Helmholtz Joint Lab SMHB Supercomputing and Modeling for the Human Brain

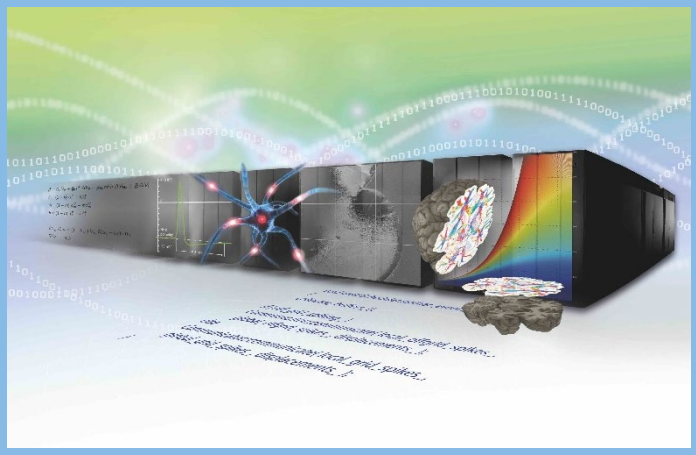
JARA Jülich Aachen Research Alliance

Member of the Bernstein Network Computational Neuroscience

JÜLICH Forschungszentrum | JÜLICH SUPERCOMPUTING CENTRE

SIMULATION AND DATA LABORATORY NEUROSCIENCE

BRIDGING NEUROSCIENCE AND HPC

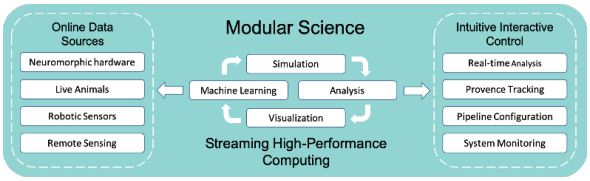


The Simulation & Data Lab Neuroscience is an inter-disciplinary team of scientists and engineers which:

- Serves the neuroscience community by providing high-level, community-oriented support to use HPC and data resources
- Carries out in-house research and development of data analytics and simulation technologies
- Ports and optimizes user codes for supercomputers
- Supports the preparation of computing time proposals and applications for test and preparatory access
- Offers tutorials, courses and workshops

Simulation Engineering & Science

- Arbor: multi-compartment models of neural networks
- NEST: spiking point-neuron simulator (tools and support)
- The Virtual Brain for HPC: neural mass models
- Learning to Learn: machine learning and parameter optimization tool for neuroscience simulations on HPC and bio-inspired AI
- Neuromorphic Computing: development of novel computing architectures for accelerated simulations of natural density neural networks
- Modular Science: co-simulator framework

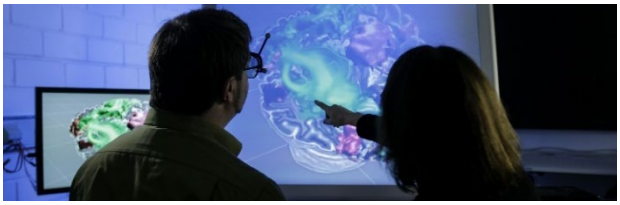


Supporting Software

- Data and workflow management support
- Software refactoring
- Software installation and maintenance on HPC systems
- Porting and support for evolving HPC architectures, Graphics Processing Units (GPUs) and accelerators

Visualization & Analysis

- Visual connectivity generation, analysis and visualization
- Optimization of analysis tools for HPC
- Interactive steering and visualization of simulations
- Helmholtz Analytics Toolkit (HEAT): Open-source software for high performance data analytics and machine learning



Neuroimaging Pipeline

- High-performance image processing on supercomputers
- Optimization of neuroimaging pipelines for HPC
- Machine learning and image analysis, e.g., PLI image segmentation

Infrastructure Design & Development

- Coordination of the EBRAINS National Node Germany
- Requirements and architecture specification, validation, development, and user support for EBRAINS, eBRAIN-Health, and Virtual Brain Twin

EBRAINS

eBRAIN-Health

VIRTUAL BRAIN TWIN

External Collaboration Partners

AMU (FR), Athena RIC (GR), BSC (ES), BU Wuppertal (D), CEA (FR), Charité (D), Cineca (IT), CNR (IT), CNRS (FR), DLR (D), EBRAINS (BE), EPFL (CH), ETHZ/CSCS (CH), FH Bielefeld (D), FT (DK), FU Hagen (D), Indoc (CA), KTH (SE), NMBU (NO), OUS (NO), RWTH Aachen (D), TU Darmstadt (D), TU Graz (AT), TU München (D), UC San Diego (US), U Heidelberg (D), U Manchester (UK), UNIPV (IT), U Oslo (NO), UPM (ES), URJC (ES), U Trier (D)

Contact: slns@fz-juelich.de | Website: www.fz-juelich.de/ias/jsc/slns