

# Quantitative Bio-image Analysis with Python and Napari

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# The team



**Marcelo Leomil Zoccoler**



**Robert Haase**



# Napari-animation

Making animations – as easy as it gets

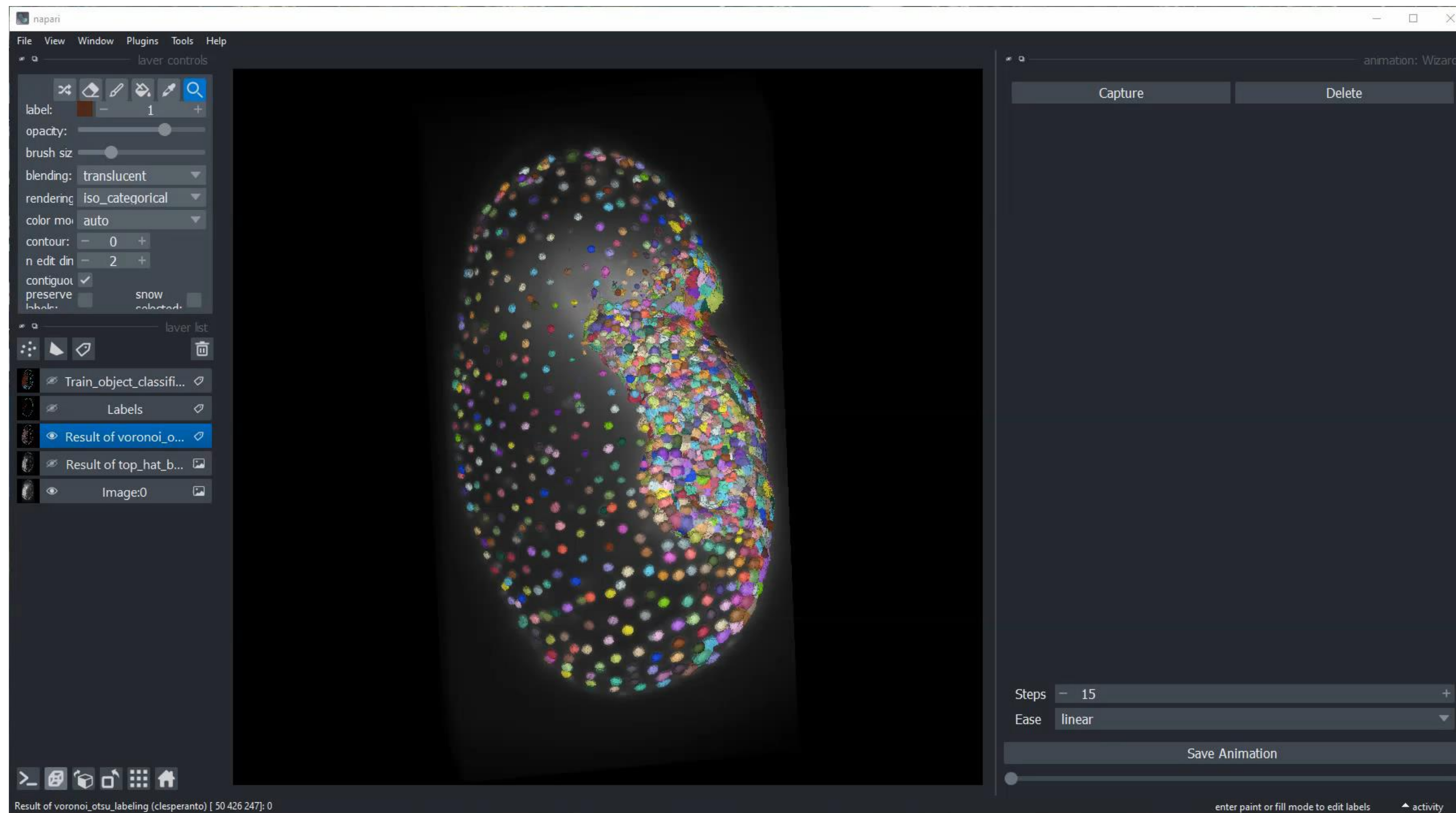


