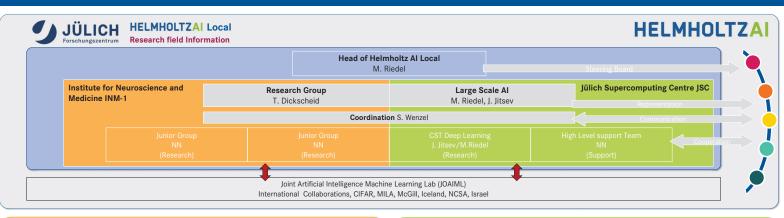
# **HELMHOLTZ AI AT FORSCHUNGSZENTRUM JÜLICH**

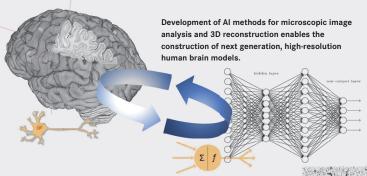
## IMPLEMENTATION OF AI METHODS ON HIGH PERFORMANCE COMPUTING SYSTEMS



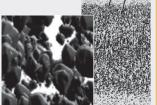
### **ORGANISATIONAL STRUCTURE**



### Research Group at Institute for Neuroscience and Medicine: Al methods for building ultrahigh resolution human brain models



Fertilizing brain-inspired Al research. As human brain models generate insight into layer structure, connectivity, and temporal dynamics, they can reduce the search space for novel architectures. The research group interacts with partners in brain-inspired AI to help finding architectures with faster learning performance and better generalizability.



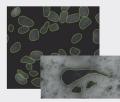
### Institute of Neuroscience & Medicine: Structural and functional organisation of the brain (INM-1)

INM-1 develops a 3D-model of the human brain which considers cytoarchitecture, connectivity, molecular structure as well as genetics and function, employing Al and Big Data methods on High Performance Computers for data analysis.



High-resolution 3D reconstruction from microscopic scans

Dickscheid, Amunts et al.: Towards 3d reconstruction of neuronal cell distributions from histological human brain sections. From Clouds and Big Data to Exascale and Beyond, 2019



Microstructural object detection using Deep Learning



Human brain mapping in histological scans using Deep Learning

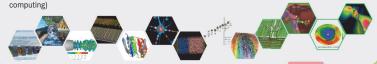
Spitzer, Amunts, Harmeling, Dickscheid, MIDL 2018

Spitzer, Kiwitz, Amunts, Harmeling, Dickscheid MICCAI 2018

### Jülich Supercomputing Centre: Large-Scale Continual Learning transferable across multiple domains and tasks

High Level Support Team (HLST) and Cross-Sectional Team Deep Learning (CST-DL)

- Large-scale, self-organizing continual learning for multi-task scenarios
- Simulation-learning closed-loops for physics-aware deep learning
- Enabling hyperspectral satellite image analysis via distributed deep learning to understand climate change
- Cooperation with scientific domains: earth sciences, nanoscale molecular manipulation, plasma physics, magnetospheric physics, turbulence dynamics, remote sensing.
- Explore innovative modular supercomputing approaches (e.g., with neuromorphic and quantum



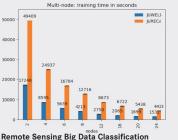
# Jülich Supercomputing Centre

Leveraging innovative modular supercomputing for distributed training of large heterogeneous AI models



IUWFLS - Iülich Wizard for Leadership Science Modular





with High Performance Distributed Deep Learning

R Sedona, G Cavallaro, J Jitsev, A Strube, M Riedel, et al Remote Sensing 11 (24), 3056



Approching Remote Sensing Image Classification with Ensembles of Support Vector Machines on the D-Wave Quantum Annealer; G. Cavallaro, D. Willsch, M. Willsch, K. Michielsen and M. Riedel, IEEE International Geoscience and Remote Sensing Symposium, 2020 (submitted)

### Deep Networks for Hyperspectral Image **Analysis** Haut, M. & Cavallaro, C. & Riedel, M., IEEE Transactions

the D-Wave

nce & Remote

### THE TEAM @FZJ



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# **OUR PARTNER**

Human Brain Project







**EBRAINS** 



Heinrich Heine Universität











