Microglia calcium activity detection with CaImAn

Demo results

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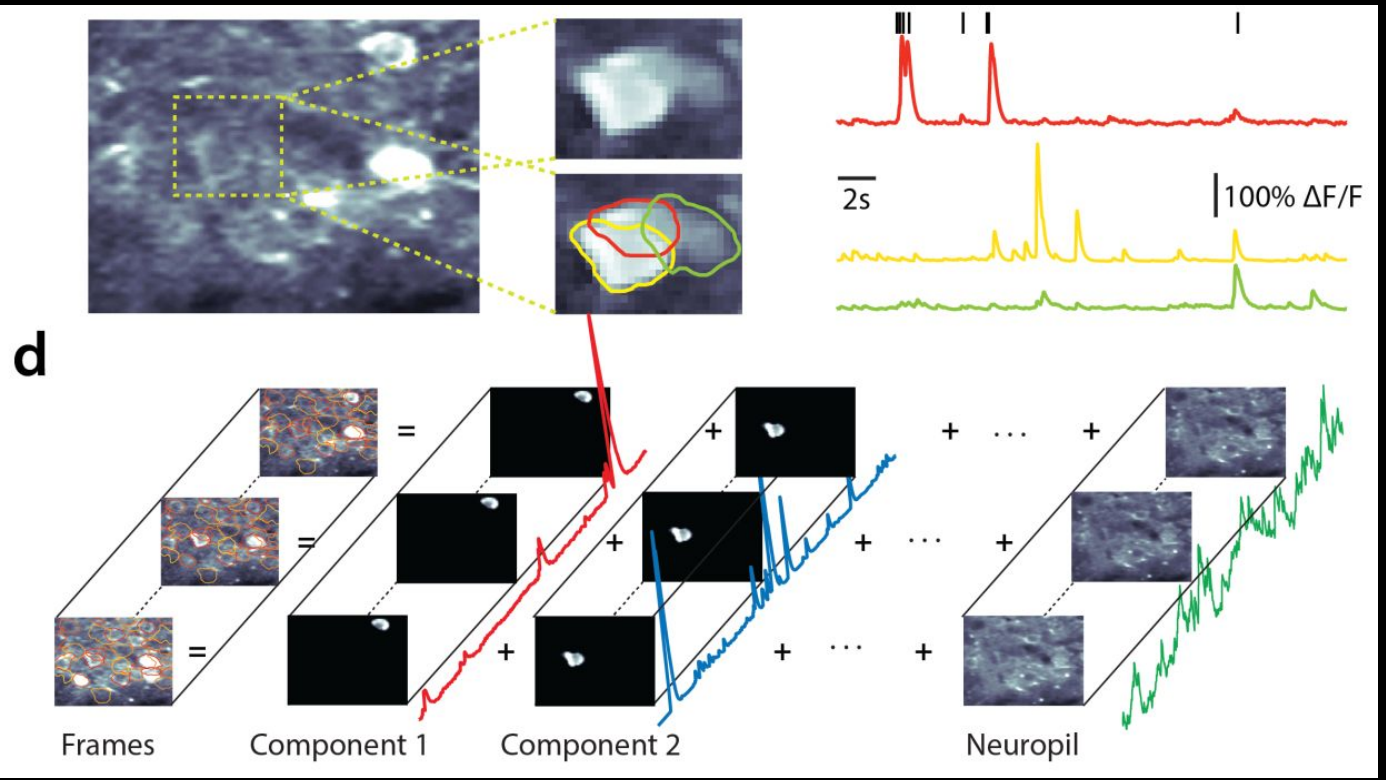
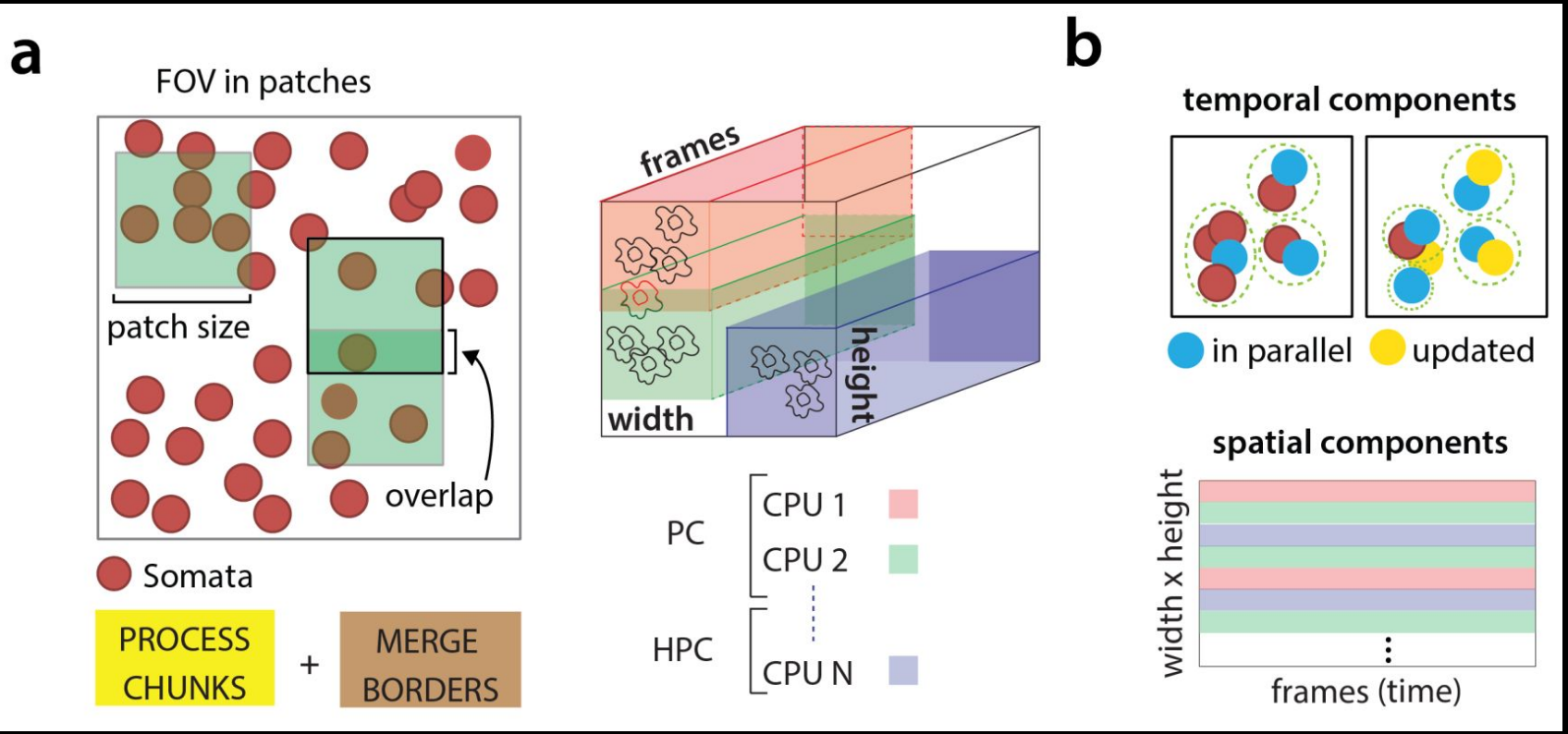
Intro to CaImAn