Image data source: Daniela Vorkel, Myers lab, MPI-CBG/CSBD



# Napari-animation

Making animations – as easy as it gets

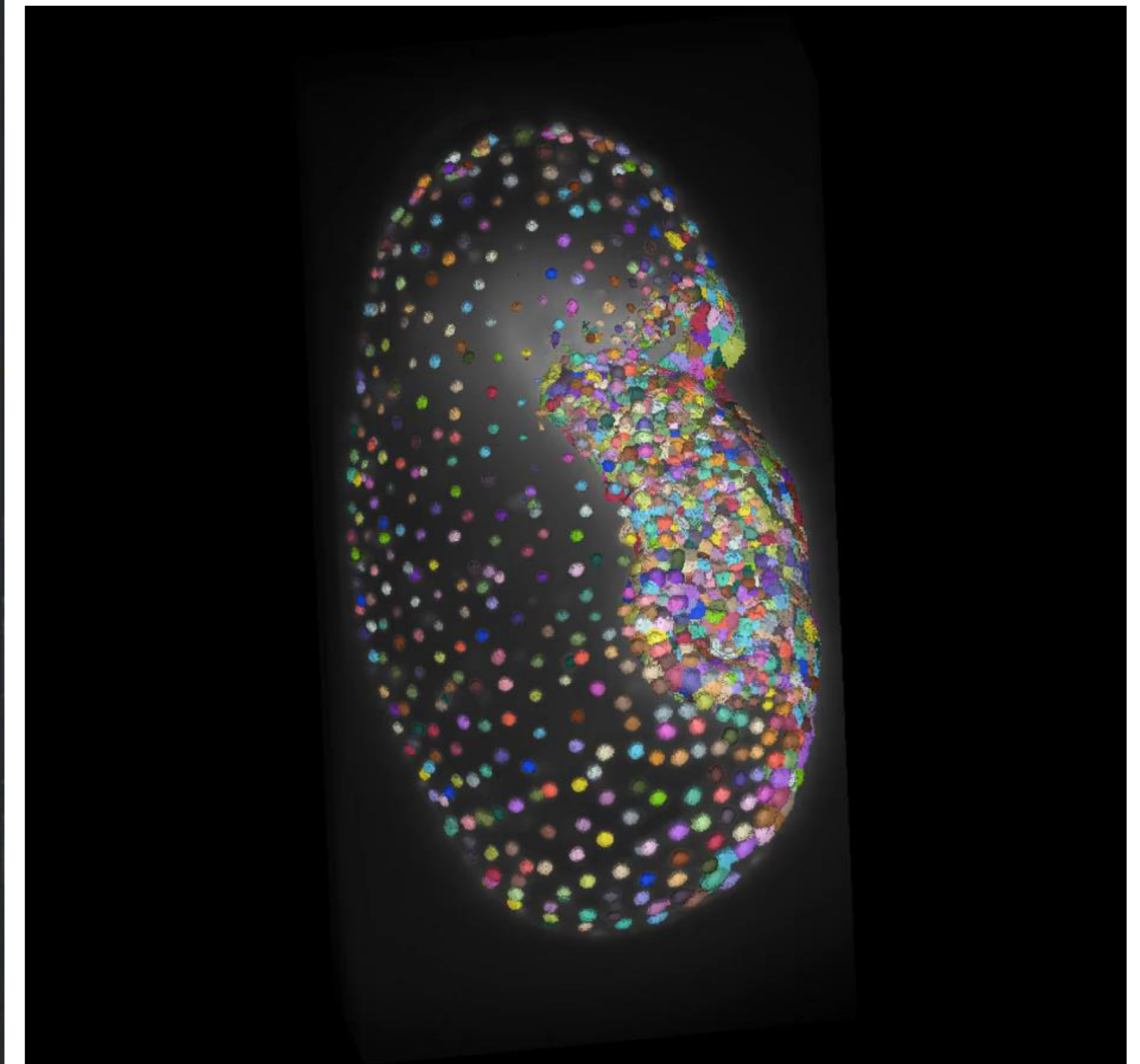
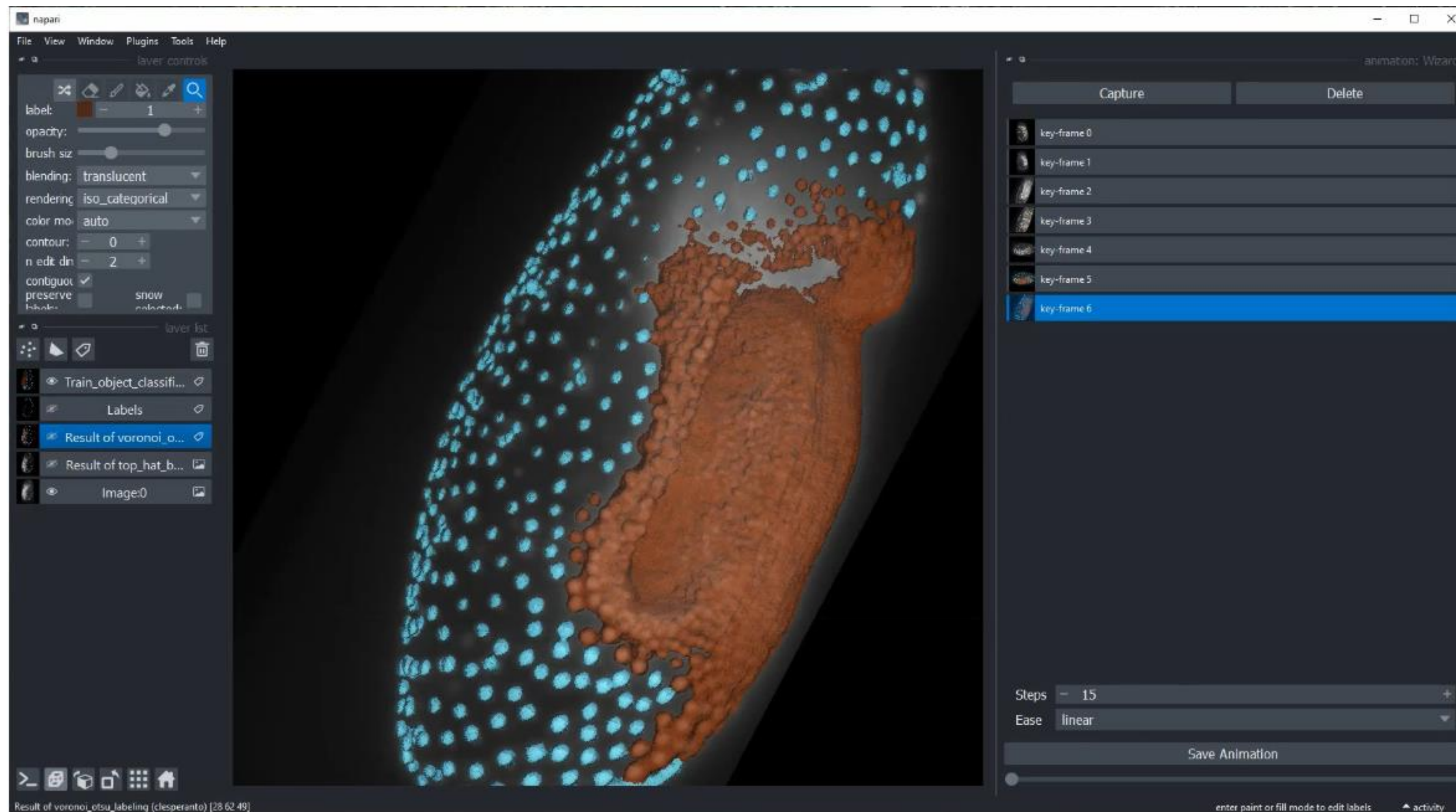
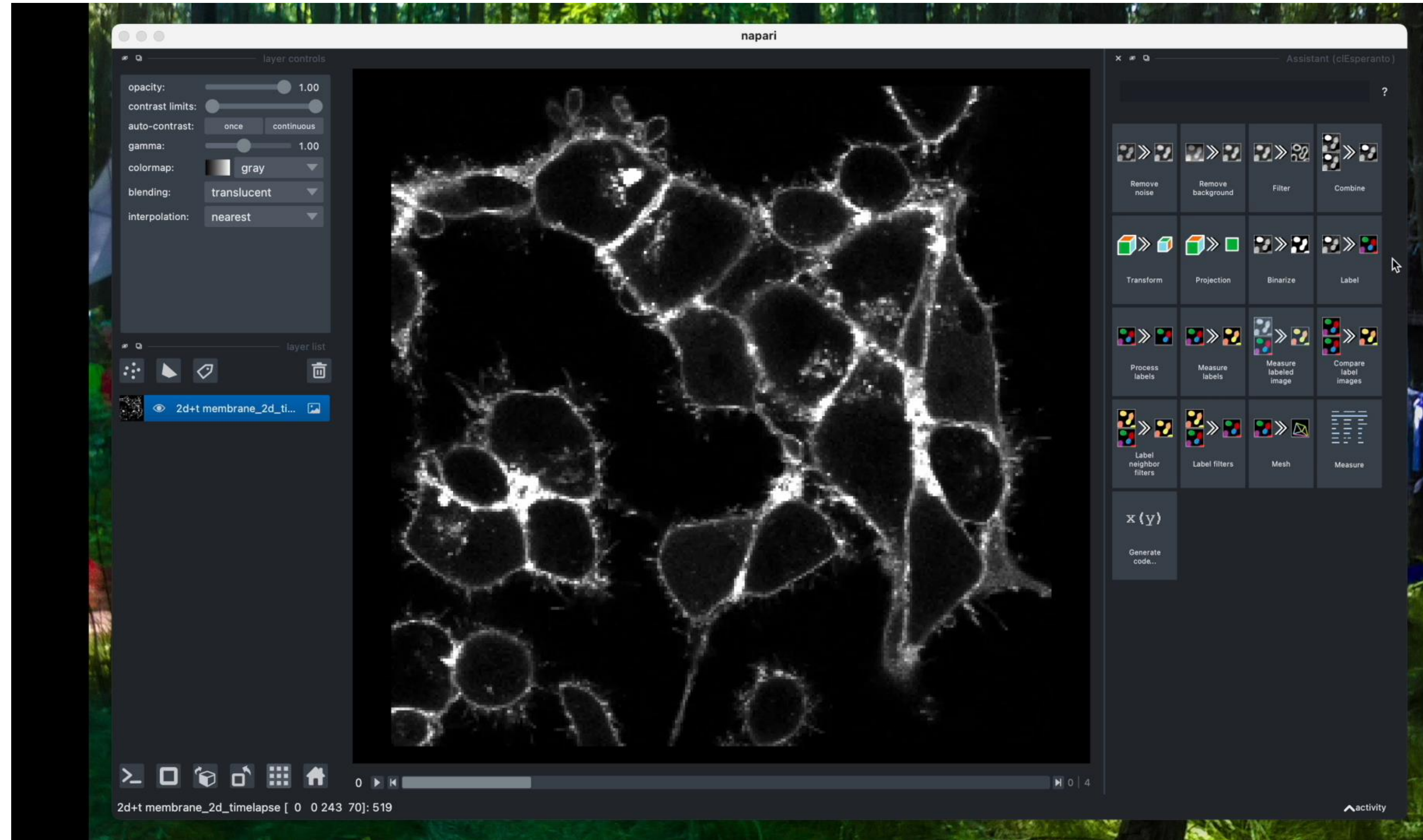


