

- Classification: using ML techniques to inform you which features are most predictive of a-priori group labels

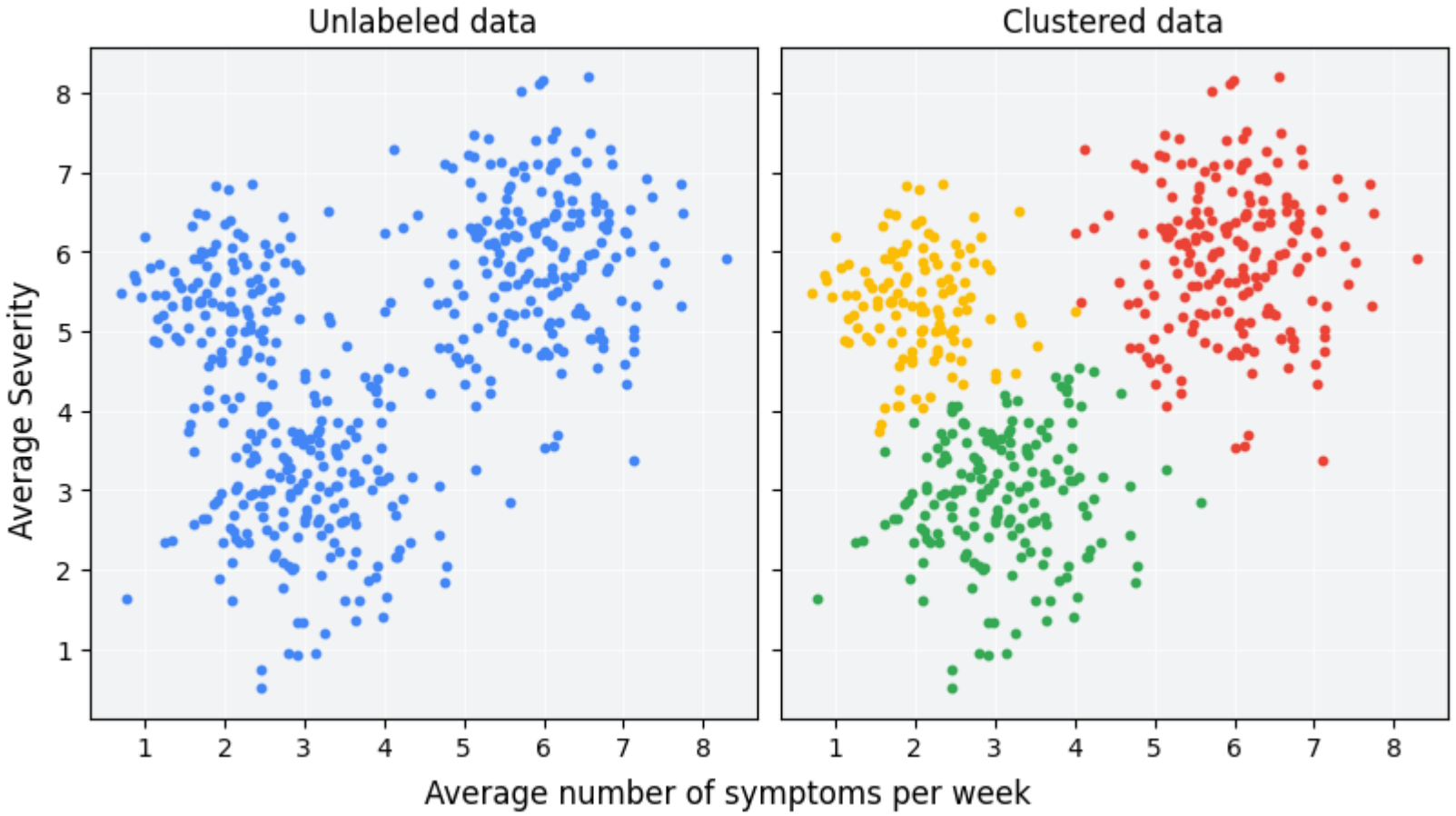




Background: methods today

Classification & Stratification

- Stratification: using ML techniques to identify ‘hidden’ or underlying subgroups within a population



Background: topics for today

Three specific topics as examples

- Topic 1: Classification of ADHD patients based on fMRI patterns
- Topic 2: Predicting COVID-19 cases and deaths based on demographics
- Topic 3: Stratifying subjects with ASD based on their brain structure

Topic 1:
Classification of ADHD patients based on fMRI patterns

- Data: fMRI activation maps during an Inhibition task
- Classifier: Gaussian Process Classifier
- Outcome: Patient diagnosis

Quantifying patterns of brain activity: Distinguishing unaffected siblings from participants with ADHD and healthy individuals

Thomas Wolfers [a b], Daan van Rooij [b], Jaap Oosterlaan [c], Dirk Heslenfeld [c], Catharina A. Hartman [d], Pieter J. Hoekstra [d], Christian F. Beckmann [b e f], Barbara Franke [a g], Jan K. Buitelaar [e h], Andre F. Marquand [b i]

