


Neurosift: DANDI exploration and NWB visualization in the browser

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Summary

Neurosift, a browser-based visualization tool, is designed for the interactive exploration of Neurodata Without Borders (NWB) files, whether stored locally, on remote servers, or within the Distributed Archives for Neurophysiology Data Integration (DANDI). Neurodata Without Borders (NWB) ([Rübel et al., 2022](#); [Teeters et al., 2015](#)) is an open data standard for neurophysiology that enables the sharing, archiving, and analysis of various types of neurophysiology data, DANDI ([Rübel et al., 2022](#)) is a cloud-based platform that supports the storage, sharing, and analysis of neurophysiology data including NWB files. With Neurosift integration, users browsing DANDI can easily open any NWB file in the browser, and explore its contents, including timeseries data, images, and more. Neurosift can also be used to browse the DANDI database or individual DANDIsets. Overall, Neurosift simplifies the visualization and exploration of complex NWB file structures, making it a valuable tool for neuroscientists.

Statement of need

In the evolving field of neuroscience research, the ability to manage and share complex data sets is crucial. NWB has emerged as a standard for neurophysiology data, aimed at facilitating data sharing, storage, and analysis. However, the specialized nature of the NWB format necessitates tools that can provide intuitive interfaces for researchers to explore their data effectively. Neurosift is designed to address this need.

Files found on DANDI can often be large and unwieldy. Various Python tools have emerged to address this by streaming portions of the NWB file without the need to download the entire file. One such tool is NWB Widgets ([Dichter, 2022](#)), which provides a suite of interactive widgets for visualizing NWB data within Jupyter notebooks or JupyterLab, enabling users to navigate the hierarchical structure of NWB files and directly visualize specific data elements. This package was a large part of the inspiration for Neurosift. The main difference is that NWB Widgets is a Python package that runs within interactive Python environments, while Neurosift is a browser-based tool that can be used without any installation. These two tools cater to different use cases, with Neurosift being more accessible to a wider audience, and is better suited for integration with DANDI.

The main technical challenge in developing Neurosift lies in its requirement to lazy-load data objects from remote NWB files, which are based on the complex HDF5 format. While HDF5's efficient data organization is ideal for the large, multidimensional datasets typical in neurophysiology, its primary implementations are in C. This necessitates a creative solution for web-based access and manipulation of these files. To bridge this gap, Neurosift leverages WebAssembly to run compiled C code in the browser, specifically utilizing a modified version of the h5wasm ([Maranville, 2022](#)) library. Unlike the original h5wasm library, which built to handle fully downloaded files, Neurosift's fork introduces an innovative approach to efficiently read data chunks from remote files. This allows for synchronous data reads without the need

42 for the entire file's prior download. This solution not only makes Neurosift a powerful tool
43 for neuroscience research but also showcases the potential of WebAssembly in overcoming
44 challenges associated with web-based data analysis tools.

45 In conclusion, Neurosift makes neurophysiology data more accessible and manageable for
46 scientists. By facilitating the exploration of complex datasets directly within a browser, without
47 requiring specialized programming knowledge, it lowers the barrier to entry for data analysis
48 and fosters collaborative research efforts. Looking forward, there is potential for Neurosift to
49 expand its capabilities, with enhanced visualizations and support for additional data types.

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