



Neuroinformatics combines neuroscience and informatics research to develop and apply the advanced tools and approaches that are essential for major advances in understanding the structure and function of the brain.

INCF @ FENS FORUM 2008, Geneva, Switzerland

Live demonstrations at booth no.328

Sunday, July 13

- 10:00 - 13:00 3-D Atlas Tool for Mouse and Rat Brain | Darine D., Hjernevik T. and Bjaalie J.G.
 14:00 - 17:00 Finding Information in Neural Data (FIND) - An Open Source Data Analysis Framework for Neural Data | Kiliass A., Garbers C. and Meier R.

Monday, July 14

- 10:00 - 13:00 Stochastic Generation and Analysis of large-scale Neuronal Networks with Realistic Morphology Using Netmorph | Koene R. A., Van Pelt J. and Van Ooyen A.
 14:00 - 17:00 MyFirstNeuron | Neftci E. and Indiveri G.

Tuesday, July 15

- 10:00 - 13:00 CARMEN: Code Analysis, Repository and Modelling for e-Neuroscience | Knowles A. and Ingram C.
 14:00 - 17:00 Thread Parallel Simulations with NEURON | Hines M.

Wednesday, July 16

- 10:00 - 13:00 The INCF Software Center | Ritz R., Hellgren Kotaleski J., Strandberg P., Larsson A., Lillberg Y., Chatzopoulou E., Holm P., Naeslund M., Wang H. and Bjaalie J. G.

INCF Special Interest Social Event:

Tuesday July 15, 18:30 – 20:30
Palexpo conference center, room Cervin.

A get-together for neuroinformaticians and anyone who would like to have a drink with us!

Featuring:

- Neuroinformatics Talk Show

Why should neuroscientists want to take advantage of neuroinformatics?

Invited participants: Alain Berthoz, Michael Hines, Colin Ingram, Wolf Singer

Chair: Rodney Douglas

- Two robotic guests

The Amphibot and Salamandra Robotica

Alessandro Crespi and Auke Jan Ijspeert



Join us for mingling and informal discussions!

3-D atlas tool for mouse and rat brain

Dmitri Darine, Trine Hjørnevik, and Jan G. Bjaalie
NeSys, CMBN and Institute of Basic Medical Sciences, University of Oslo, Oslo, Norway

Atlases are used widely at many levels of investigation in neurosciences. Several atlases of 2-D diagrams through the mouse and rat brain are currently available but only a few 3-D atlas resources have been produced. We present a framework for reconstructing published atlases in 3-D, allowing full 3-D visualization of selected structures, slicing at any angle of orientation selected by the user, as well as import of various data formats into the atlas framework. The reconstructed atlases can be viewed and manipulated using a Java3d based tool, made available via the INCF Software Center.

Finding Information in Neural Data (FIND) - An Open Source Data Analysis Framework for Neural Data

Antje Kilius, Christian Garbers and Ralph Meier
Bernstein Center for Computational Neuroscience Freiburg, Germany

The complexity of neurophysiology data has increased tremendously over the last years, especially due to the widespread availability of multi-channel recording techniques. With adequate and increasing computing power the current limitation for computational neuroscience is the effort and time it takes for scientists to translate their ideas into working code.

Advanced analysis methods are complex and often lack reproducibility on the basis of published descriptions. To overcome this limitation we develop FIND (<http://find.bccn.uni-freiburg.de>) as a platform-independent, open source framework for the analysis of neuronal activity data based on MATLAB (Mathworks). We will outline the structure of the FIND framework and describe its functionality, our measures of quality control, and the policies for developers and users.

Within FIND we have developed a unified data import from various proprietary formats, simplifying standardized interfacing with tools for analysis and simulation. FIND covers a wide range of a steadily increasing number of tools. Analysis methods available address various types of neural activity data, including discrete series of spike events, continuous time series and imaging data. Additionally, FIND provides solutions for the simulation of parallel stochastic point processes to model multi-channel spiking activity. We illustrate an example of complex analyses within FIND: We present a time-resolved characterization of the spiking irregularity in an in vivo extracellular recording from a mushroom-body extrinsic neuron in the honeybee during odor stimulation.