Topic 1:
Classification of ADHD patients based on fMRI patterns

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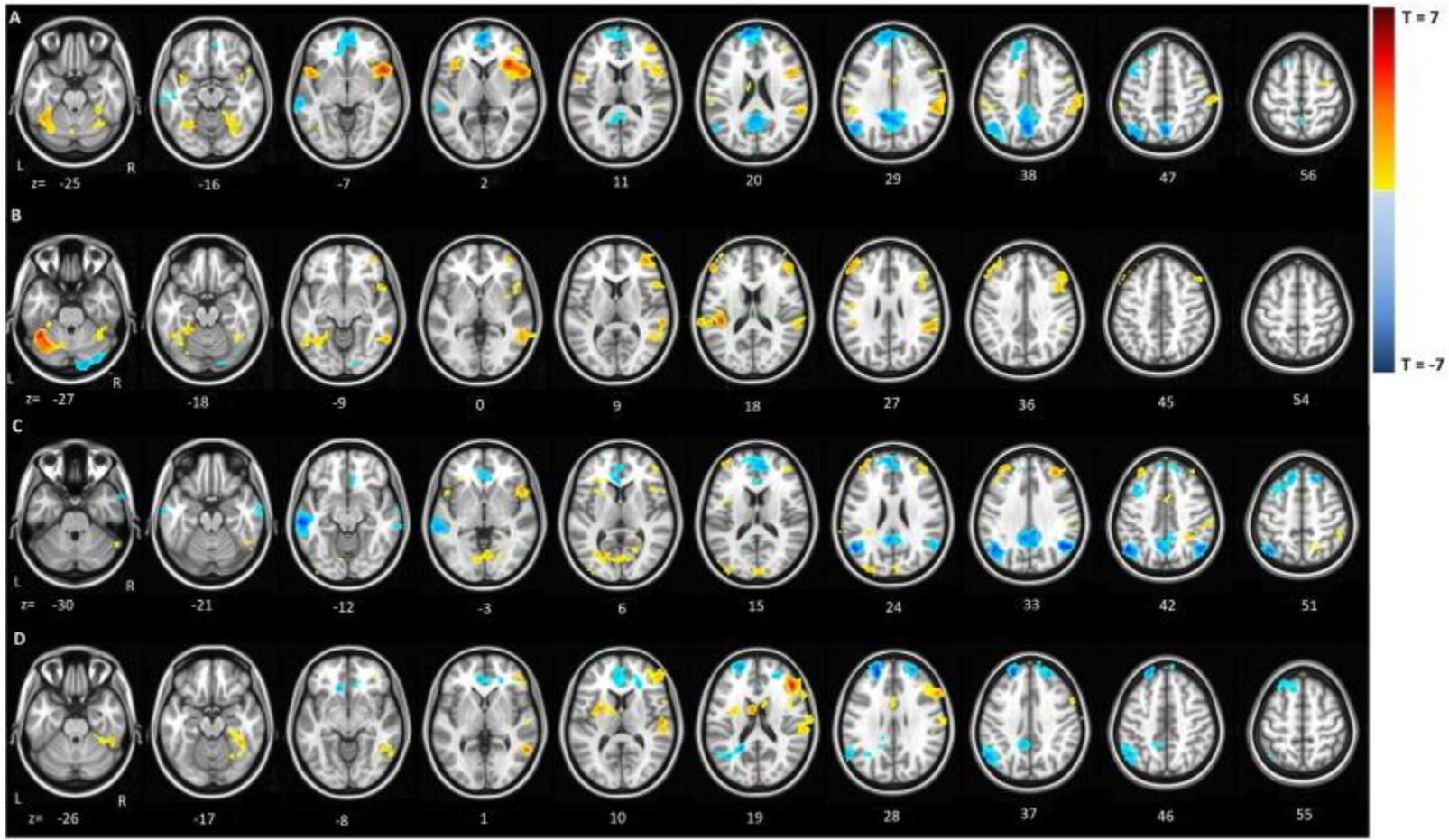

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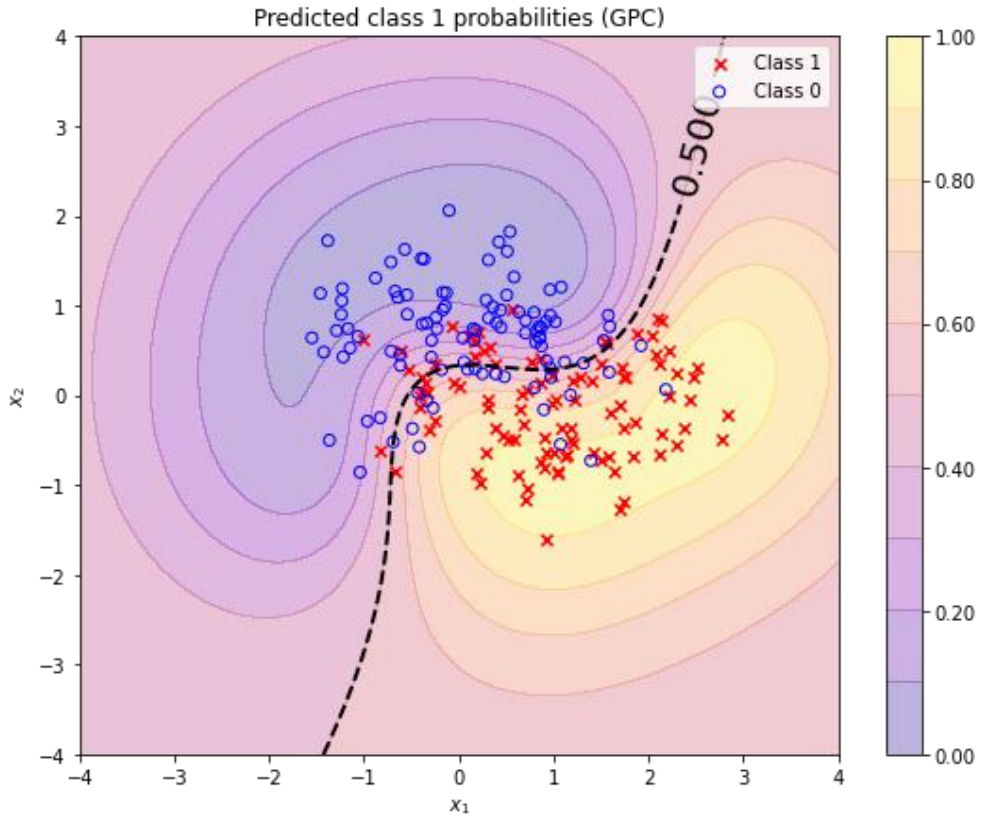

