Industry-Academia Collaboration

Novartis-Oxford Big Data Institute

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Basel Biometrics Society Seminar, UniBas

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Foto: Dieter Häring

Multiple sclerosis (MS) research objectives

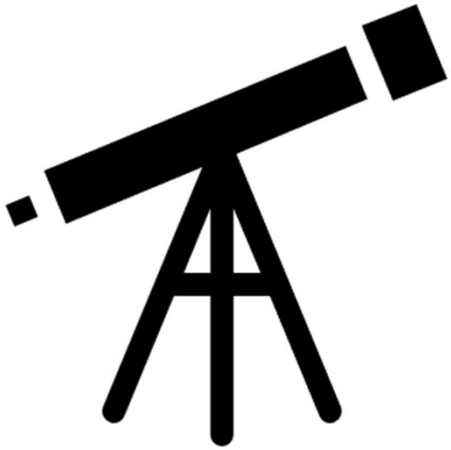
1. Disease characterization

Patient grouping according to disease biology

2. MS disease progression

Why are patients getting worse and how can we interfere?

3. Prognosis



Informing the patient-physician dialog

Novartis-Oxford Multiple sclerosis database (NO.MS)

Dahlke, F., Arnold, D. L., Aarden, P., Ganjgahi, H., Häring, D. A., Čuklina, J., ... & Wiendl, H. (2021). Characterisation of MS phenotypes across the age span using a novel data set integrating 34 clinical trials (NO. MS cohort). *Multiple Sclerosis Journal*, *27*(13), 2062-2076.

