Master Seminar: Machine Learning in Neuroimaging

Nuno Wolf, Bailiang Jian, Fabian Bongratz,

Yitong Li, Prof. Dr. Christian Wachinger

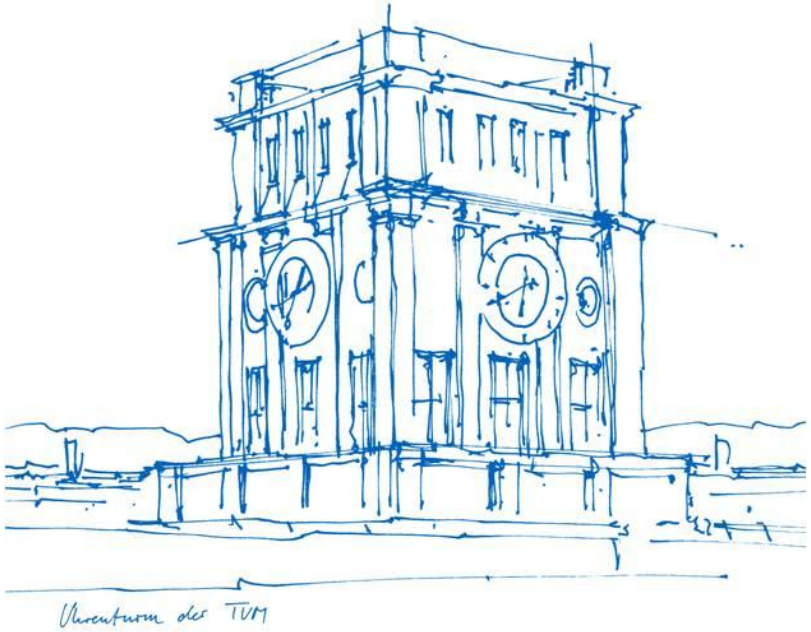
Lab for Artificial Intelligence in Medical Imaging

Department of Radiology

School of Med & Health, School of CIT

Technical University of Munich

www.AI-Med.de



06.02.2024, 1pm

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“It gave me so much without stress”

Student from this semester

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06.02.2024, 1pm

Lab for AI in Medical Imaging

Research topics:

- Segmentation
- Registration
- Neuroimaging
- Shape modeling
- Interpretability & Explainability
- Disease progression
- Causal inference
- Generative models
- ...