2P registration structure & intuitive depiction of CNMF algorithm



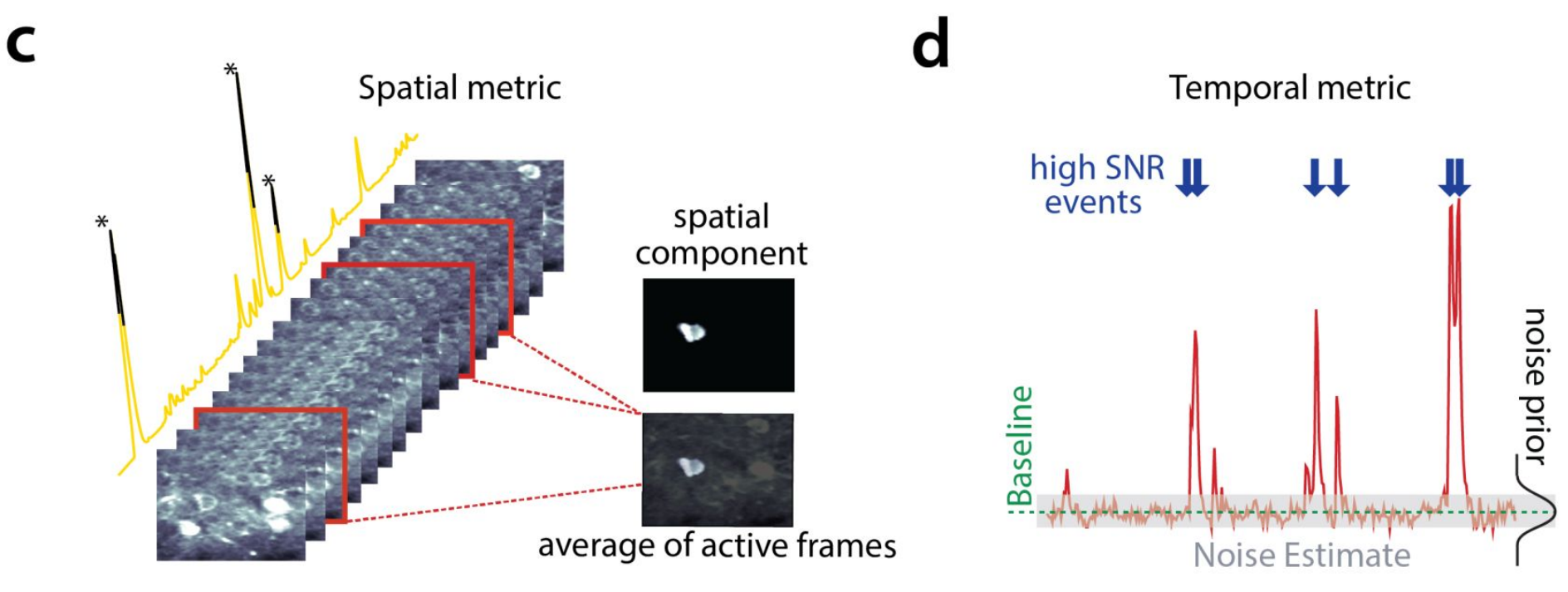
Giovannucci er al., 2019, DOI: https://doi.org/10.7554/eLife.38173