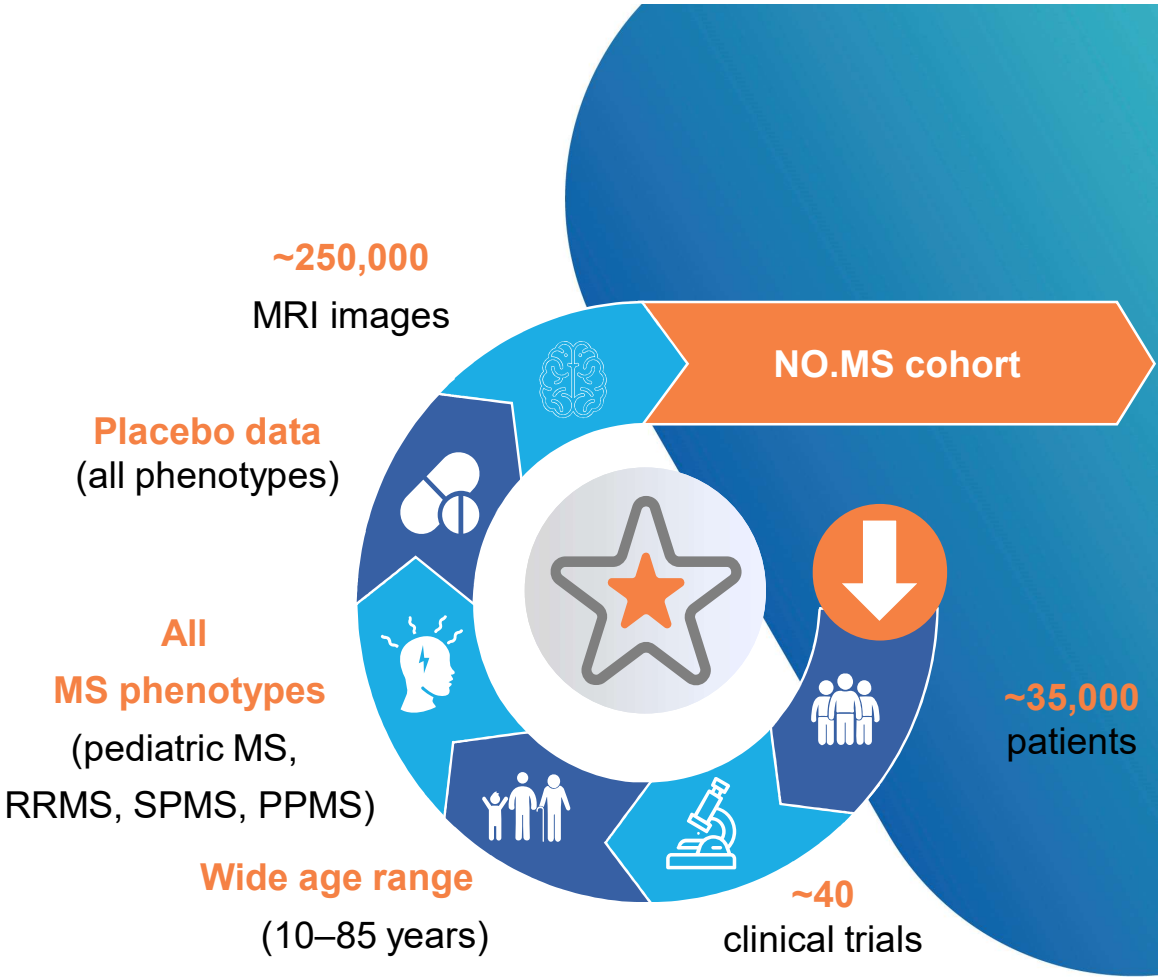


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Diagram refers to the status of NO-MS 2024

Risk based anonymisation of clinical data

A prerequisite for additional research

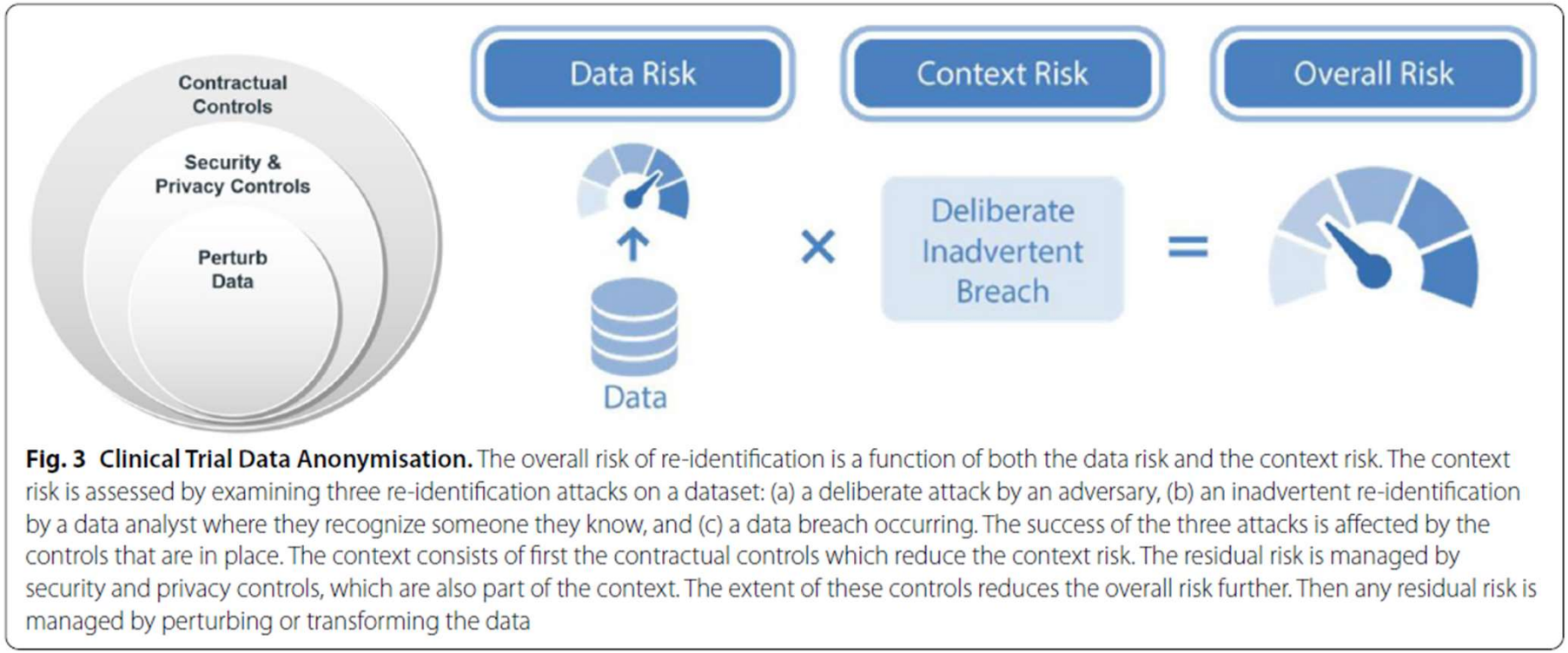
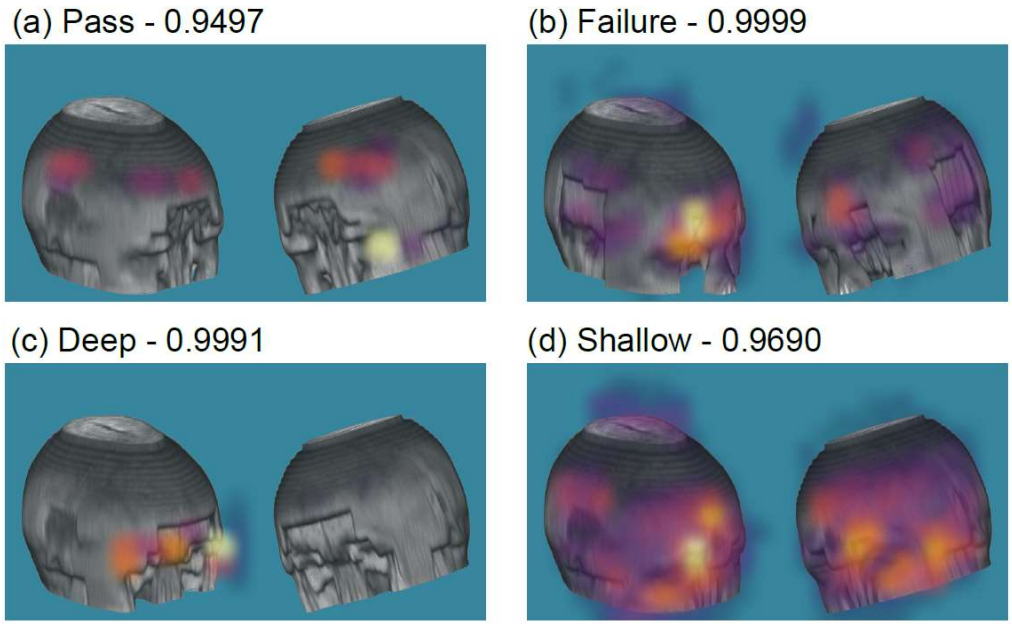


