

Tools for Neurophysiology Data Management and Analysis at the German Neuroinformatics Node

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www.g-node.org

The German National Node of the International Neuroinformatics Coordinating Facility (INCF), G-Node, has been established to facilitate interaction and collaboration between experimental and theoretical neuroscientists, both nationally and internationally, with a focus on cellular and systems neuroscience. G-Node is funded by the German Federal Ministry for Education and Research (BMBF) and is an integral part of the Bernstein Network. G-Node collaborates with individual researchers within and outside the Bernstein Network, as well as with INCF and other neuroinformatics initiatives. The goal is to establish an infrastructure for the sharing of data and analysis tools, improving key ingredients of neuroscientific research: *data access*, *data storage and exchange*, and *data analysis*, together with supporting activities for *teaching and training*.

I Data access

Problem:

There is a plethora of recording devices, proprietary data formats, and custom made local solutions, while attempts for standardization are rare.

Solution strategies and benefits:

- develop unified formats and standards for data access together with participating labs, INCF, and other initiatives, e.g. signalml.org
- develop electronic lab book template
- develop metadata tools and standards
- all tools will be open source and freely available

Example development:

Format for metadata exchange (www.g-node.org/odml)

- flexible, extensible
- enables specification of any metadata
- useful for collection of metadata in the laboratory and automated processing of metadata

In collaboration with The *LabLog* and *Relacs* Projects
(J. Grewe, J. Benda, LMU Munich)



III Data analysis

Problem:

Advanced data analysis methods are often not readily available for use by experimentalists. New methods are often not tested in depth on real data.

Solution strategies and benefits:

- development of open source tools and implementation of algorithms with standardized interfaces and professional documentation
- G-node aims at close collaborations with existing open source projects and development platforms

Example development:

Methods for automated processing and analysis of experimental data, using a relational database management system (PostgreSQL) and Python as high-level programming language for simulation and analysis (PL/Python), which enables use of open-source analysis tools for neurophysiological data, e.g. *NeuroTools* (neuroensemble.org)

Example application: See posters on combination of analysis of morphological data with single cell response simulation using pyNEURON.

II Data basing and data exchange

Problem:

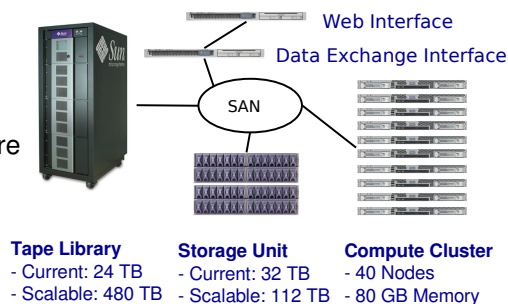
- “aged data“ become unavailable for further analysis
- data are generally not secured against hardware failures
- collaborations typically work on multiple local copies of the data
- public data access requires modern data base techniques

Solution strategies and benefits:

- central and secure storage facility
- searchable data base
- integration with in-lab client software data mining services

→ ideal for data exchange

- within scientific collaborations
- system supports public access data base solutions



Example development:

Data Management Platform

Scientists can upload and manage data at central storage infrastructure

- Secure storage of data for long-term accessibility
- Organize and hierarchically group data in datasets, experiments, projects
- Share data with specific collaborators or make data publicly available

IV Teaching and training

Problem:

- students in the neurosciences often lack specialized education in advanced data analysis, computer science and neuroinformatics

Solution strategies and benefits:

- G-Node offers courses in the areas I-III (incl. units on „good practice“)
- G-Node offers lecture notes and course modules at its portal site
- G-Node offers incentives for students & postdocs to submit raw and processed data, analysis tools, and computational models for open use

G-Node Courses:

- *Neural Data Analysis* (01/2009, 03/2010)
- *Visualization and Segmentation Methods in Neuroscience* (03/2009)
- Joint Swiss/German/UK Nodes *Image Processing School* (09/2009)
- *Advanced Scientific Computing in Python* (09/2009, 01/2010 in collab. with Univ Warsaw, 10/2010 in collab. with Univ Trento)

Literature:

[1] Herz et al. (2008) *G-Node: An integrated tool-sharing platform to support cellular and systems neurophysiology in the age of global neuroinformatics*. *Neural Networks* 21:1070-1075. doi.org/10.1016/j.neunet.2008.05.011

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