HBP SCIENCE MARKET

HIGH PERFORMANCE ANALYTICS & COMPUTING PLATFORM

SP7

What we do

One of today's science challenges is to understand how our brains work. Usually new endeavours require new tools and technologies to get to the next level. Neuroscientists in the Human Brain Project (HBP) collect a lot of data, develop models based on this data that try to explain how mechanisms in the brain work, and finally they simulate these models. In these simulations, neural networks (parts of the neurons and their connections in the brain) are built in the computer, get some input stimulation (like the actual brain gets input from our senses) and then these "digital" neurons and neural networks react to it. The scientists analyse the simulation results and compare them to experimental data to improve their models. We support neuroscientists to do this research by developing the tools and technology that they need for it. We make huge storage available at four places in Europe to store the data. The storage at one site alone would be enough to store 3–4 billion books or for 250–300 years of high definition movies. At the same places, there are also supercomputers, which are among the most powerful computers worldwide. The human brain is so complex that a normal computer in the scientist's office is not enough to simulate even a fraction of the human brain. One of the supercomputers is as powerful as about 350,000 standard computers. Our job in the HBP is not only to make this hardware available to the scientists, but also to develop software that supports neuroscientists in their endeavour, e.g. to manage their huge datasets, to simulate models most efficiently on the supercomputers (getting better results as fast as possible) or to look at "visualisations" of the datasets. A visualisation turns the columns of numbers produced by a simulation into a graphical representation like pictures or even 3D objects.

How we are organised

WP7.1 SIMULATION TECHNOLOGY. Here, we develop the concepts, numerical algorithms, and software technologies for the implementation of new features of the simulation codes of the HBP and focus on the extension of the functionality of the simulation engines.
WP7.2 DATA-INTENSIVE SUPERCOMPUTING. This WP aims to link extreme scale data processing challenges to the exploitation of scalable computer resources. The work is driven by specific use cases coming from different areas of the HBP to ensure that R&D work is guided towards enabling infrastructure for future neuroscience research.
WP7.3 INTERACTIVE VISUALISATION. We aim to develop a software infrastructure for timely user-centric visual data analysis for the HBP using new and existing visualization tools.
WP7.4 DYNAMIC RESOURCE MANAGEMENT. This WP seeks to combine different tools and techniques to achieve a novel approach to dynamic resource management in high-performance computing facilities, therefore having a direct impact on how neuroscience applications are executed.
WP7.5 HIGH-PERFORMANCE ANALYTICS AND COMPUTING PLATFORM. We are responsible for HBP high-end computer and data analytics Platform services, from HBP internal and external sources, as the HBP Research Infrastructure becomes operational.
WP7.6 MANAGEMENT AND COORDINATION. This WP manages the High Performance Analytics and Computing Platform. It coordinates and validates the technology and infrastructure development in the Subproject, ensuring that the work is aligned with the overall HBP objectives, meets actual user needs and is efficiently organized and documented.

SP LEADER Thomas LIPPERT
DEPUTY SP LEADER Thomas SCHULTHESS
WORK PACKAGE LEADERS

- WP7.1 Simulation technology: Markus DIESMANN and Hans Ekkehard PLESSER
- WP7.2 Data-intensive supercomputing: Dirk PLEITER
- WP7.3 Interactive visualisation: Torsten KUHLEN, BENJAMIN WEYERS
- WP7.4 Dynamic resource management: Raül SIRVENT, Julita CORBALÁN
- WP7.5 High Performance Analytics & Computing Platform: Thomas SCHULTHESS, Colin MCMURTRIE
- WP7.6 Management and coordination: Thomas LIPPERT, Boris ORTH

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Publication highlights

Amunts K, Ebell C, Muller J, Telefont M, Knoll A, Lippert L. *The Human Brain Project: Creating a European Research Infrastructure to Decode the Human Brain.* Neuron 2016;92:574-581. DOI: 10.1016/j.neuron.2016.10.046.

Hahne J, Helias M, Kunkel S, Igarashi J, Kitayama I, Wylie B *et al.* *Including Gap Junctions into Distributed Neuronal Network Simulations.* Brain-Inspired Computing pp. 43-57. Cham: Springer International Publishing/ Amunts, Katrin (Editor) ; Cham : Springer International Publishing, 2016.

Hänel C, Khatami M, Kuhlen TW, Weyers B. *Towards Multi-user Provenance Tracking of Visual Analysis Workflows over Multiple Applications.* Proceedings of EuroVis Workshop on Reproducibility, Verification, and Validation in Visualization (EuroRV3), Barcelona, 2016.