Fig. 3 Clinical Trial Data Anonymisation. The overall risk of re-identification is a function of both the data risk and the context risk. The context risk is assessed by examining three re-identification attacks on a dataset: (a) a deliberate attack by an adversary, (b) an inadvertent re-identification by a data analyst where they recognize someone they know, and (c) a data breach occurring. The success of the three attacks is affected by the controls that are in place. The context consists of first the contractual controls which reduce the context risk. The residual risk is managed by security and privacy controls, which are also part of the context. The extent of these controls reduces the overall risk further. Then any residual risk is managed by perturbing or transforming the data

Mallon, A. M., Häring, D. A., Dahlke, F., Aarden, P., Afyouni, S., Delbarre, D., ... & Holmes, C. (2021). Advancing data science in drug development through an innovative computational framework for data sharing and statistical analysis. *BMC Medical Research Methodology*, *21*, 1-11.

Neural network to supervise the anonymization and the defacing of MRI scans



Impact/Innovation

- *Defacing (removal of eyes, noses, lips and ears) and trimming of meta-data is implemented to protect patient privacy rights and enables Novartis to collaborate with external imaging experts on scientific questions using these defaced images.*
- *The developed CNN is able to QC the automatic defacing, checking for facial & brain features similar to how a human would do it, but much more efficiently.*
- *All images go through a final check by a human.*

Delbarre, D. J., Santos, L., Ganjgahi, H., Horner, N., McCoy, A., Westerberg, H., ... & Mallon, A. M. (2022). Application of a convolutional neural network to the quality control of MRI defacing. *Computers in Biology and Medicine*, *151*, 106211.