Prof. Dr. Christian Wachinger
Professor for AI in Radiology

www.ai-med.de

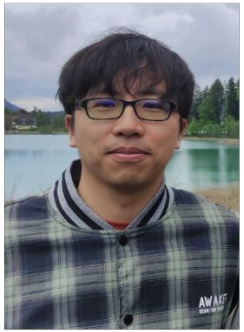
Lab For AI in Medical Imaging

@AI_medic

Morteza Ghahremani
Postdoc

Tom Nuno Wolf
PhD student

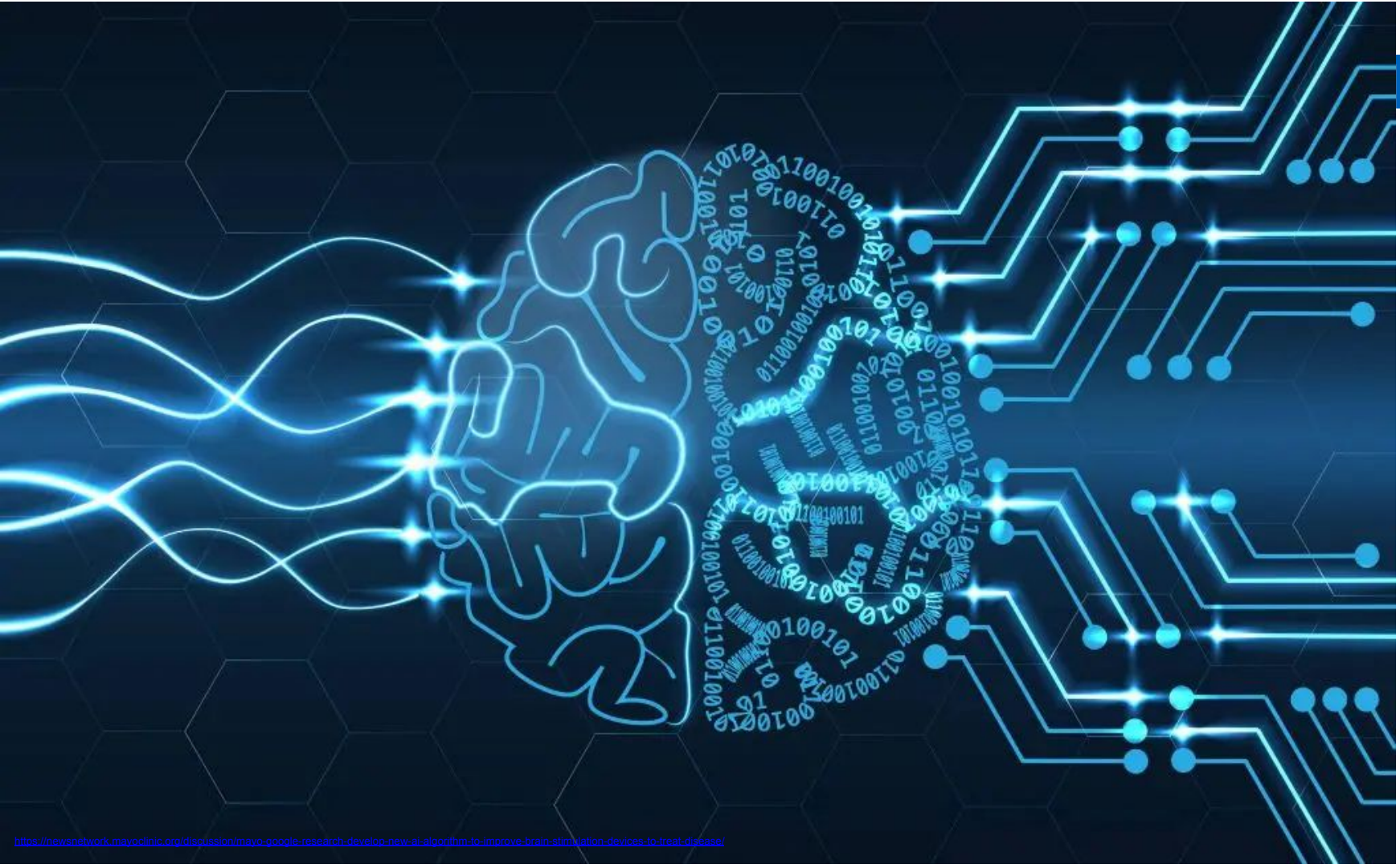
Yitong Li
PhD student



Bailiang Jian
PhD student

Anne-Marie Rickmann
PhD student

Fabian Bongratz
PhD student

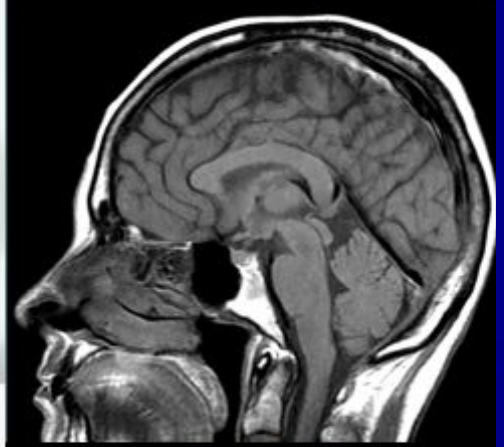


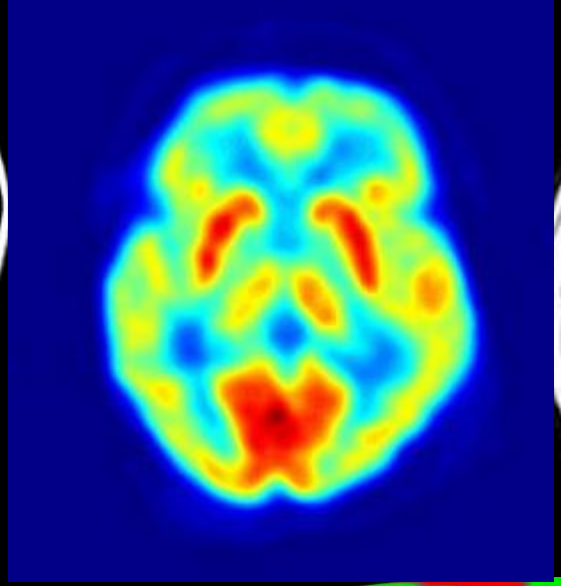
https://newsnetwork.mayoclinic.org/discussion/mayo-google-research-develop-new-ai-algorithm-to-improve-brain-stimulation-devices-to-treat-disease/