Rinke S, Naveau M, Wolf F, Butz-Ostendorf M. *Critical periods emerge from homeostatic structural plasticity in a full-scale model of the developing cortical column*. The Rewiring Brain - A Computational Approach to Structural Plasticity in the Adult Brain. Academic Press, New York, 2017.

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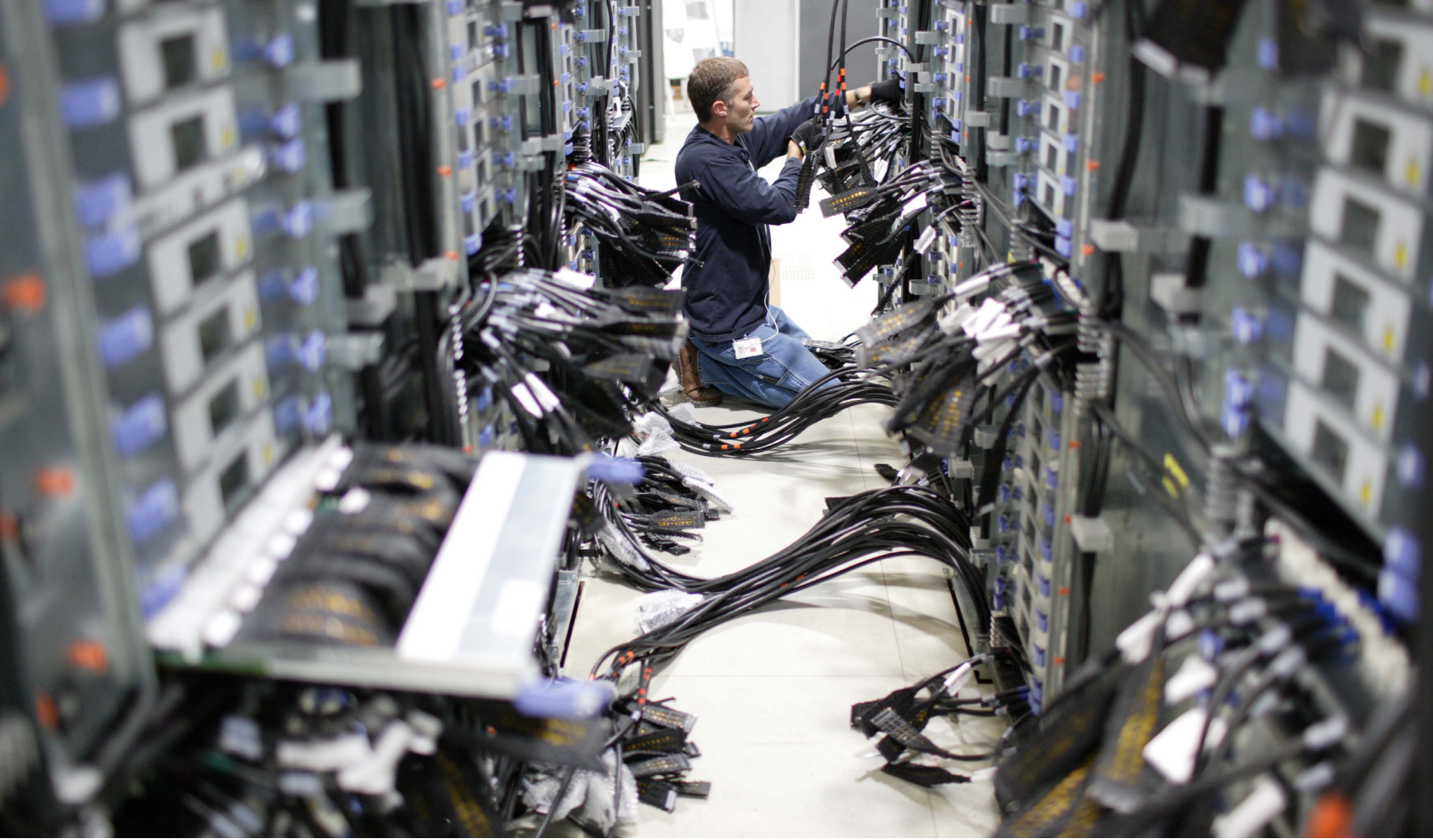
https://www.humanbrainproject.eu/en/about/project-structure/subprojects/



Human Brain Project

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