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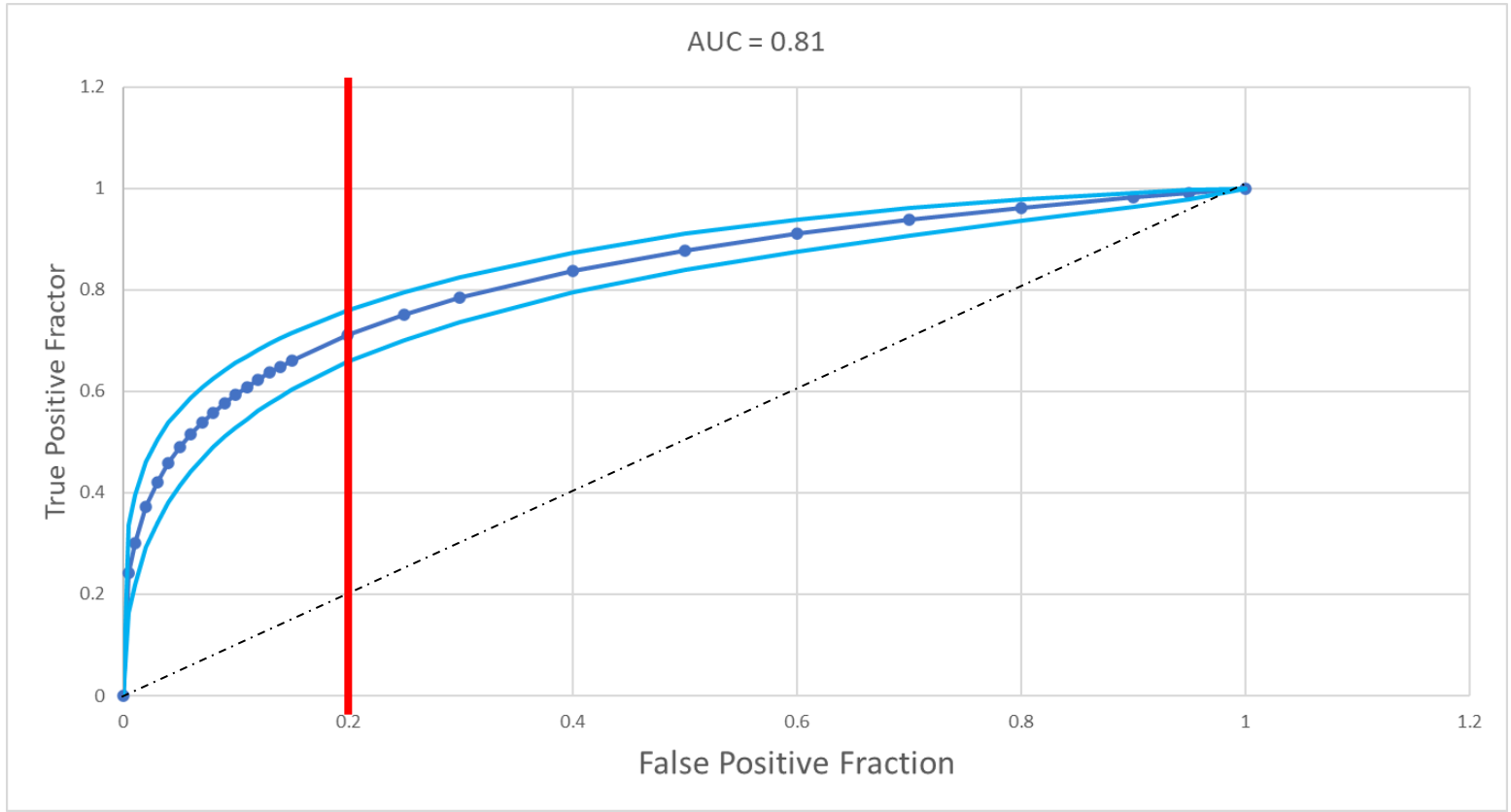
Classification of ADHD patients based on fMRI patterns

- Data: fMRI activation maps during an Inhibition task
- Classifier: Gaussian Process Classifier
- Outcome: Patient diagnosis + feature weight map



Number of Cases	700
Number Correct	540
Accuracy	77.10%
Sensitivity	75%
Specificity	80%
Pos Cases Missed	100
Neg Cases Missed	60
Fitted ROC Area	0.827
Empiric ROC Area	0.819

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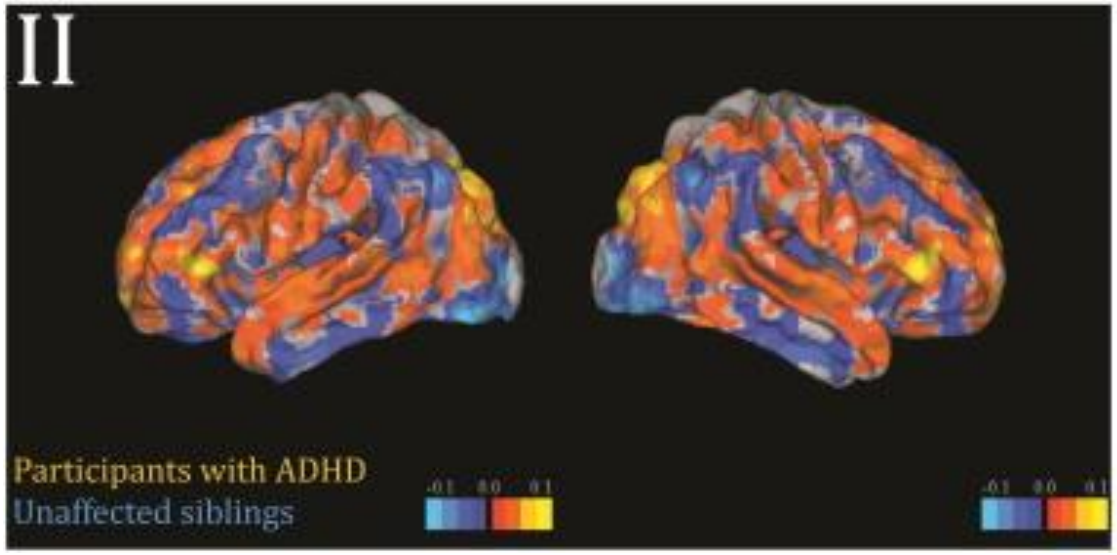
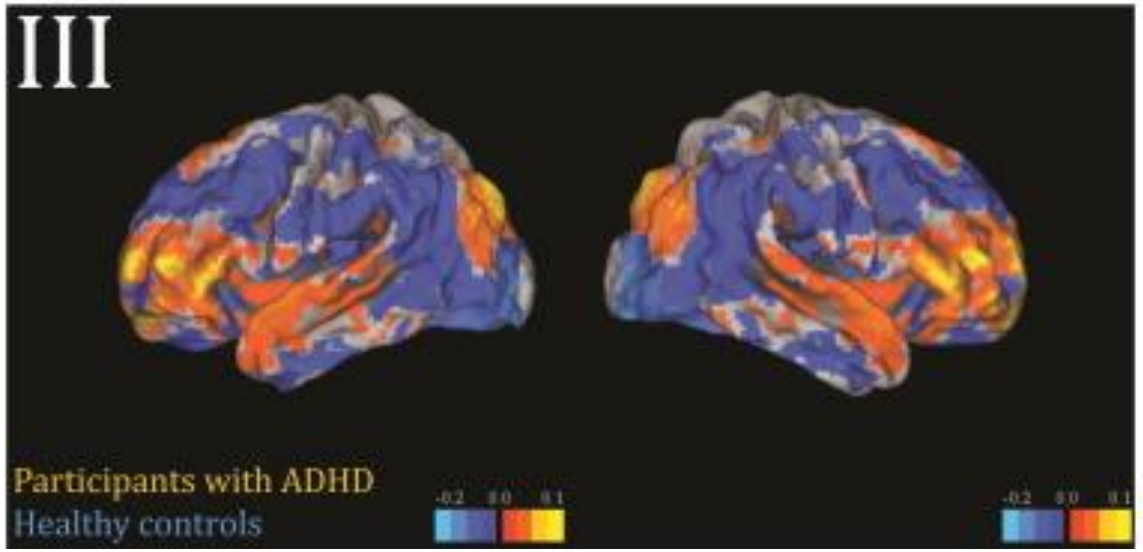