Image data source: Daniela Vorkel, Myers lab, MPI-CBG/CSBD



# Napari, segment blobs and things with membranes!

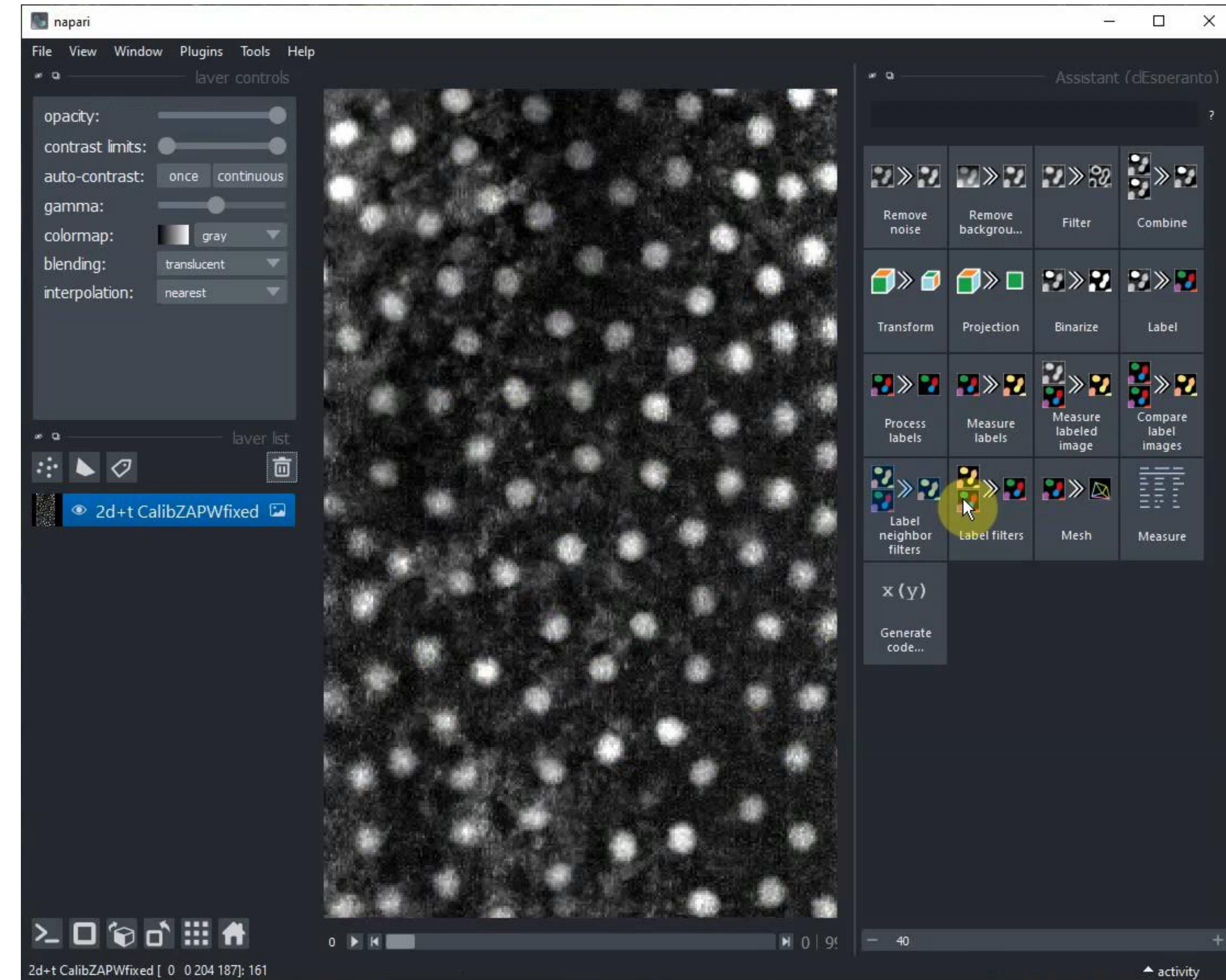
- Filtering,
- thresholding,
- spot detection,
- seeded watershed segmentation,
- Voronoi-Otsu-labeling