Parallelized processing

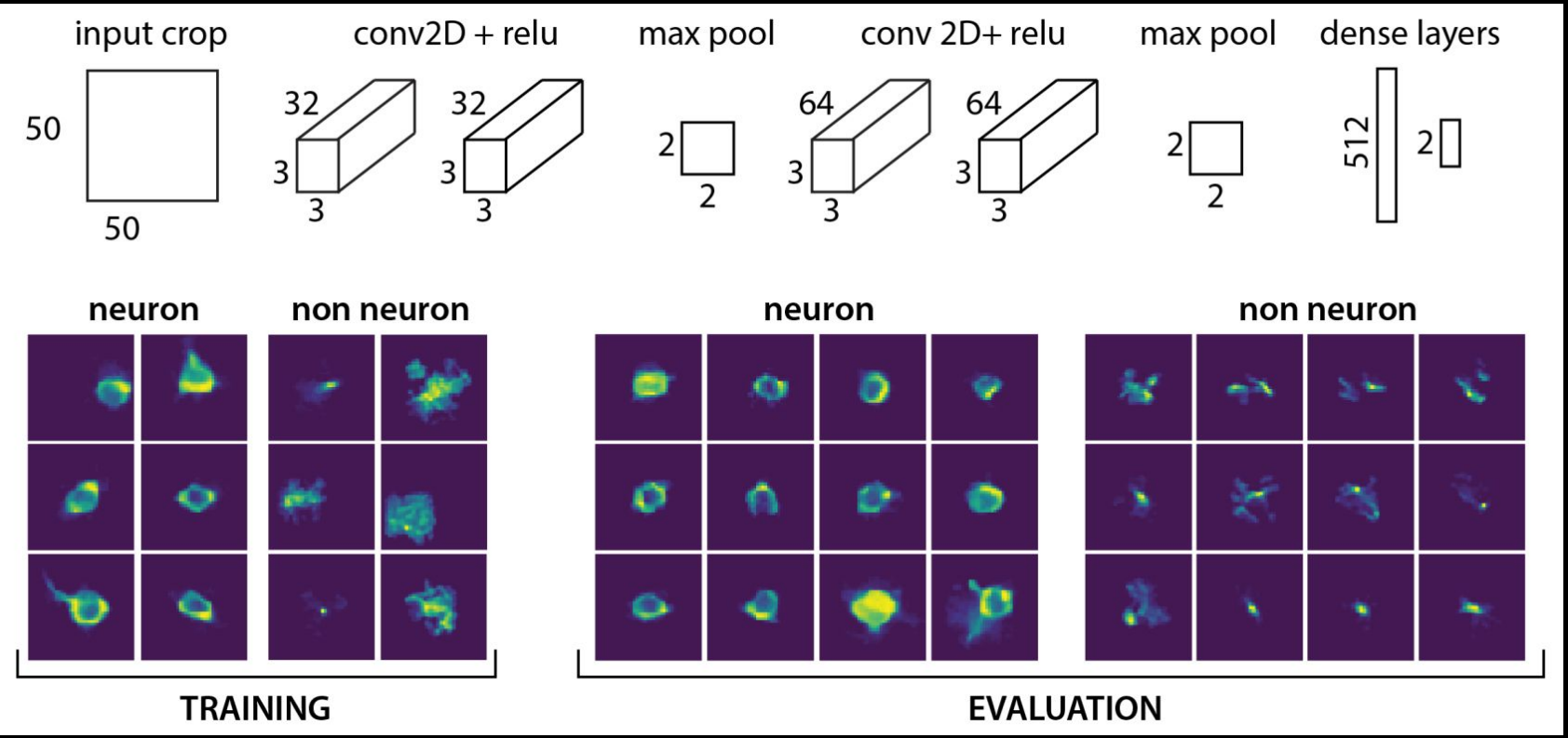


Giovannucci er al., 2019, DOI: https://doi.org/10.7554/eLife.38173

Quality assessment in space & time



CNN based assessment for somas



Giovannucci er al., 2019, DOI: https://doi.org/10.7554/eLife.38173

Crucial parameters of CaImAn

Init:
- component initialization like neuron size gSig, patch size etc.

Motion:
- motion correction parameters (max shift size, patch size etc.)

Quality:
- component evaluation (spatial correlation, SNR and CNN)

Spatial:
- used in detection of spatial components

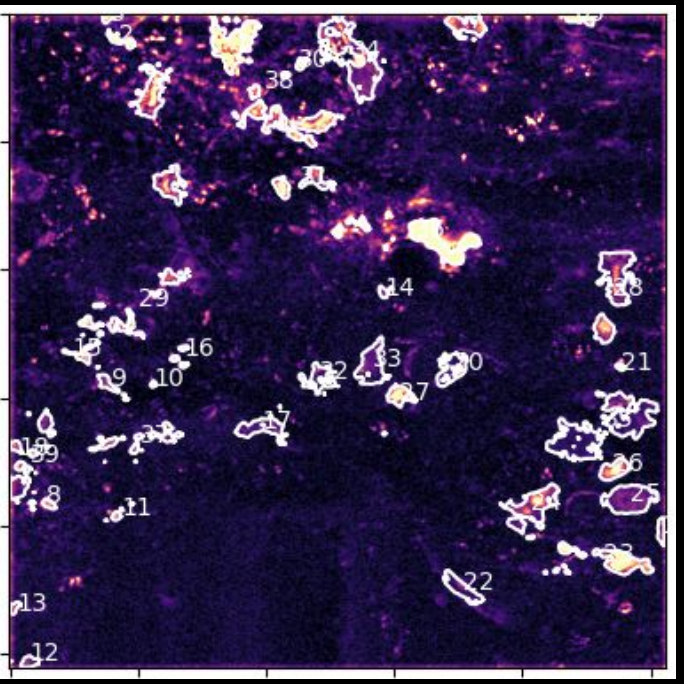
Temporal:
- used in extraction of temporal components and deconvolution