Topic 1:
Classification of patients based on fMRI patterns

Promises:

- Better classification of patients
- More insight into neurobiology of disorders
- More insight into heterogeneity between subjects

Risks:

- Determinism/wrongful interpretation
- Inaccurate predictions
- Malignant use (e.g. by insurance companies)

Topic 2:
Predicting COVID-19 cases and deaths based on demographics

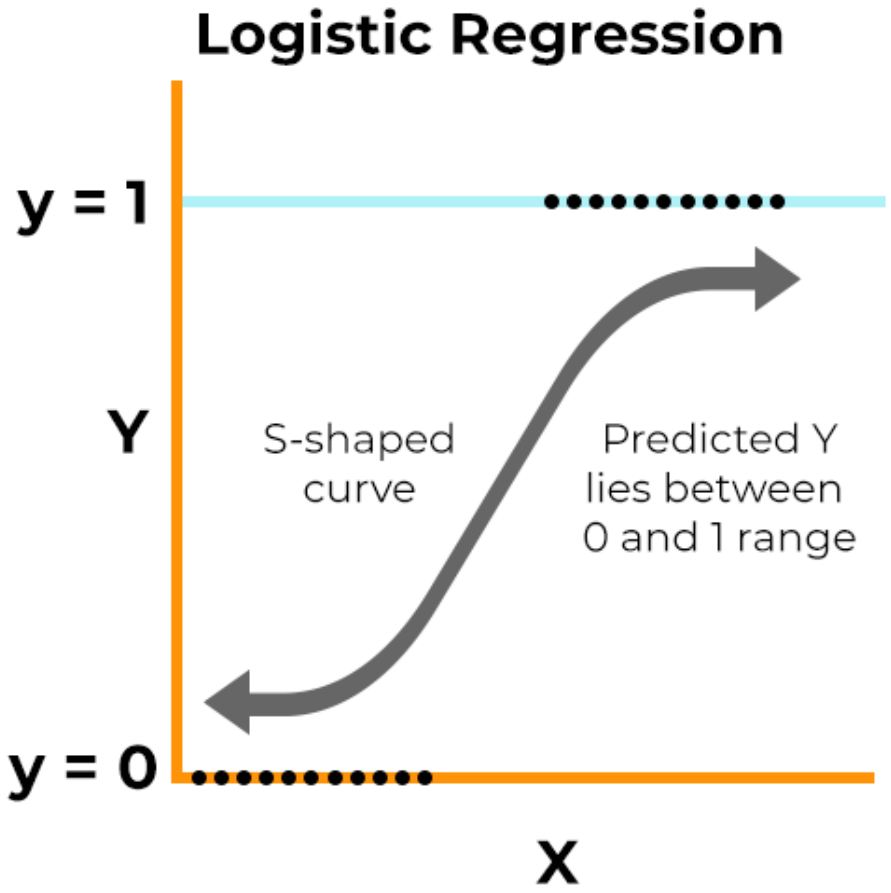
- Data: COVID-19 clinical data + population demographics
- Methods: logistic regression
- Outcome: odds-ratios/risk for COVID-19 cases & deaths (in a community)

Identifying novel factors associated with COVID-19 transmission and fatality using the machine learning approach

Mengyuan Li [a b], Zhilan Zhang [a b], Wenxiu Cao [a b], Yijing Liu [c], Beibei Du [c], Canping Chen [a b], Qian Liu [a b], Md. Nazim Uddin [a b], Shanmei Jiang [a b], Cai Chen [d], Yue Zhang [e f g], Xiaosheng Wang [a b]