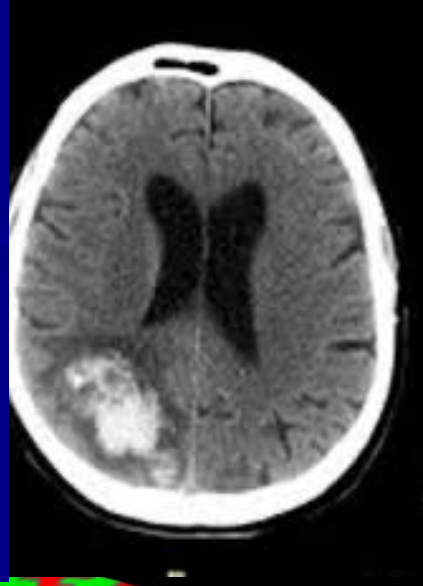

MRI

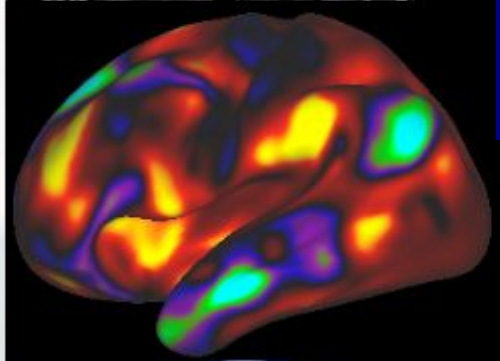

CT

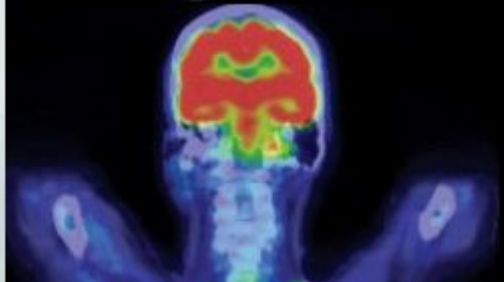

PET

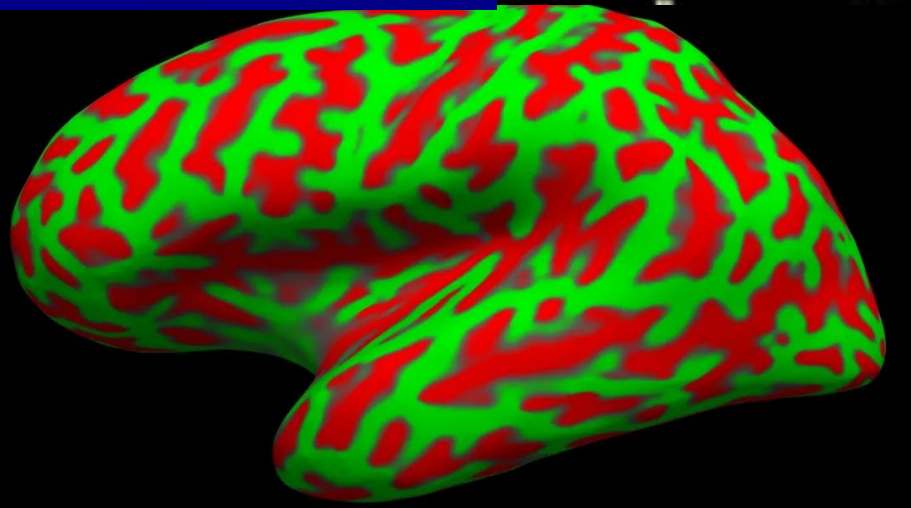


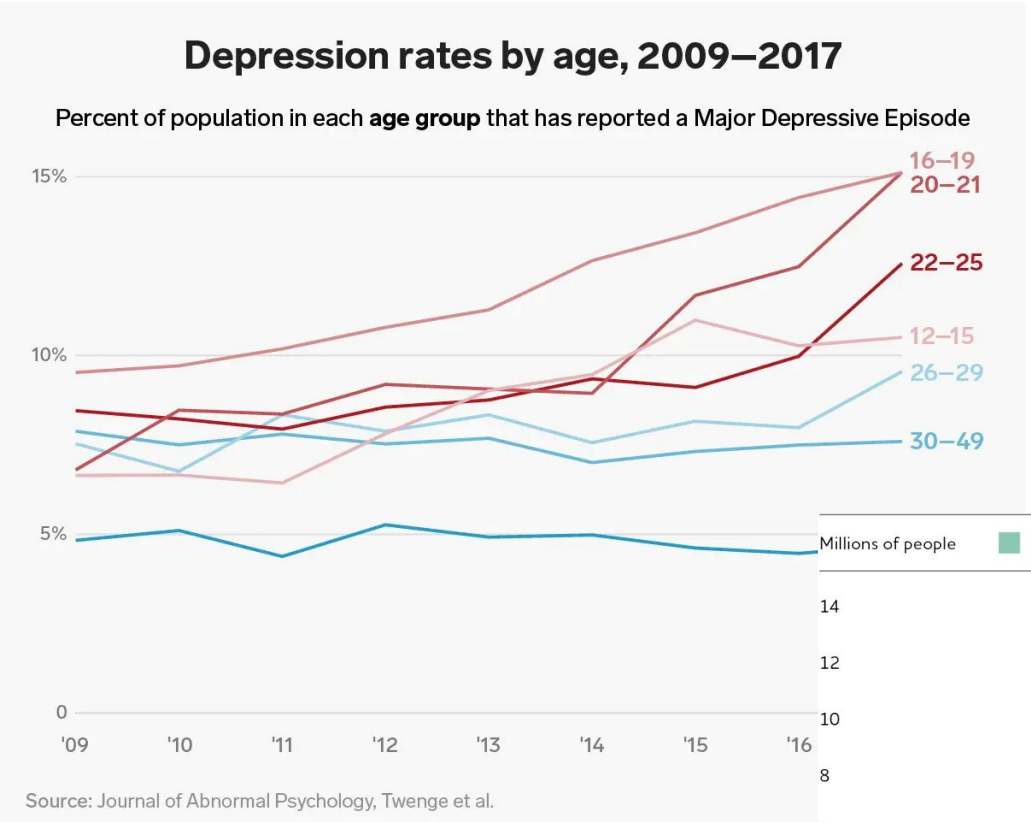




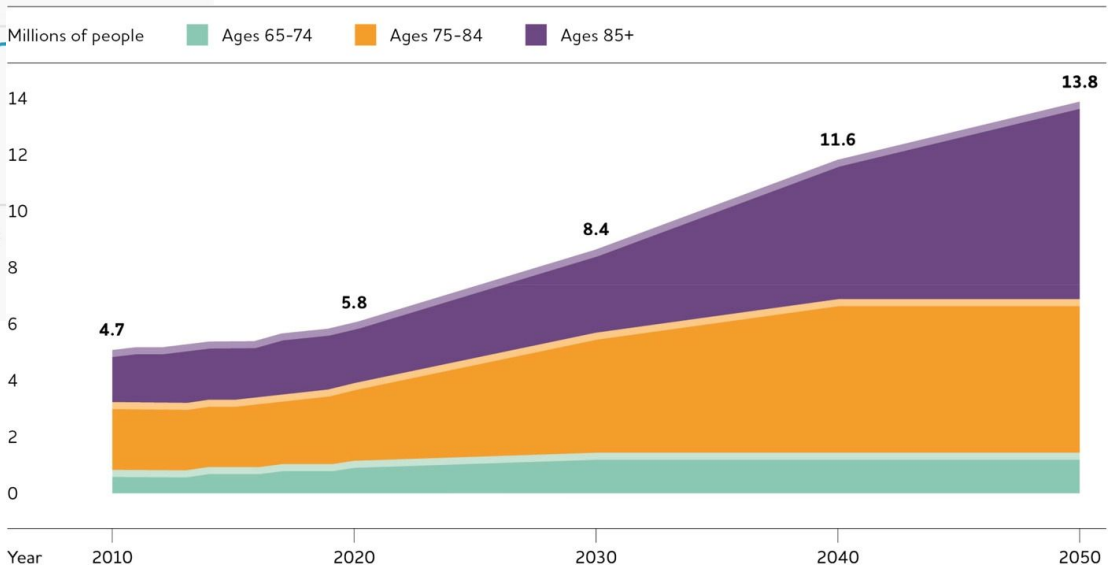


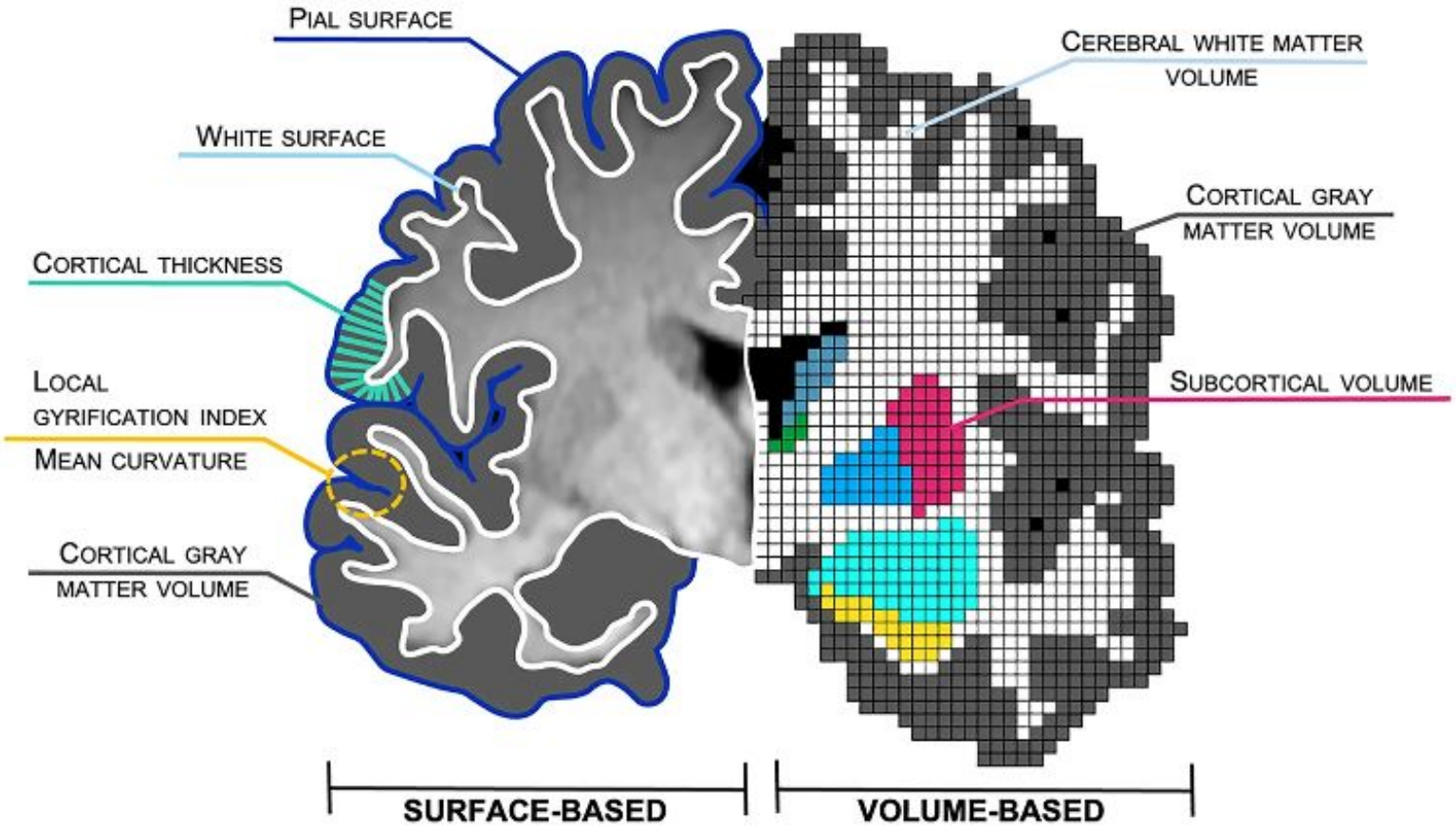






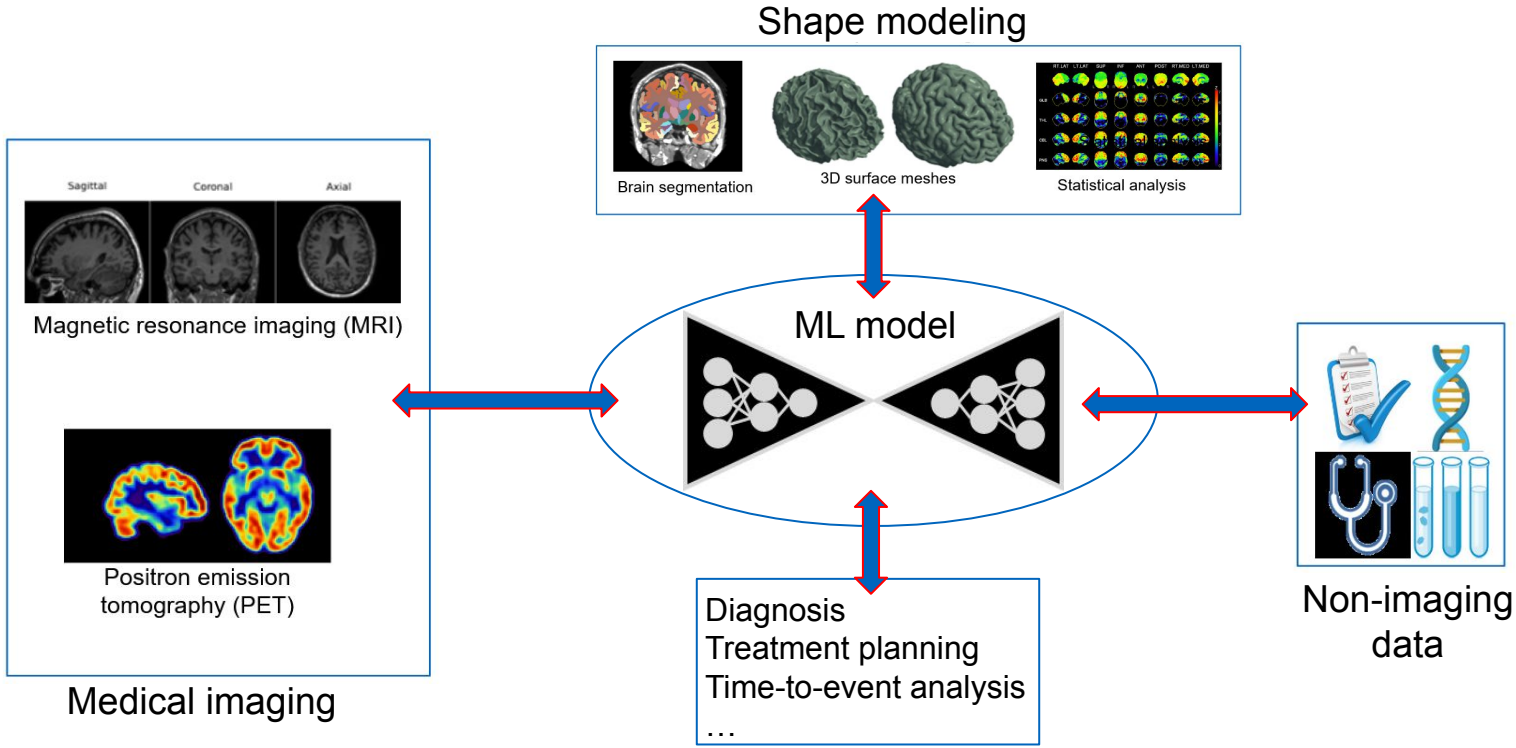
Alzheimer's disease





https://link.springer.com/article/10.1007/s11065-021-09496-2#Fig1

Machine Learning in Neuroimaging: Overview