# Napari + pyclesperanto + assistant

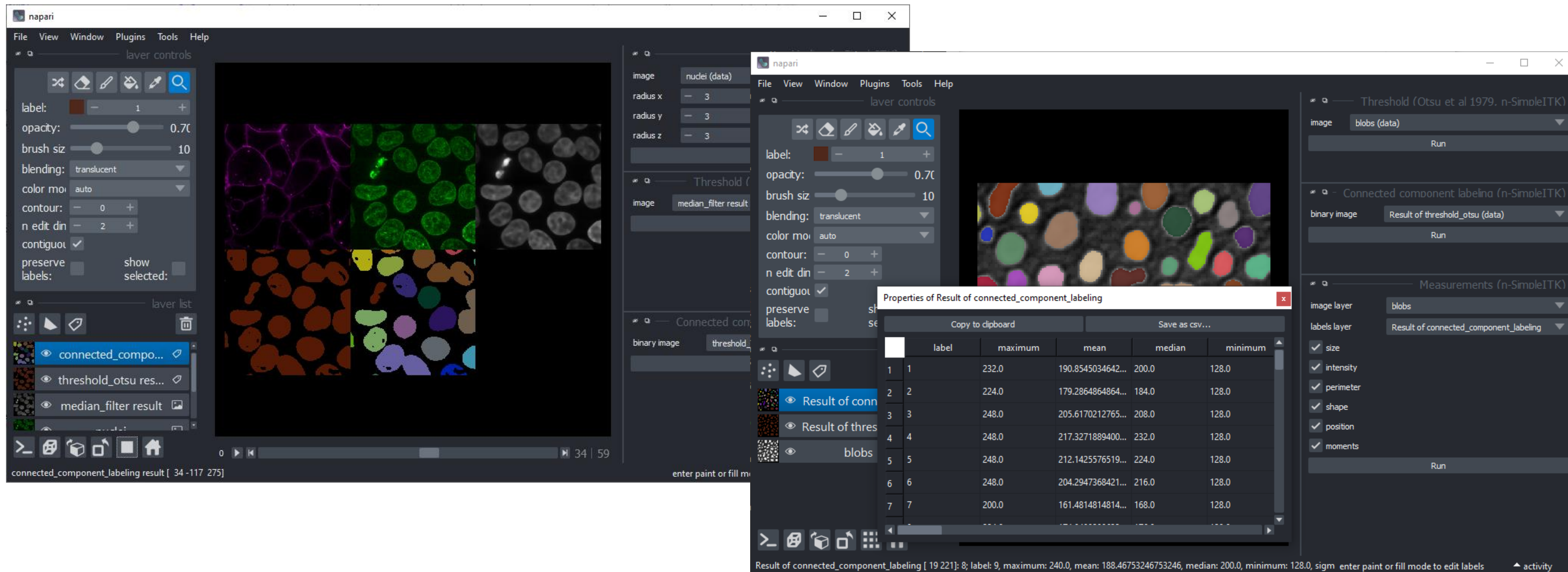
GPU-accelerated image processing with  
a pocket-calculator like graphical user  
interface





# napari-simpleitk-image-processing

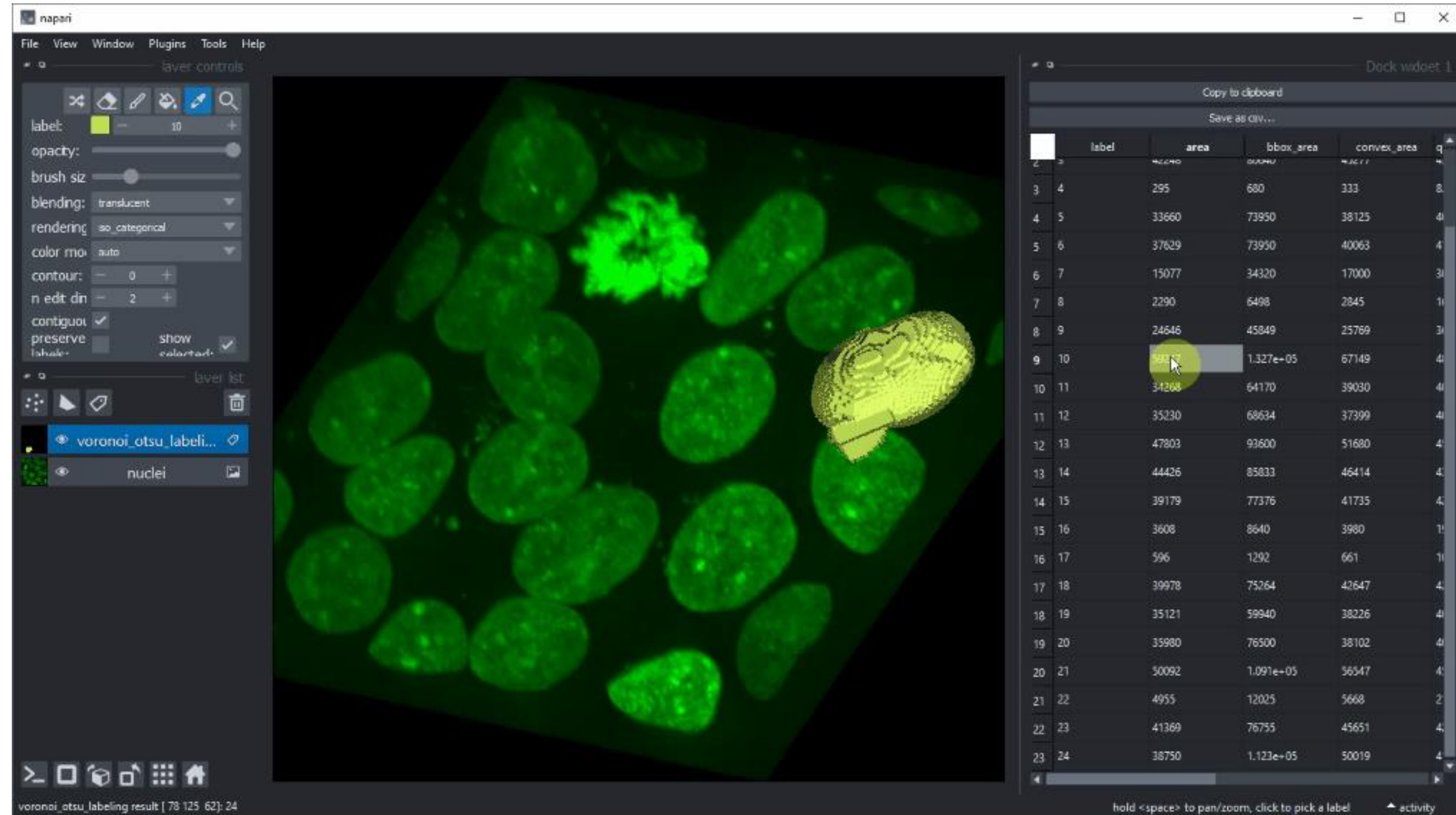
Recommended for 3D-measurements, based on the SimpleITK-project