Topic 2:
Predicting COVID-19 cases and deaths based on demographics

- Methods: logistic regression



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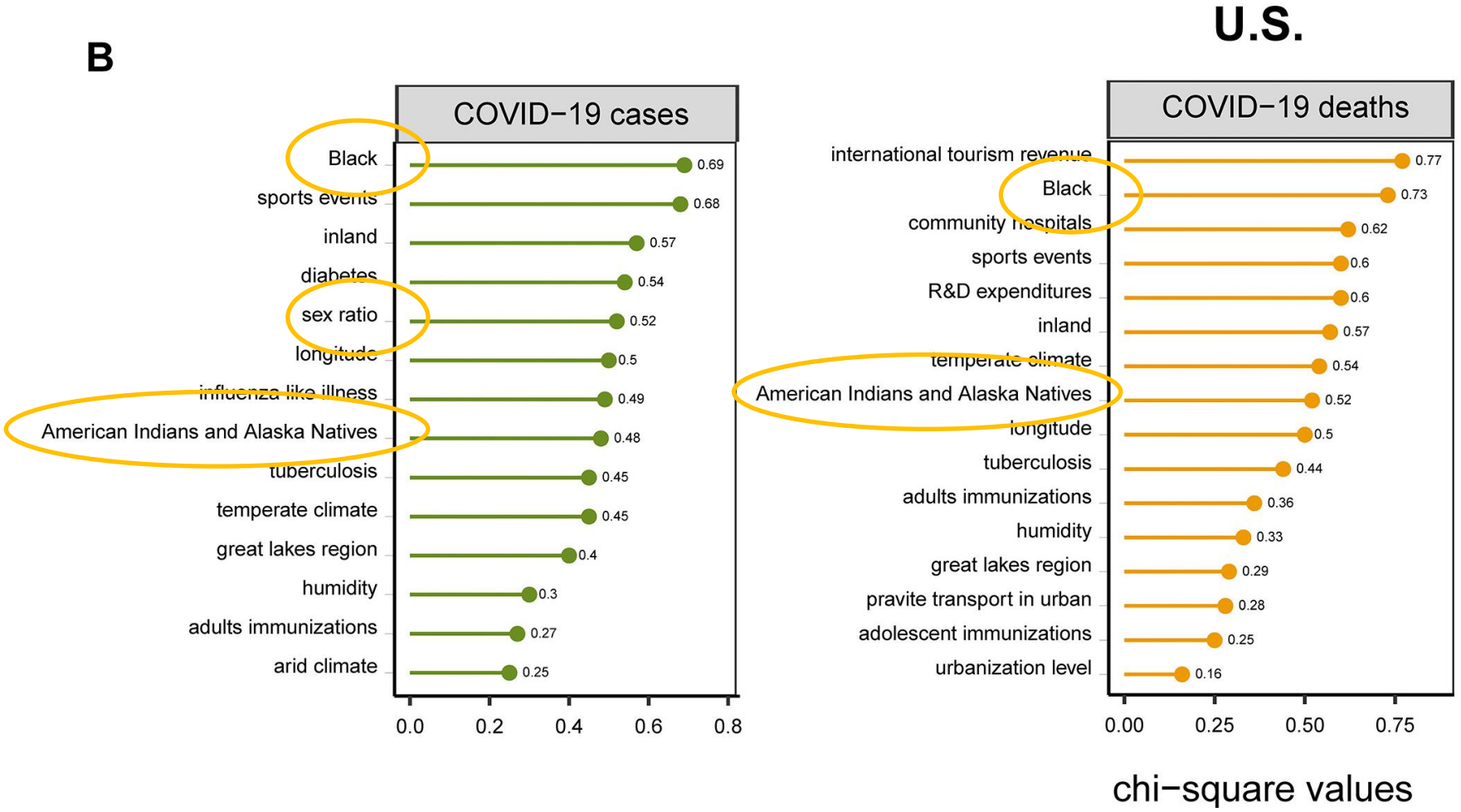

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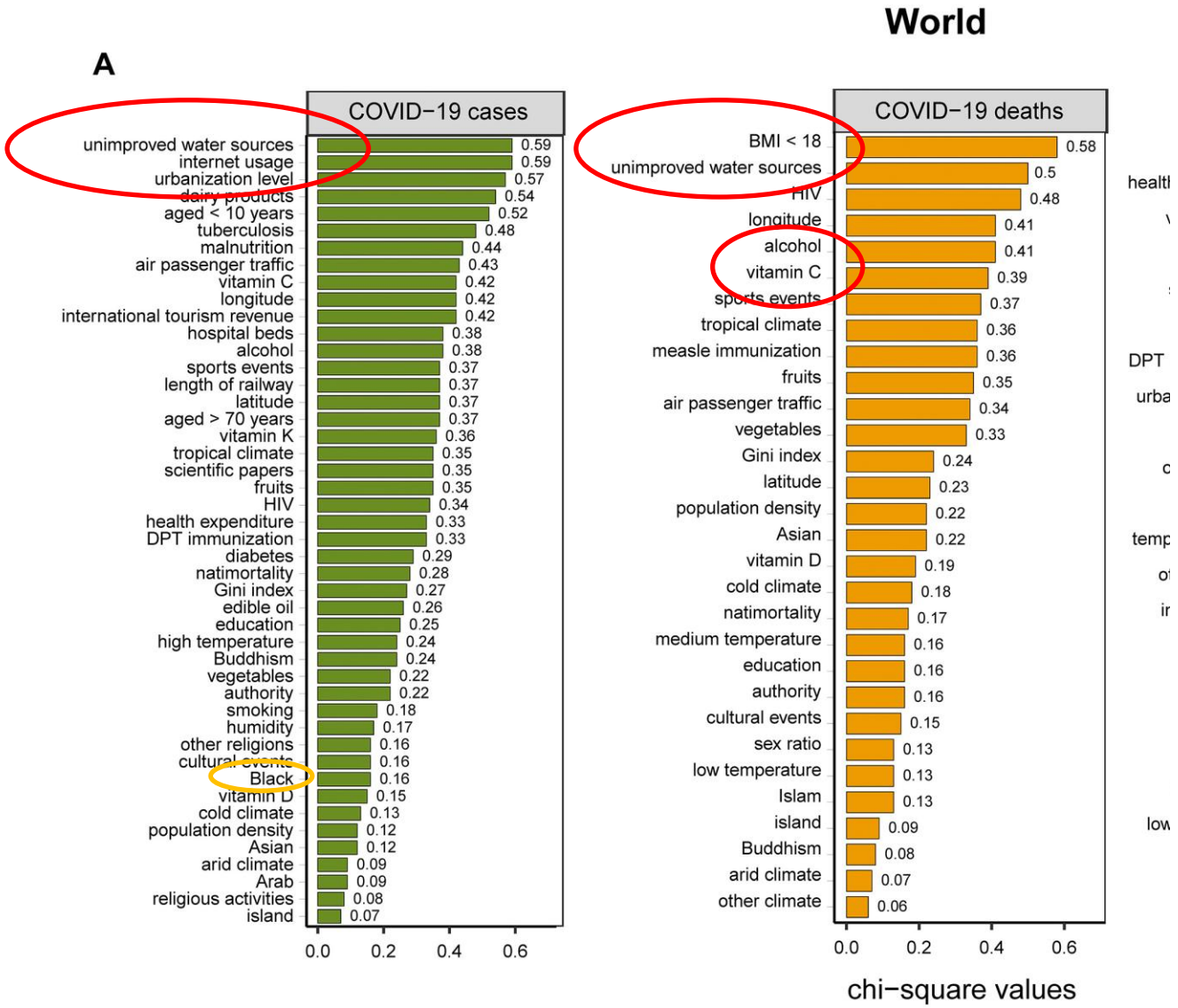

Topic 2:
Predicting COVID-19 cases and deaths based on demographics

Promises:

- Better understanding of COVID-19 spread
- Targeted interventions in ad-risk populations
- Improvement of health care system

Risks:

- Discrimination/ inequality
- Wrongful attribution of causality (black-box)
- Wrongful biological determinism
- ‘what you put in is what you get out’

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Topic 3:
Stratifying subjects with ASD based on their brain structure

- Data: structural morphometry of 53 brain segments
- Methods: normative modeling + spectral clustering
- Outcome: clusters of patients + clinical profiles

nature > translational psychiatry > articles > article

Article | Open Access | Published: 06 November 2020

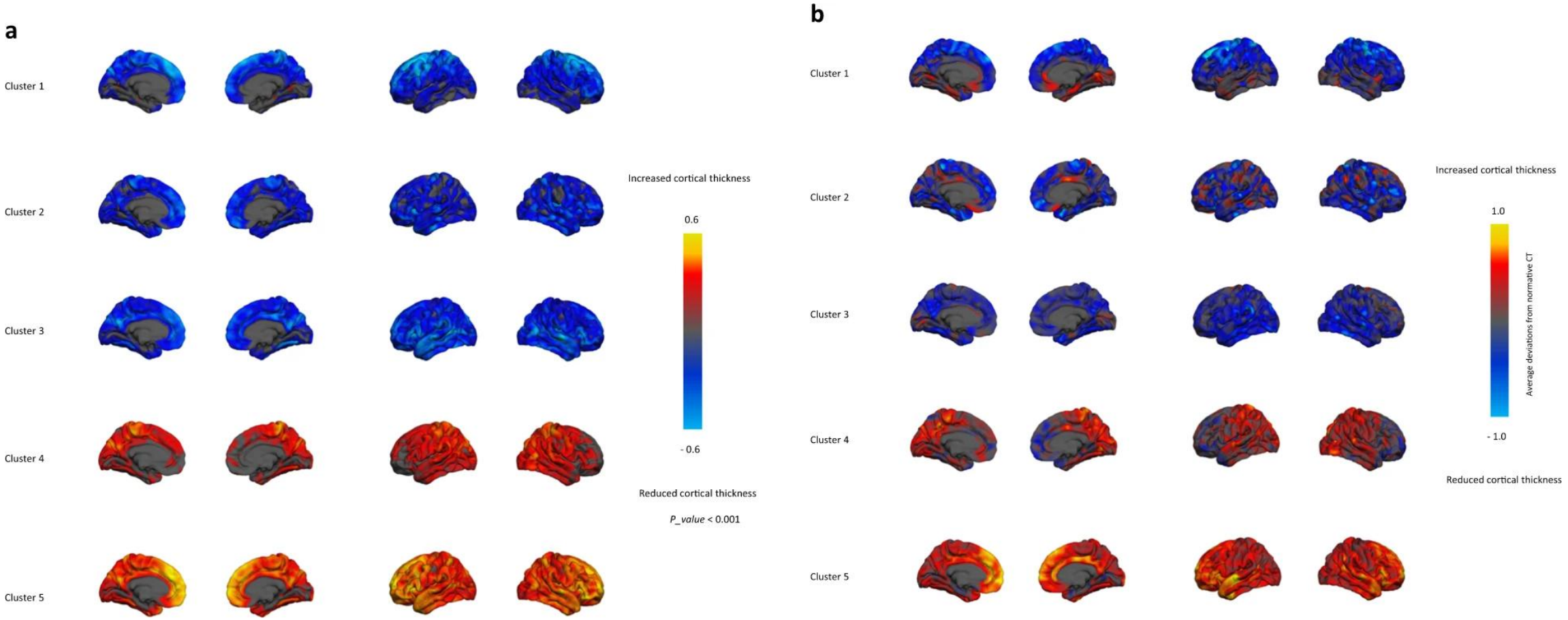
Fractionating autism based on neuroanatomical normative modeling

Mariam Zabihi, Dorothea L. Floris, Seyed Mostafa Kia, Thomas Wolfers, Julian Tillmann, Alberto Llera Arenas, Carolin Moessnang, Tobias Banaschewski, Rosemary Holt, Simon Baron-Cohen, Eva Loth, Tony Charman, Thomas Bourgeron, Declan Murphy, Christine Ecker, Jan K. Buitelaar, Christian F. Beckmann, Andre Marquand & The EU-AIMS LEAP Group

Translational Psychiatry **10**, Article number: 384 (2020) | Cite this article

Topic 3:
Stratifying subjects with ASD based on their brain structure

- Outcome: clusters of patients + clinical profiles



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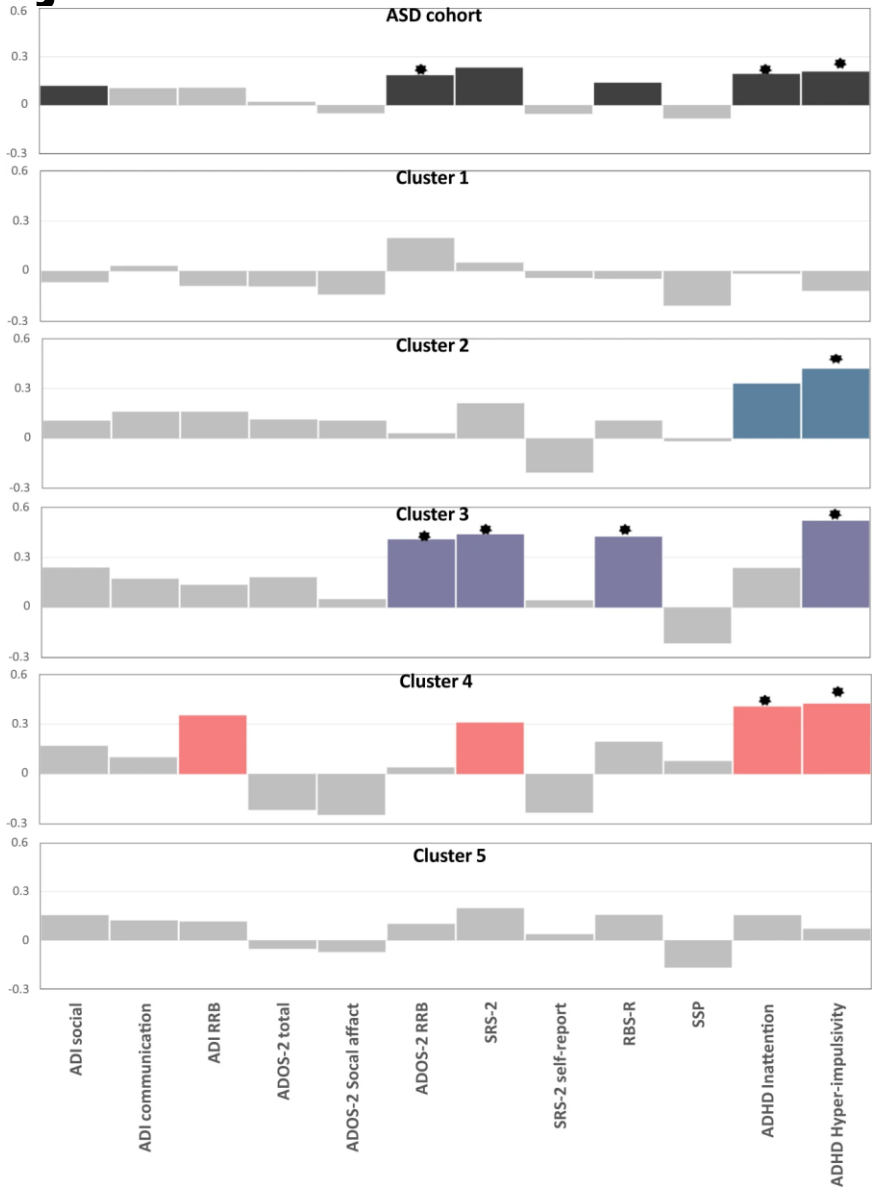