caiman.readthedocs.io/en/master/Getting_Started.html

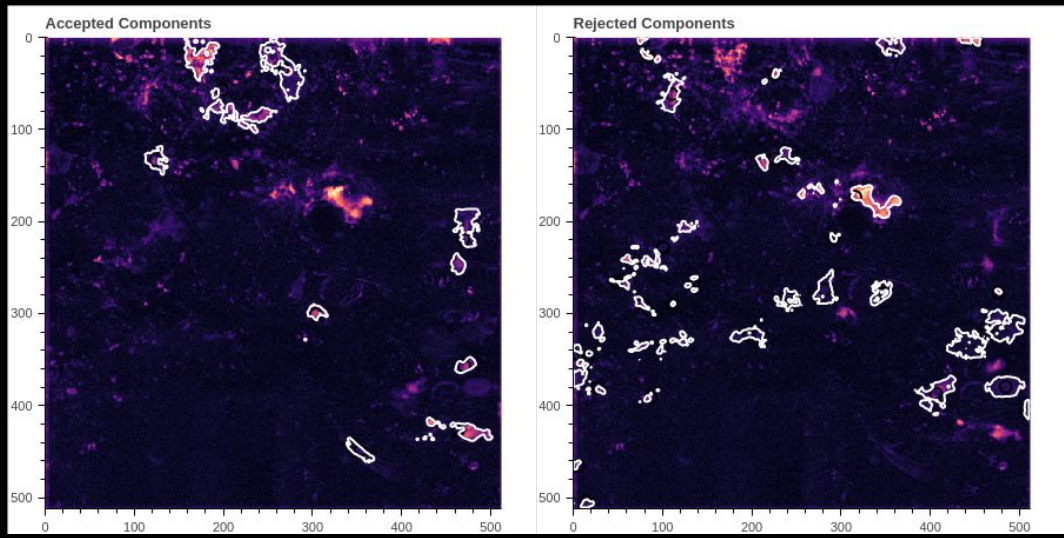
First results

E_0002, Field 7

Motion correction & components detection with CaImAn (demo_cell_det.ipynb)



Field 7, detected spatial components contours

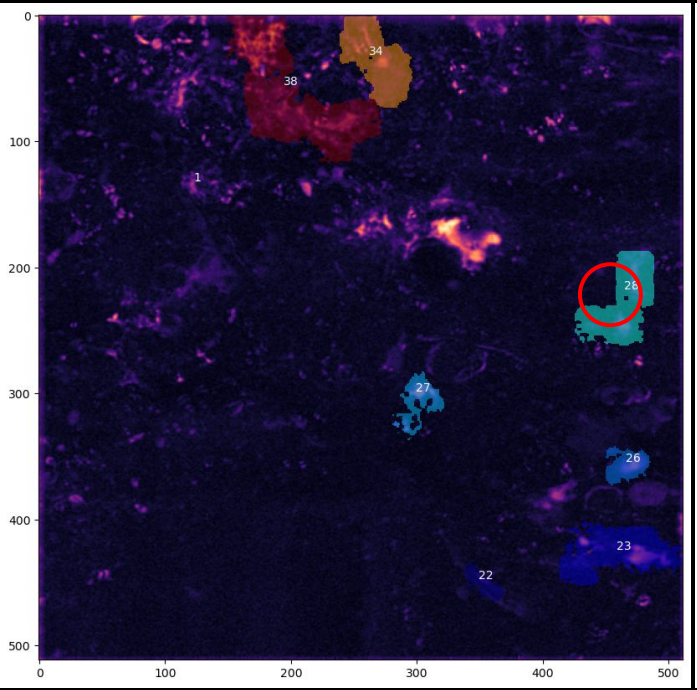


Field 7, selected spatial components contours

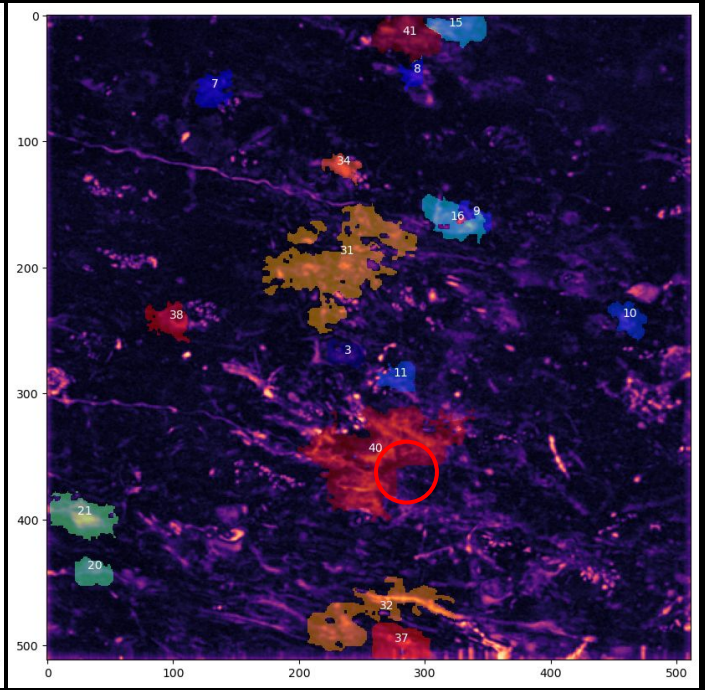
Quality parameters:

- min. SNR = 10
- min. space correlation = 0.9
- min. area = 100 px

Motion correction & components detection with CaImAn (demo_cell_det.ipynb)



Field 7,
components mask

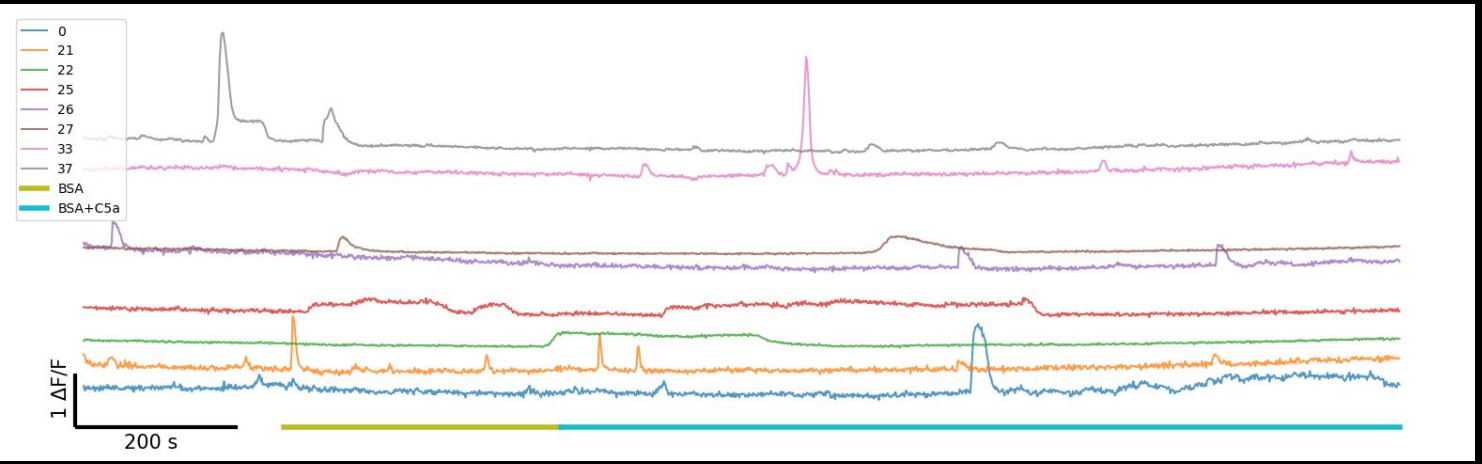


E_0002,
components mask

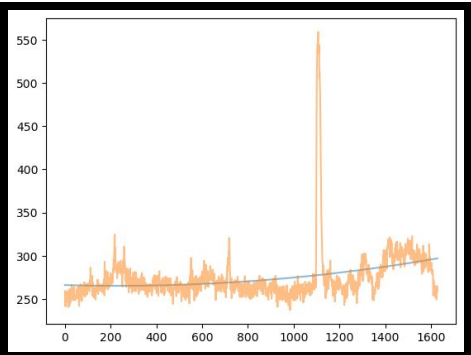
Output data frame columns:

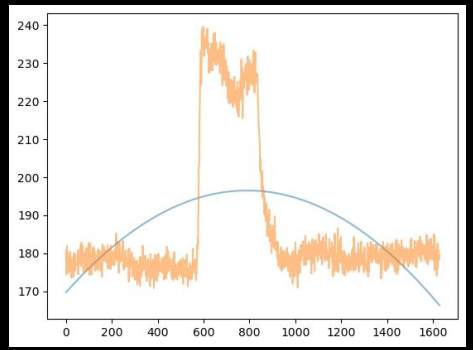
- reg_name: registration name
- time: frame time (s)
- comp: spatial component number
- profile_raw: raw intensity value (component area mean, a.u.)
- profile_C: corresponding temporal component value