# Data exploration

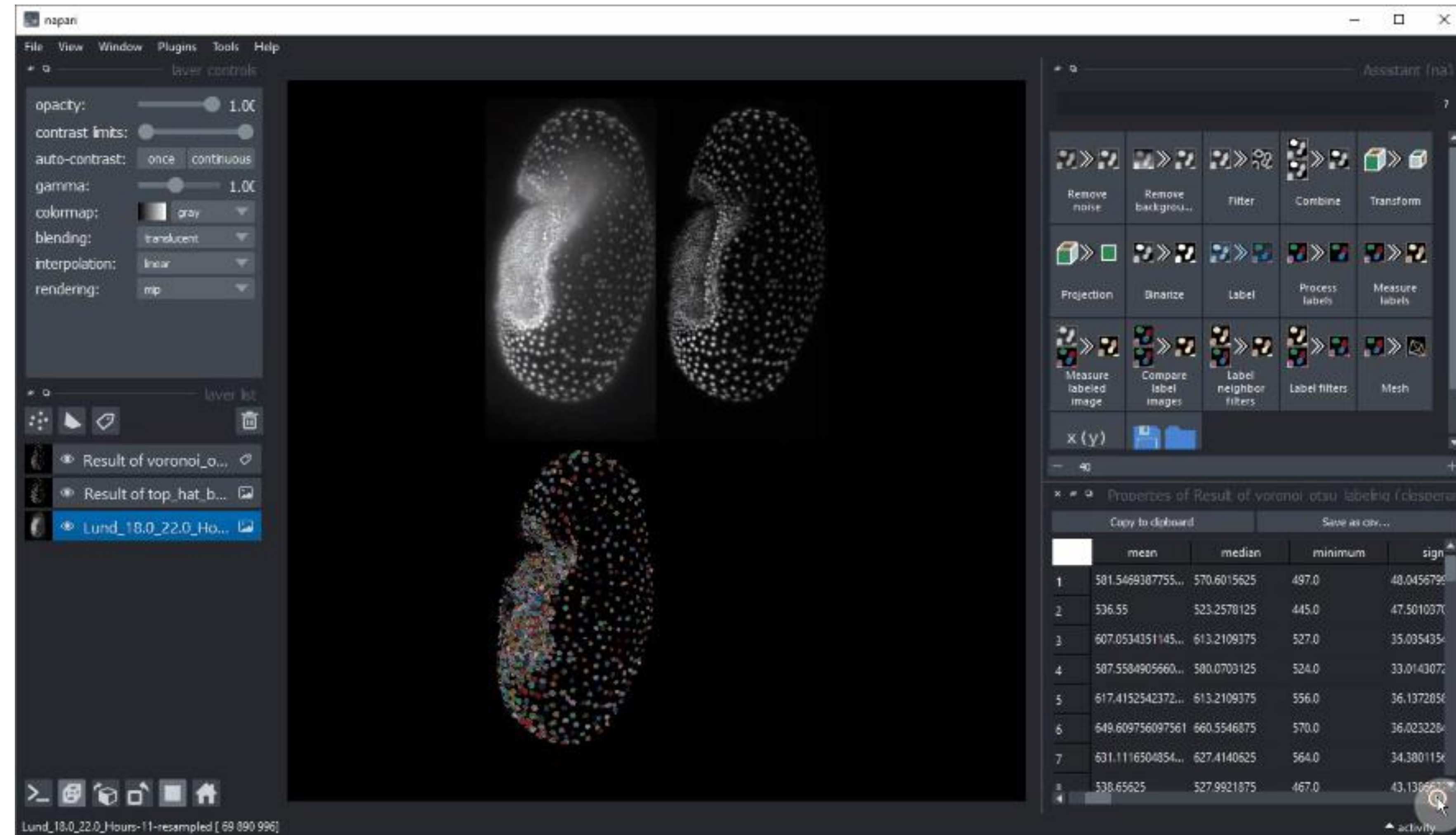
- Click on a cell to view the object the measurement belongs to





# Data exploration

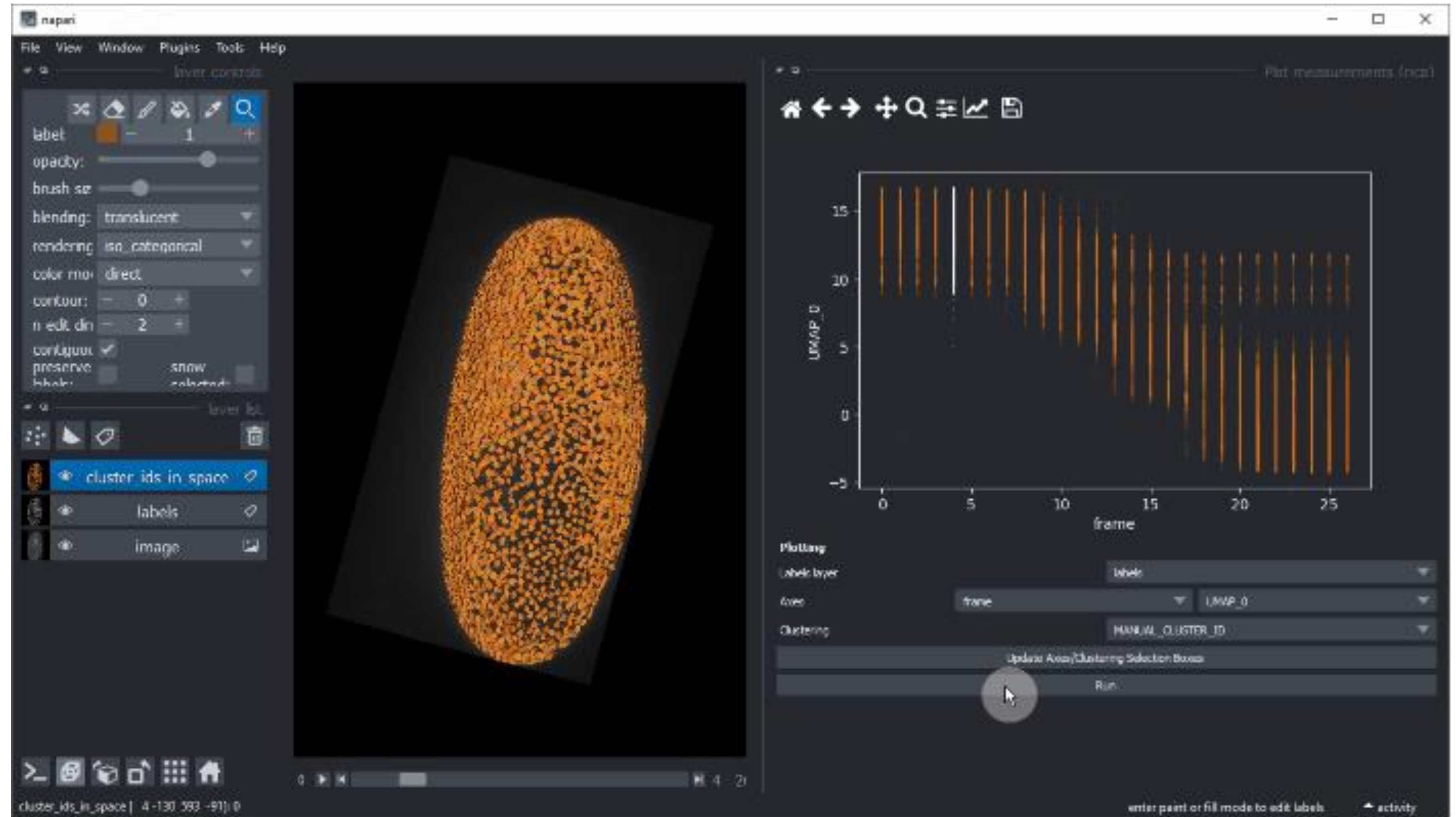
- Double-click on a column of measurements to view a parametric image





# Data exploration

- Manual clustering to gain deeper insights in relationships between measured parameters