Harmonization of anonymized images

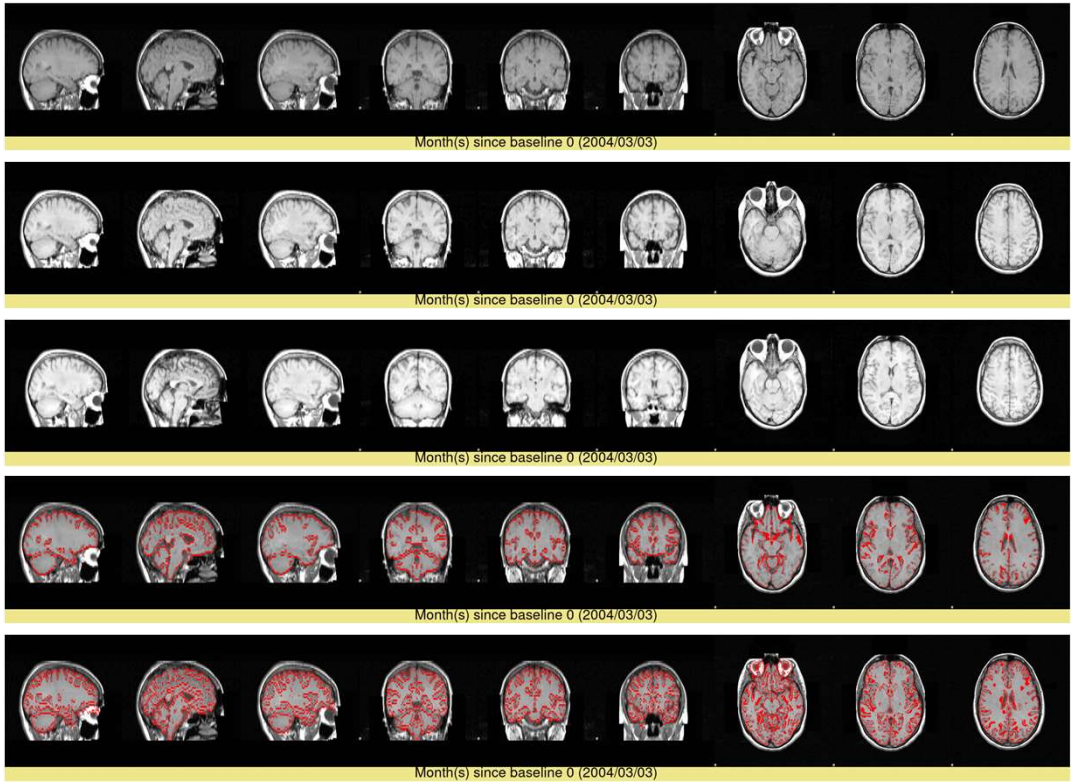
Raw scans

Motion & bias corrected

Contrast Enhanced Synthetic Template

Segmented Brain

Segmented Grey Matter



Conclusion - Innovation is a journey

Opportunities

- Understanding disease biology
- Methodological learnings
- Team effort with an academic partner

Challenges

- Respecting data privacy rights while preserving pattern
- Time & resource: ~90% of the overall effort is data anonymization and data wrangling

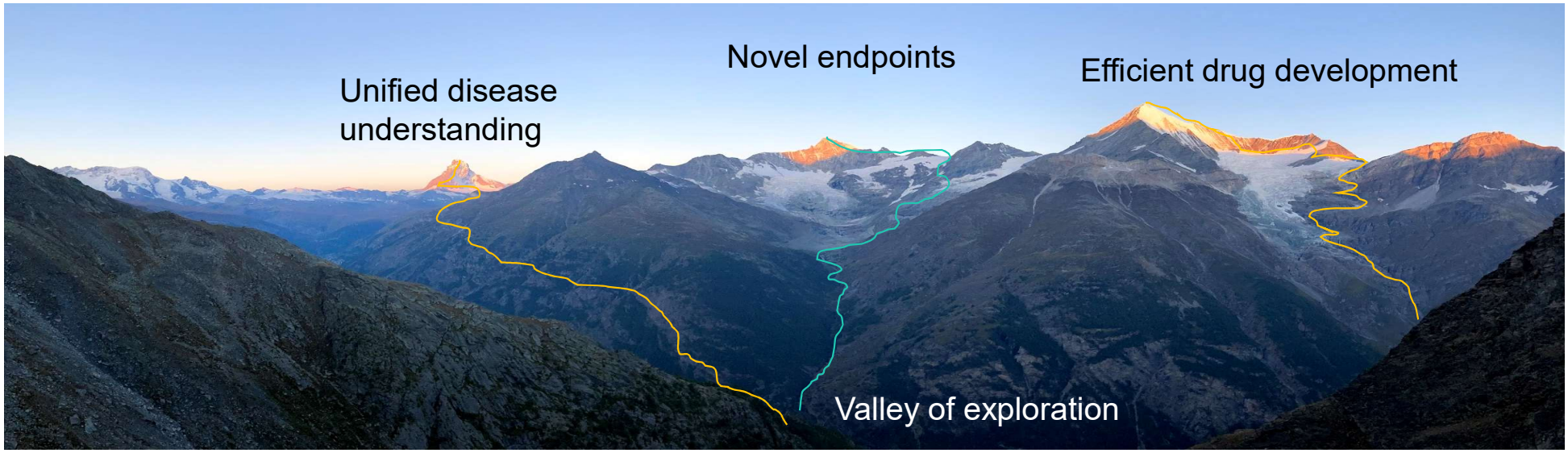


Foto: Dieter Häring

Thank you