Peaks detection & peaks features estimation (demo_peak_det.ipynb)



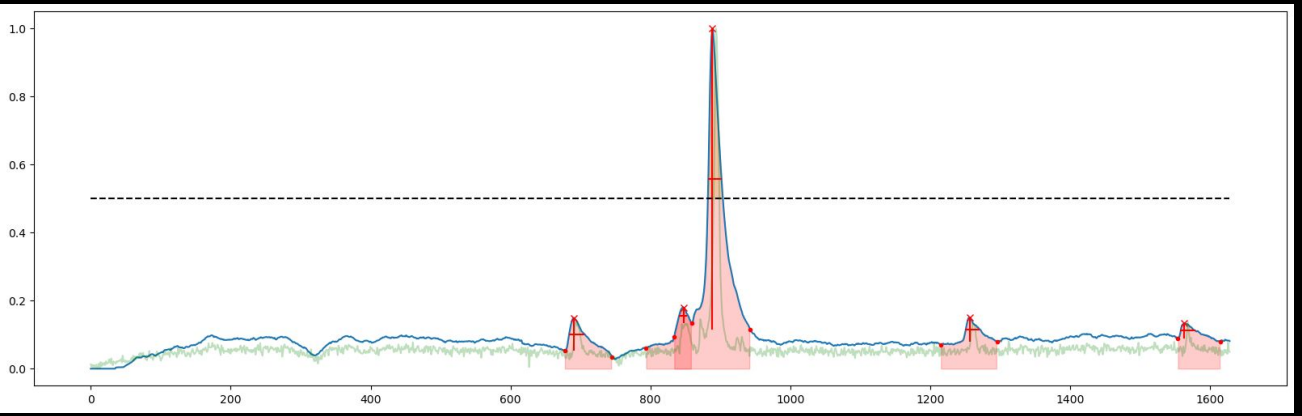
Field 7,
components ΔF/F profiles



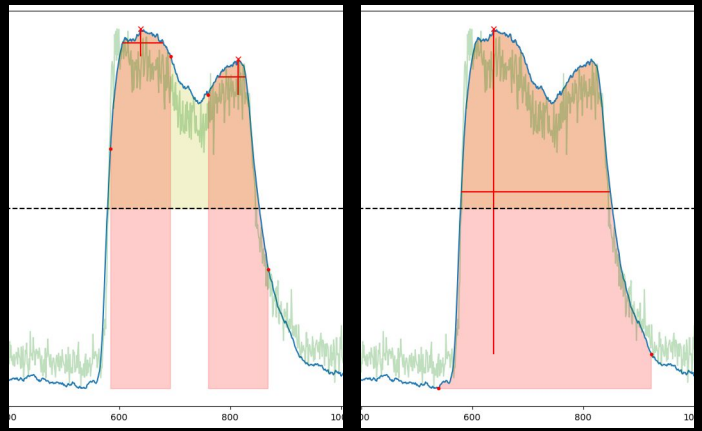


Field 7,
selected profiles baseline,
fitting with 2nd degree polynomial

Peaks detection & peaks features estimation (demo_peak_det.ipynb)

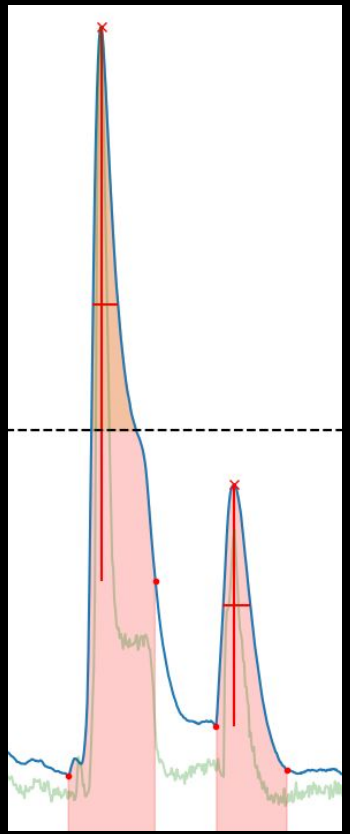


Field 7,
peaks detection in selected profile



Field 7,
plateaus detection problem

Peaks detection & peaks features estimation (demo_peak_det.ipynb)