Laura Žigutytė  
@zigutyte

Ryan Savill  
@RyanSavill4

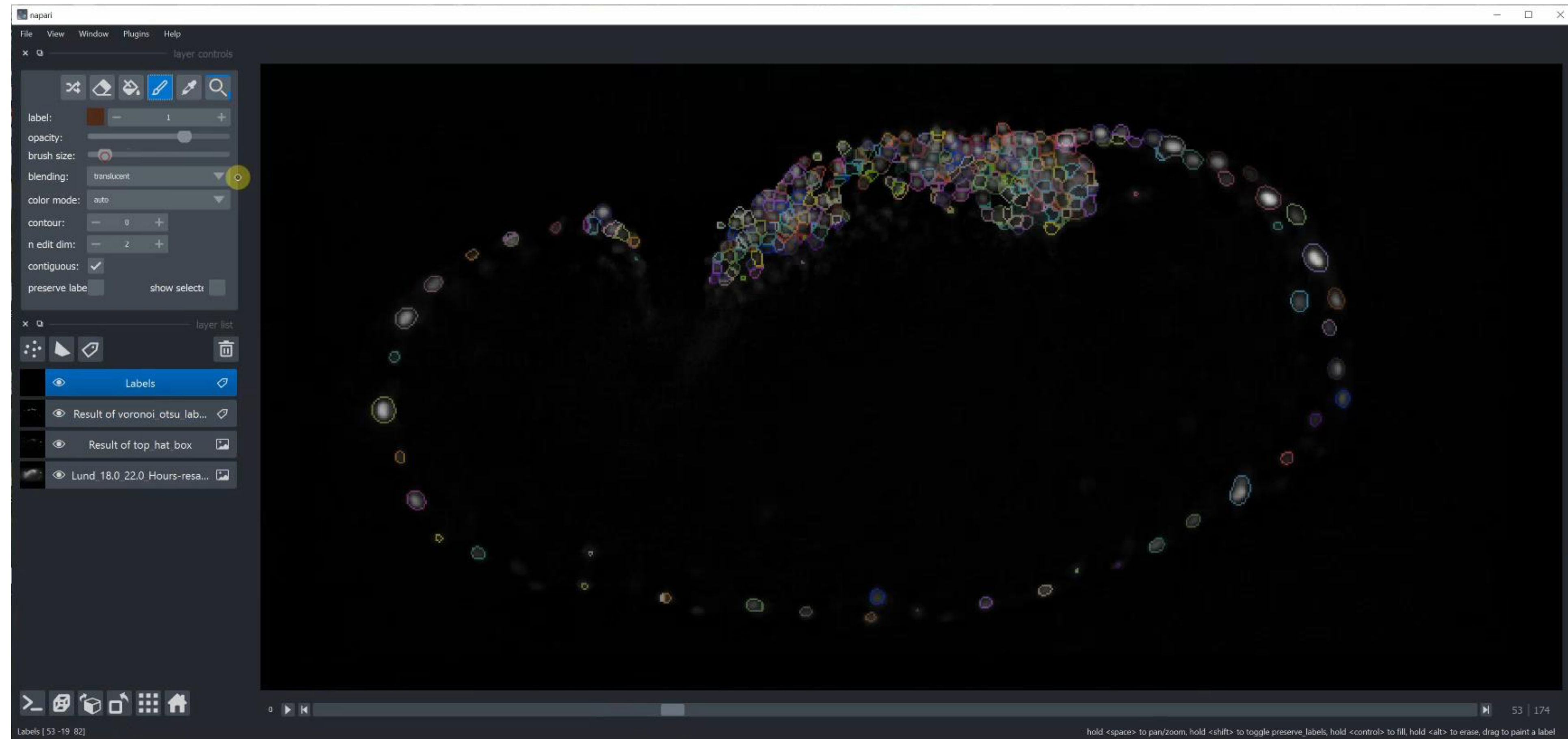
Marcelo Zoccoler  
@zoccolermarcelo



# Supervised machine learning for tissue classification

## Random Forest Classifiers based on

- scikit-learn and
- clesperanto





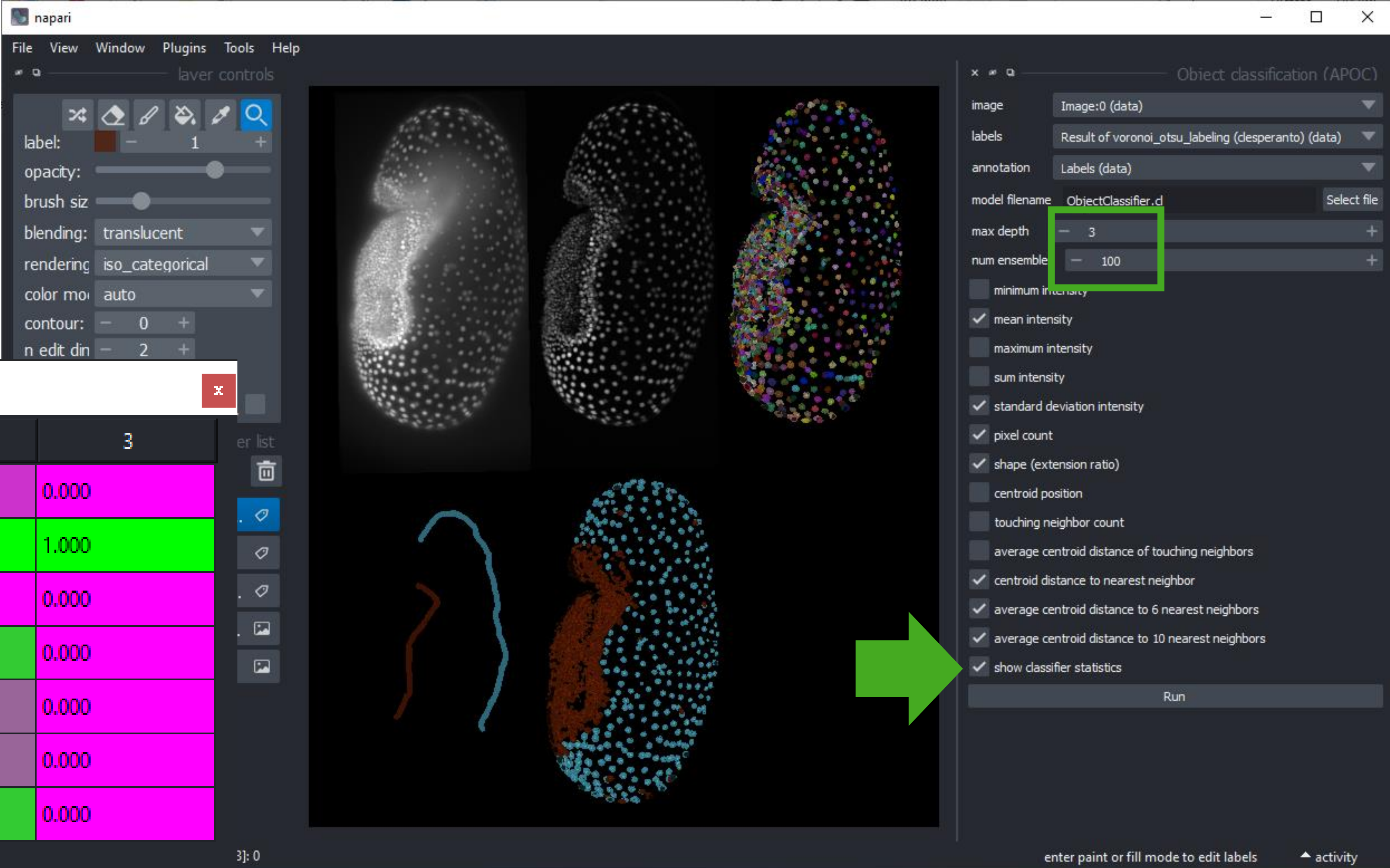
# Data exploration / supervised machine learning

Inspect how the random forest classifier makes decisions

Note: Beware of correlated parameters!

