Keeping track of your data with NIX: tools for comprehensive data organization

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Managing neuroscience data requires the integration of information from multiple sources. Background information, or metadata, about the experiment is necessary to interpret the resulting data correctly. Storing such information consistently is an essential part of experimental research and depends crucially on available file formats. Many existing formats provide only limited support for storing metadata along with the data. Here we present the NIX project [1], consisting of an open format and software tools to store and organize data and metadata.

The NIX project specifies a versatile format for neuroscientific data. It provides libraries for accessing these files from different platforms. NIX is based on a well-defined data model which can be used to represent both data and related metadata. In particular, it provides generic entities designed to store a wide variety of data types like continuous signals, spike events, image stacks, or other multi-dimensional data. Metadata storage is supported via adaption of the odML data model [2].

An I/O backend for Neo [8] maps the Neo data model to the NIX format:
- Data stored in any format supported by Neo can be converted to NIX.
- Enables easy storage of data analysis done with Neo compatible tools, e.g., the Elephant [9] toolkit.
- Converting data to NIX, or using NIX as a backend for Neo, enables the use of NIX as well as HDF5 tools and viewers:
  - NIX language bindings for C++, Python, Matlab, Java.
  - NixView.
  - HDFView, h5dump, h5ls, etc.

The model provides all information to interpret the data correctly.

The odML model

Main Entities:
- Array: stores n-dimensional data with information about data type and units, defines dimensions using Dimension entity.
- Tag: Defines points or regions, representing segments, spike times, events, and relationships between data.

All entities have:
- a unique id: allows synchronization and identification across files.
- a name: serves as a human readable identifier.
- a type: provides semantic context, domain-specificity.

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Libraries and language bindings

The schema definition for HDF5 [3] represents all entities of the data model hierarchy. It was designed to be easily readable even without a special library.

Easy reading and writing of the NIX file format, even without deep knowledge about the exact format specification, is provided by an IO-library in C++ [1], supporting major compilers and operating systems such as Linux, OSX and Windows, and language bindings for Python [5], Matlab [6] and Java [7]. The Python package [5] additionally provides quick and easy installation without requiring the C++ library.

NIX backend for Neo

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Resources

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