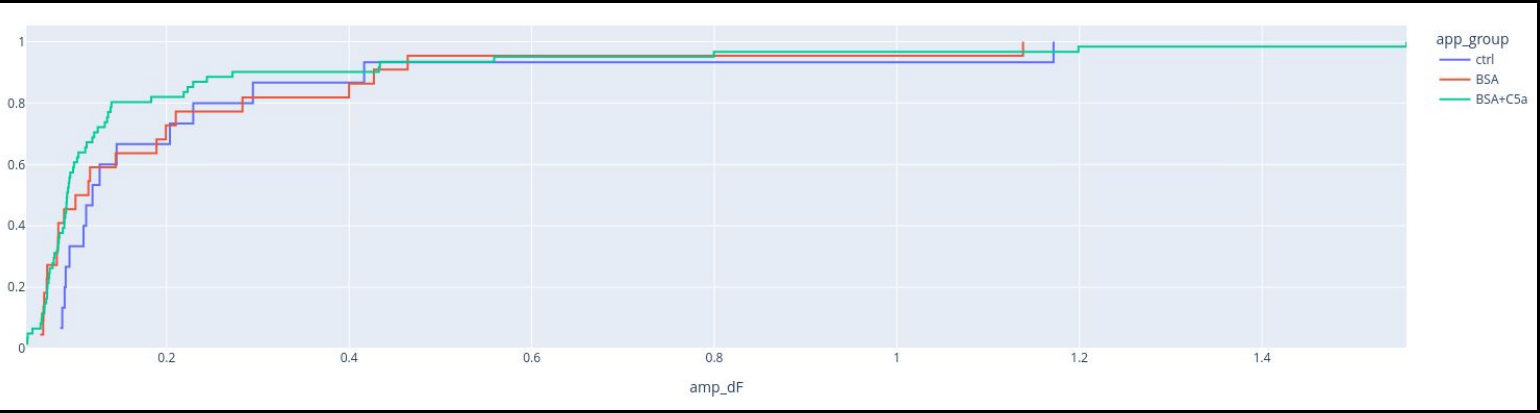
Measured peak features:

- Amplitude (a.u. or ΔF/F)
- Rise time (s)
- Decay time (s)
- FWHM (s)
- Integral (a.u. or ΔF/F)

Output data frame columns:

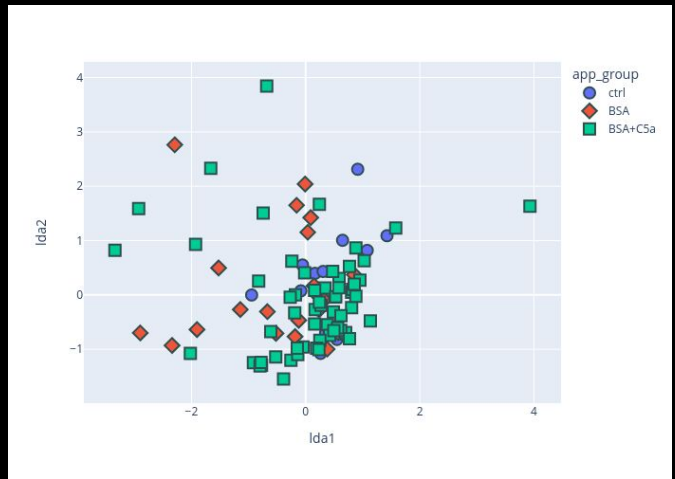
- sample: registration name
- comp: fspatial component number
- app_group: application group
- peak_i: peal index in profile, frames
- peak_time: peak time, sec
- rise: rise time, sec
- decay: decay time, sec
- FWHM: full width at half maximum, sec
- amp_abs: absolute amplitude, a.u.
- prom_abs: prominence from raw profile, a.u.
- integral_abs: signal integral in rise-decay window by raw profile
- amp_dF: elative amplitude, ΔF/F
- integral_dF: ignal integral in rise-decay window by relative profile, ΔF/F

Peaks features statistical analysis (demo_stat.ipynb)



Field 7,
peaks amplitude (ΔF/F) ECDF

two-sample Kolmogorov-Smirnov
ctrl vs. BSA+C5a
p-val.=0.044



Field 7,
LDA

Thank you!