Dock widget 1

	1	2	3
area	0.010	0.056	0.000
mean_intensity	0.200	0.278	1.000
standard_deviation_intensity	0.030	0.000	0.000
mean_max_distance_to_centroid_ratio	0.270	0.222	0.000
average_distance_of_n_nearest_neighbors=1	0.120	0.111	0.000
average_distance_of_n_nearest_neighbors=6	0.170	0.111	0.000
average_distance_of_n_nearest_neighbors=10	0.200	0.222	0.000





# Data exploration / supervised machine learning

Inspect how the random forest classifier makes decisions

Note: Beware of correlated parameters!

napari

File View Window Plugins Tools Help

layer controls

label: 1

opacity:

brush size:

blending: translucent

rendering: iso\_categorical

color mode: auto

contour: 0

edit distance: 2

contiguous: ☒

preserve labels: ☐

show labels: ☐

layer list



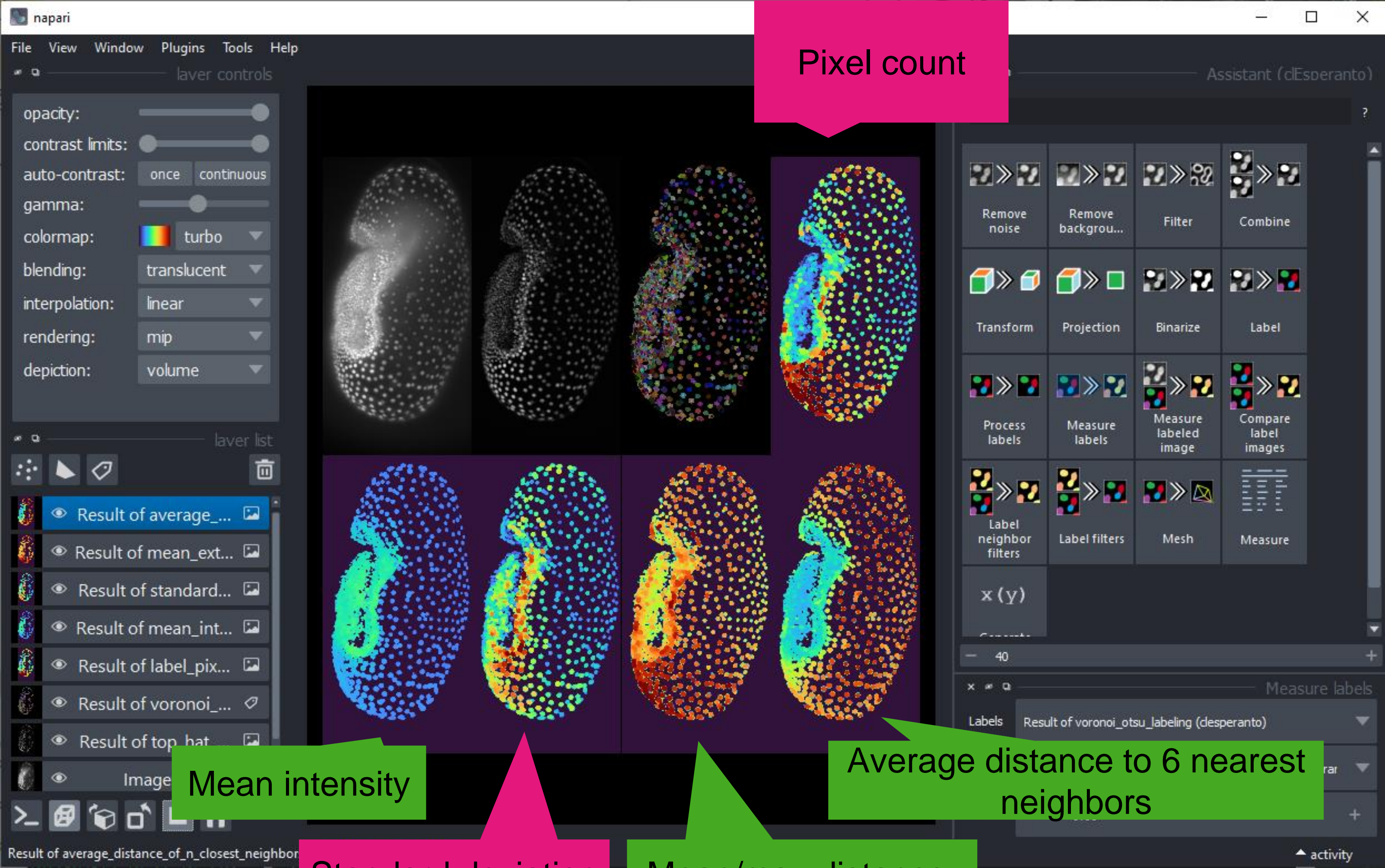
# Data exploration / supervised machine learning

Inspect how the random forest classifier makes decisions

Note: Beware of correlated parameters!