Exemplary Topics

- Deep learning architectures (CNN, GNN, Transformer)
- Multi-modal data analysis
- Generative models
- Disease prediction (e.g. Alzheimer's)
- Supervised and unsupervised learning strategies (and in-between, e.g., semi-supervised)
- Shape analysis, geometric deep learning
- Explainable AI
- Causal inference

See also topics from previous semesters in the wiki (the wiki is the central platform)

Learning outcomes

- How to read a paper in a structured way?
- How to phrase complex ideas in an understandable blog post?
- How to present research findings to an audience?

What to deliver?

- Paper presentation (20 min. presentation, 10 min. discussion)

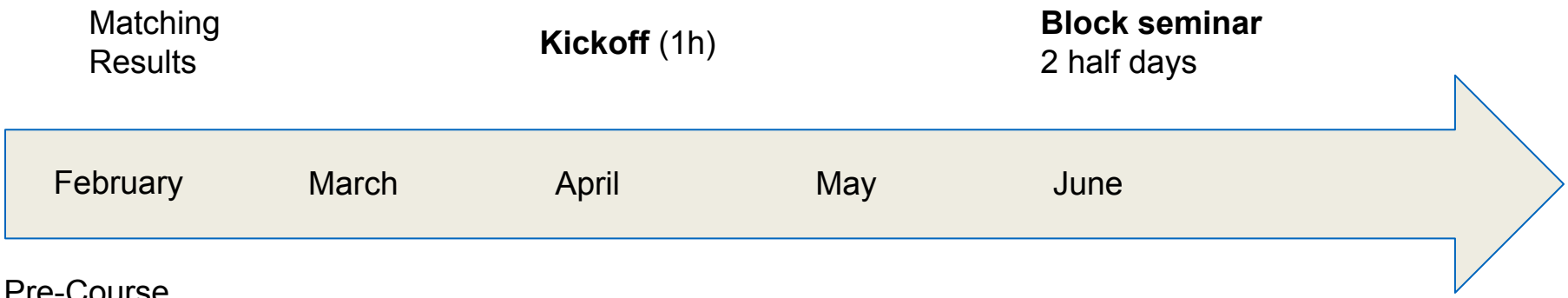
  70% of final grade
- Blog post (~4 pages DIN A4, working with ChatGPT encouraged) about the selected paper

  30% of final grade

Preliminaries (recommended)

- Machine learning principles (e.g. IN2357 Machine Learning for Computer Vision, IN2064 Machine Learning)
- Fundamentals of deep learning (e.g. IN2346 Introduction to Deep Learning)
- Medical image analysis (e.g. AI in medicine I/II, CAMP I/II)
- Computer vision (e.g. IN2228 Computer Vision II: Multiple View Geometry)

Timeline


Matching Results
Kickoff (1h)
Block seminar
2 half days
February
March
April
May
June
Pre-Course Meeting
Meet your supervisor

Schedule

06.02.24: Pre-course meeting (today)

23.02.24: Matching results

April 4, 2024, 23:59: Deadline for deregistration

April: Kickoff (seminar room Holbeinstr. 11, attendance mandatory), exact dates TBA

During the semester: Meet your supervisor (not mandatory but recommended)

June (2 days): Block seminar (seminar room Holbeinstr. 11, attendance on both days mandatory)

Contact

seminars@ai-med.de

Find these slides at https://wiki.tum.de/display/mlneuro (TUM Wiki)

Don’t forget to register in the matching system (matching.in.tum.de)!