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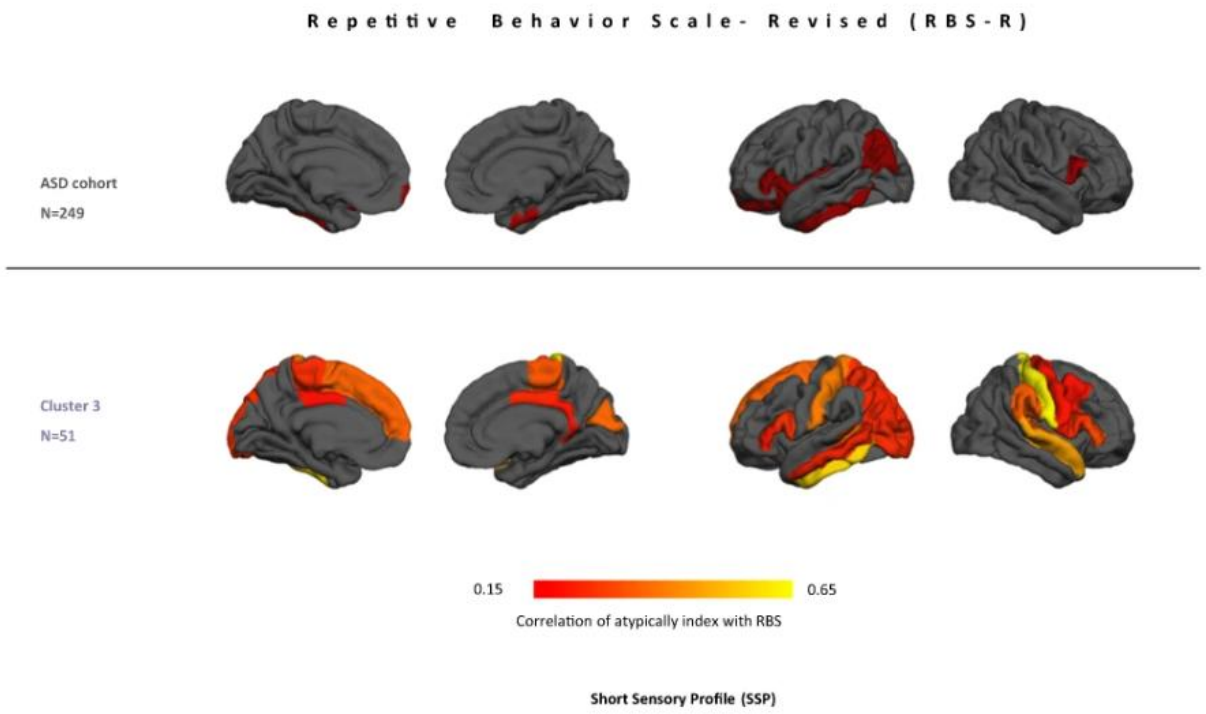