Stochastic Generation and Analysis of large-scale Neuronal Networks with Realistic Morphology Using Netmorph

Koene R. A., Van Pelt J. and Van Ooyen A.
Dept. Exp. Neurophysiol., CNCR, VU Univ., Amsterdam, Netherlands

We present the novel simulation framework: NETMORPH. This framework is used to develop 3D large-scale neuronal networks with realistic neuron morphologies. Previous approaches to network generation either do not consider the detailed morphology of single neurons, or, if they do, do not take into account the developmental aspects of morphogenesis and synapse formation. NETMORPH simulates neuronal morphogenesis from the perspective of individual growth cones at axons and dendrites. Each growth cone can cause elongation, branching and turning of a neurite, processes that are described in a stochastic, phenomenological manner. We generate the realistic axon and dendrite morphology of model neurons, including specific curvature between branch points. The development of network connectivity is simulated by establishing synaptic connections during the outgrowth of many neurons. Initial models determine synapse formation on the basis of proximity between axons and dendrites. Analyses focus on the characteristics of emerging network connectivity and on the consequences to the networks when synaptic connections are deleted, as may occur in diseases such as Alzheimer's. NETMORPH also enables us to simulate activity dynamics in the generated networks and the reciprocal interaction between network activity and connectivity. NETMORPH is a flexible and highly modular tool that can be applied to a wide variety of research questions regarding morphology and connectivity, such as the complex relationship between neuronal morphology and global patterns of synaptic connectivity.

Supported by NWO grant CLS2003 (635.100.105) and E. U. grant MRTN-CT-2005-019247 (NEURoVERS-it).

My First Neuron

Emre Neftci and Giacomo Indiveri
Institute of Neuroinformatics, ETH Zurich, Switzerland

My First Neuron is a toy "neural" system designed for teaching and play. The goal is to teach kids something about neural processing, and possibly make them think that neurons are "cool". Available system components are:

- Neuron (blue) - with 6 individually addressable synapses

- Hair cell (red) - provides spikes to other cells
- Muscle pillow (yellow) - twitches when it receives a spike
- Axon readout lamp (black) - gives visual indication of spiking activity

My First Neuron features an audible piezo buzzer for indicating spiking activity and an LED bar graph for showing the internal membrane potential. The neuron is fully programmable, and multiple neuron models can be stored simultaneously (selectable using a switch). Excitatory and inhibitory synapses are supported, with learning models if desired. Cell parameters can be adjusted at runtime via a set of dials. All components except the axon readout lamp are covered with soft rubber for easy handling.

CARMEN: Code Analysis, Repository and Modelling for e-Neuroscience

Alastair Knowles and Colin Ingram

The sharing, preservation and optimal use/reuse of scientific data is imperative to our efforts to understand the brain. Prior to the commoditization of networked computing, peer reviewed articles provided the optimal dissemination media. Now, escalating data rates and rapidly increasing capacity to archive and transport data shift our focus towards the publication of experimental datasets and analysis resources, in some cases prior to peer review. This poses challenges for neuroscience, both infrastructural and cultural. CARMEN - Code, Analysis, Repository and Modelling for e-Neuroscience - is a consortium of 11 UK universities and commercial and international partners, engaged in the development of a virtual laboratory for neurophysiology. The virtual laboratory is a web based infrastructure comprising federated server nodes supporting data storage, sharing and remote analysis, exposed to neuroscience users by way of an internet portal. Newly defined metadata structures provide indices for searching and curation. The platform facilitates cultural change through provision of security infrastructure, allowing resource owners to delegate access to collaborators in a controlled way. CARMEN commenced in October 2006 and combines computer science research with experimental and computational neuroscience. The programme has recently undergone periods of user requirements gathering and system design, and is now moving into implementation of a production system. This presentation reviews the state of the implementation and reports on the development of novel resources such as minimum information standards for annotation of neurophysiology experiments, and translation mechanisms for time and image series data formats. Cultural perceptions relating to the CARMEN concept are discussed. Finally, a review of prospective business models for long term curation of CARMEN data and software resources is provided.

Thread Parallel Simulations with NEURON

Michael Hines

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The NEURON simulation environment can use threads on multicore desktop systems to speed up simulation run times. In contrast to the use of MPI with NEURON, the familiar GUI is available and no change is required to the model specification either for network or single cell models. For thread performance to approach that of shared memory communication under MPI, it was necessary to avoid false cache line sharing and minimize data transfer between threads. The former is accomplished by re-allocating all memory containing thread specific data. Re-allocation also allows an internal data ordering which gives greater cache efficiency. Minimization of data transfer, ironically is best served using algorithms almost identical to those used for the MPI multipleprocess case, i.e. multisplit for parallel distributed single neurons, and, for inter-thread spike events, exploiting the minimum-spike-delay-interval to allow gathering spikes into a buffer prior to the target thread placing them into its event queue.

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