Optical Physiology in NWB

NEURODATA WITHOUT BORDERS

https://bit.ly/nwb-cosyne-2023

Optical Physiology in NWB

The community has made calcium imaging analysis tools that support reading and/or writing of NWB files:

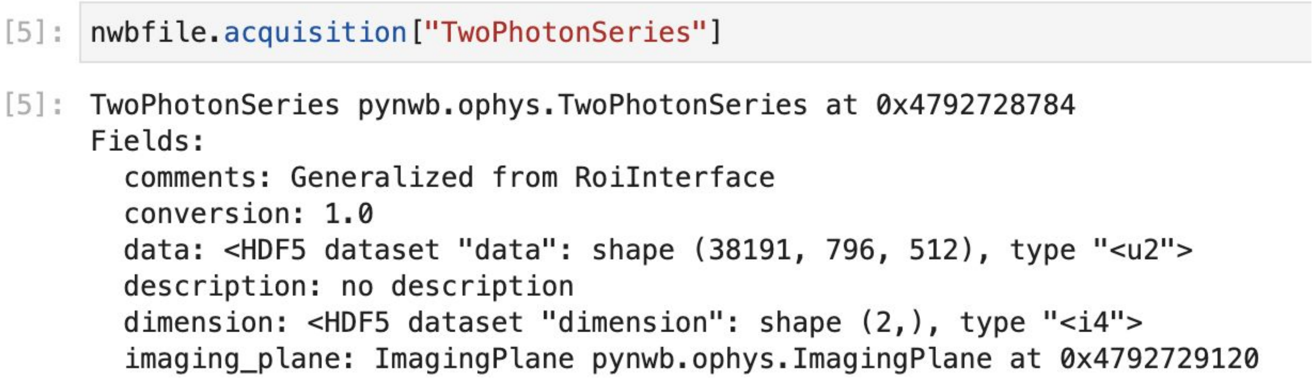
- Suite2p (Pachitariu et al., bioRxiv)
- CaImAn (Giovannucci et al., 2019)
- CIAtah (Corder, Ahanonu, et al., 2019)
- EXTRACT (Inan et al., bioRxiv)

We do not have time to fully explain the details of how these packages work…

…so we will simply explain the input-output (I/O) workflow

Input: Storing 2p data in NWB

- The NWB data type for two-photon data is called `TwoPhotonSeries`
  - Recommended to store the imaging data internally instead of externally

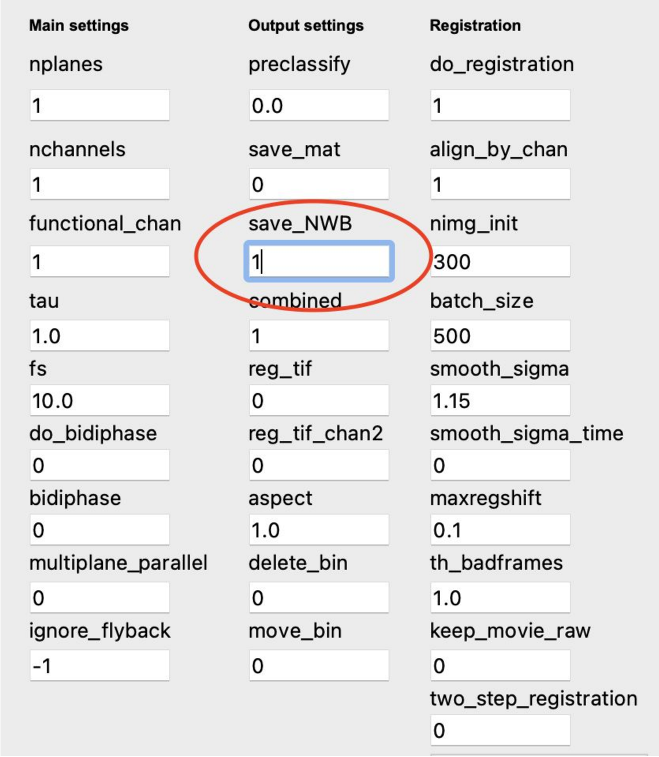


```
[5]: nwbfile.acquisition["TwoPhotonSeries"]

[5]: TwoPhotonSeries pynwb.ophys.TwoPhotonSeries at 0x4792728784
     Fields:
       comments: Generalized from RoiInterface
       conversion: 1.0
       data: <HDF5 dataset "data": shape (38191, 796, 512), type "<u2">
       description: no description
       dimension: <HDF5 dataset "dimension": shape (2,), type "<i4">
       imaging_plane: ImagingPlane pynwb.ophys.ImagingPlane at 0x4792729120
```

Suite2p on NWB 2p imaging data

1. Install suite2p: https://github.com/MouseLand/suite2p
2. Select an NWB file. Explore NWB file using nwbwidgets to make sure that the file contains a `TwoPhotonSeries` with internally stored imaging data
3. Rename NWB file from `*.nwb` to `*.h5`
4. In suite2p, select File > Run suite2p
5. Select input format “h5”
6. Enter data path “`/acquisition/TwoPhotonSeries/data`”
7. Click “Add directory to data_path” and select path of the directory with the data
8. Change “save_NWB” output setting from 0 to 1
9. Click “RUN SUITE2P” button



Main settings

nplanes	1
nchannels	1
functional_chan	1
tau	1.0
fs	10.0
do_bidiphase	0
bidiphase	0
multiplane_parallel	0
ignore_flyback	-1

Output settings

preclassify	0.0
save_mat	0
save_NWB	1
combined	1
reg_tif	0
reg_tif_chan2	0
aspect	1.0
delete_bin	0
move_bin	0

Registration

do_registration	1
align_by_chan	1
nimg_init	300
batch_size	500
smooth_sigma	1.15
smooth_sigma_time	0
maxregshift	0.1
th_badframes	1.0
keep_movie_raw	0
two_step_registration	0

Suite2p: Load ROIs from NWB file

CaImAn on NWB 2p imaging data

1. Install CaImAn: https://github.com/flatironinstitute/CaImAn
2. Use NWB file and name of `TwoPhotonSeries` object (usually "`TwoPhotonSeries`")

```
opts_dict = {'fnames': ['/Users/rly/example_movies/Sue_2x_3000_40_-46.nwb'],
             'var_name_hdf5': 'TwoPhotonSeries',
             # ...
```

CaImAn on NWB 2p imaging data

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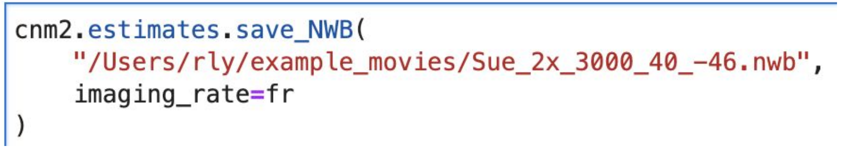
             'var_name_hdf5': 'TwoPhotonSeries',
             # ...
```

3. Use CaImAn to do motion correction, CNMF fitting, and plot and review results
4. Save estimates back to NWB file



```
cnm2.estimates.save_NWB(
    "/Users/rly/example_movies/Sue_2x_3000_40_-46.nwb",
    imaging_rate=fr
)
```