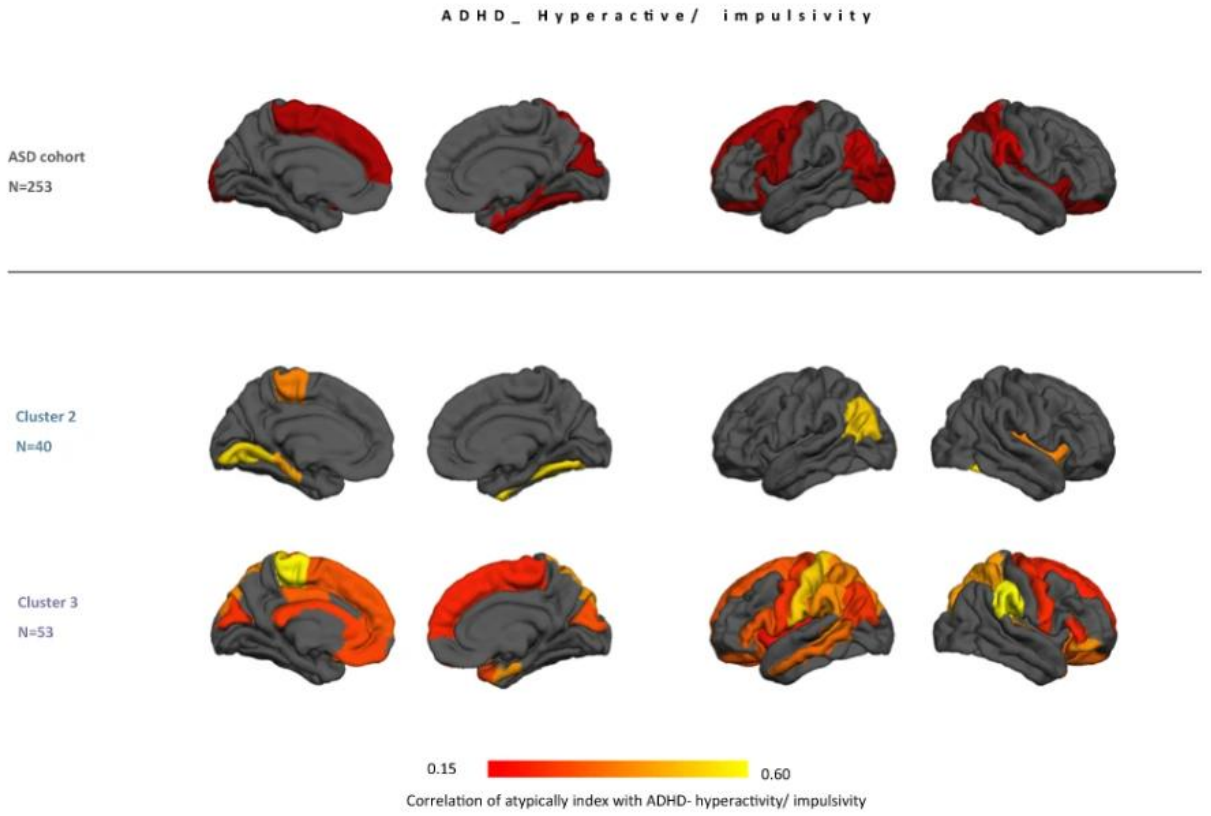

Topic 3:
Stratifying subjects with ASD based on their brain structure

Promises:

- More insight into heterogeneity between subjects
- Targeted interventions based on subject profile

Risks:

- Statistical spurious results

Conclusions:

- Many different applications for AI use in medical field
- More data, more data access, better AI methods
- Applications can have great benefits to science and health, but also risk
- Understanding of the AI methods necessary to mitigate risks

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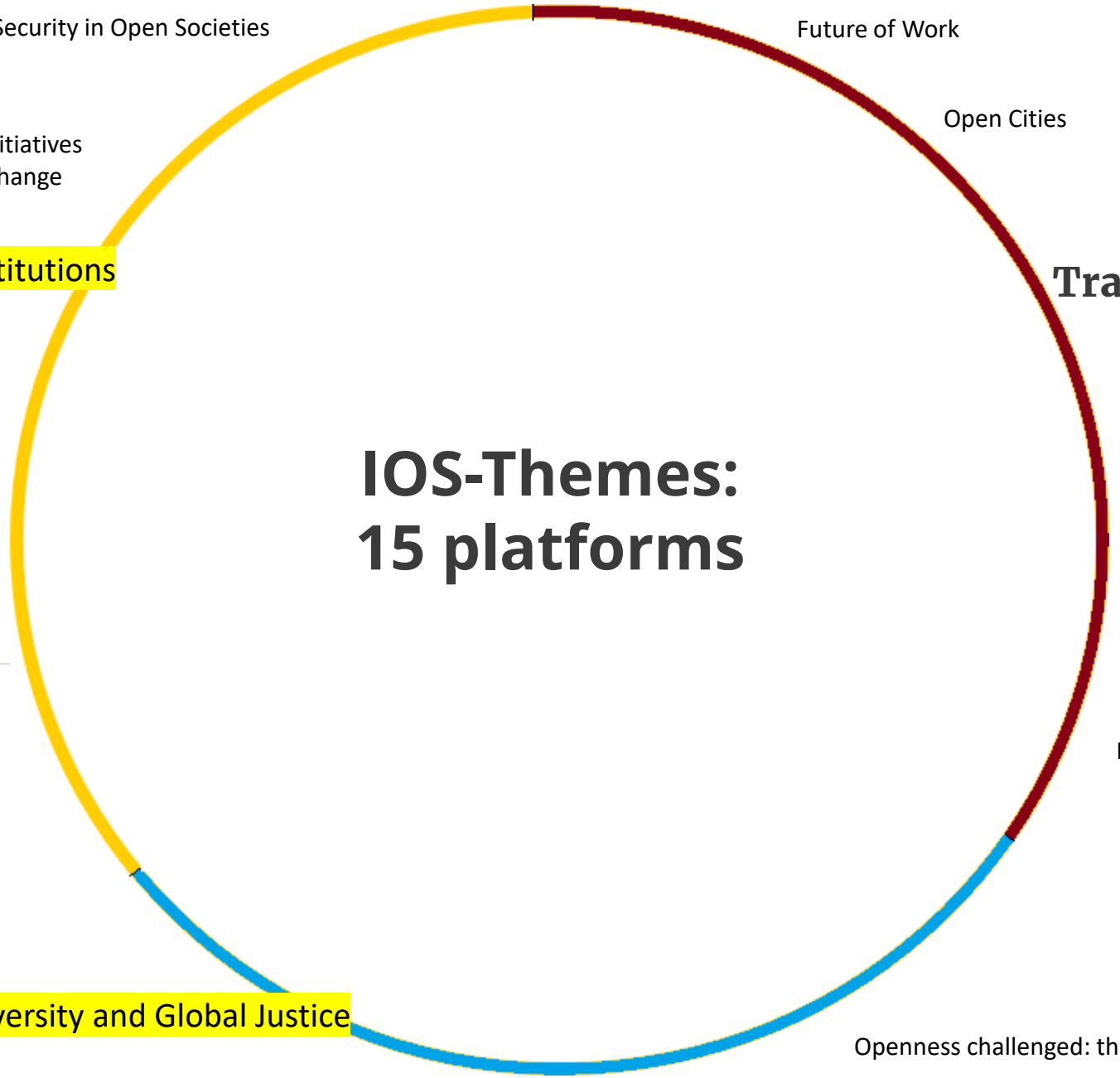

Security in Open Societies

Future of Work

Bottom-up Initiatives
for Societal Change

Open Cities

Behaviour and Institutions

Transitions and well-being

Democracy and
good governance

Fair Transitions

Contesting Governance

Longtermism and Institutional Change

Futures of Democracy

The Transactional State
as an Institution for Good

Markets and Corporations

Gender, Diversity and Global Justice

Openness challenged: the university at risk?

In/Equality

Equality and diversity