Dock widget 2

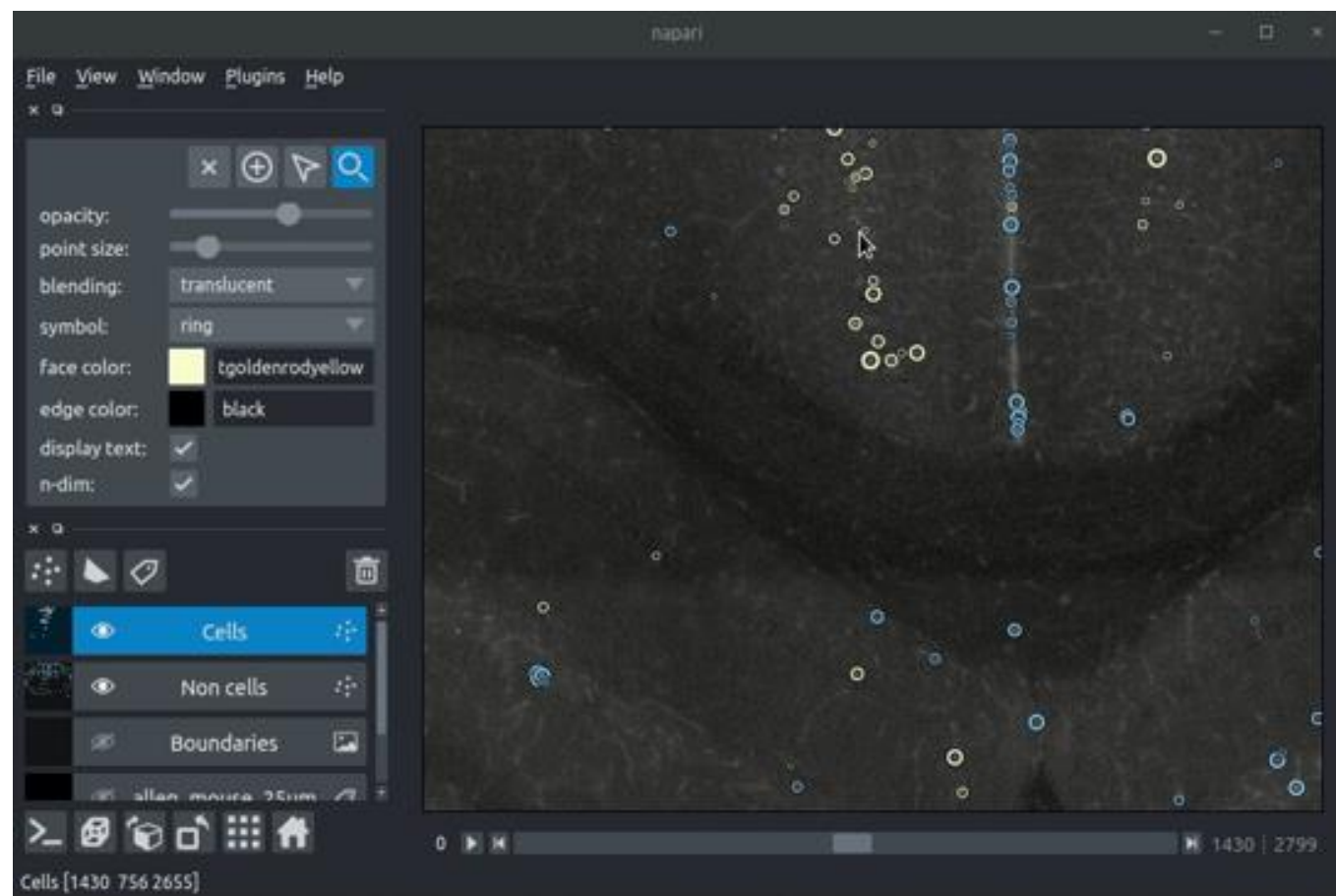
	1	2	3
area	0.060	0.000	0.000
mean_intensity	0.330	0.167	0.000
standard_deviation_intensity	0.040	0.111	0.000
mean_max_distance_to_centroid_ratio	0.260	0.444	1.000
average_distance_of_n_nearest_neighbors=6	0.310	0.278	0.000





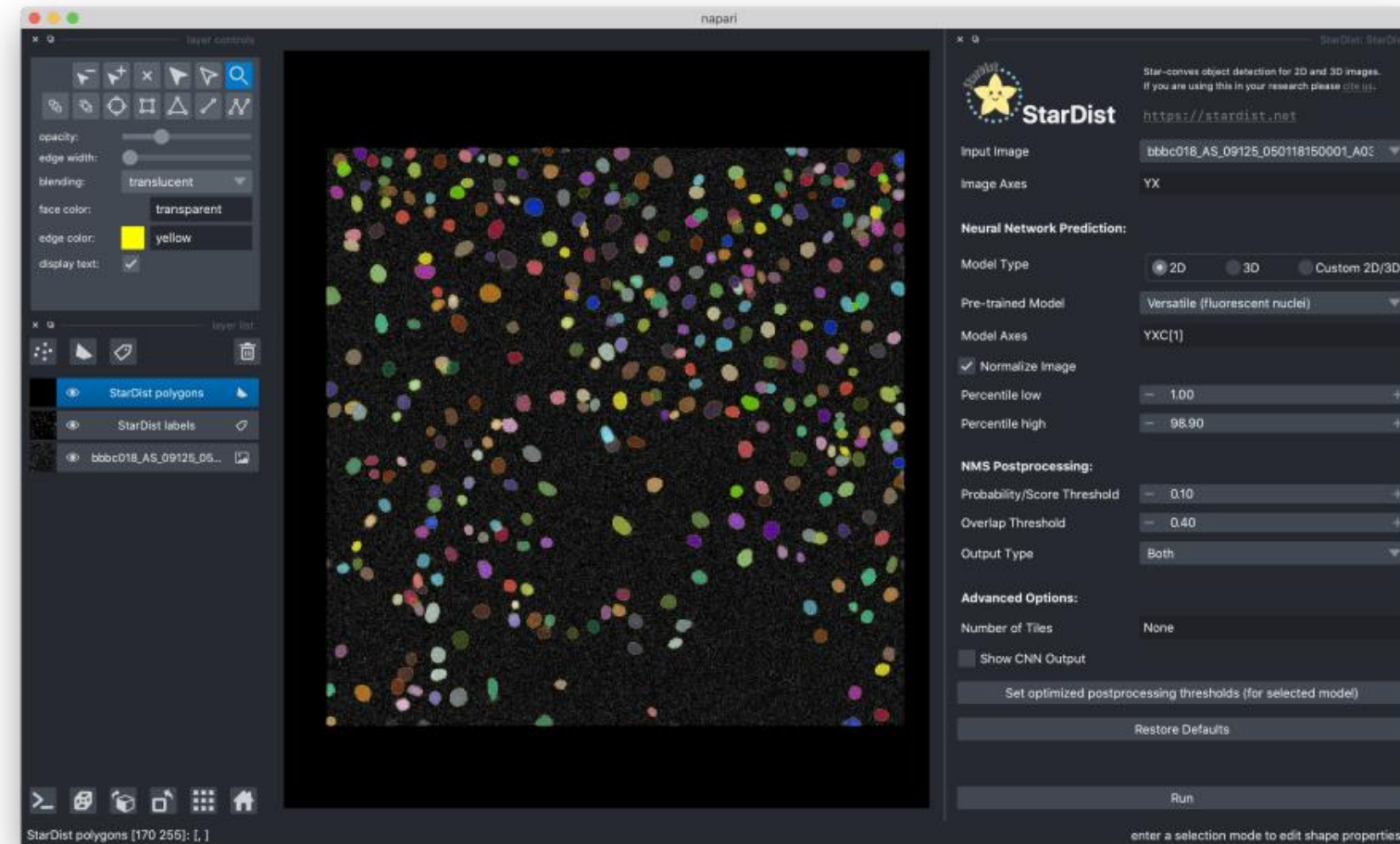
# The era of napari plugins has just begun

cellfinder



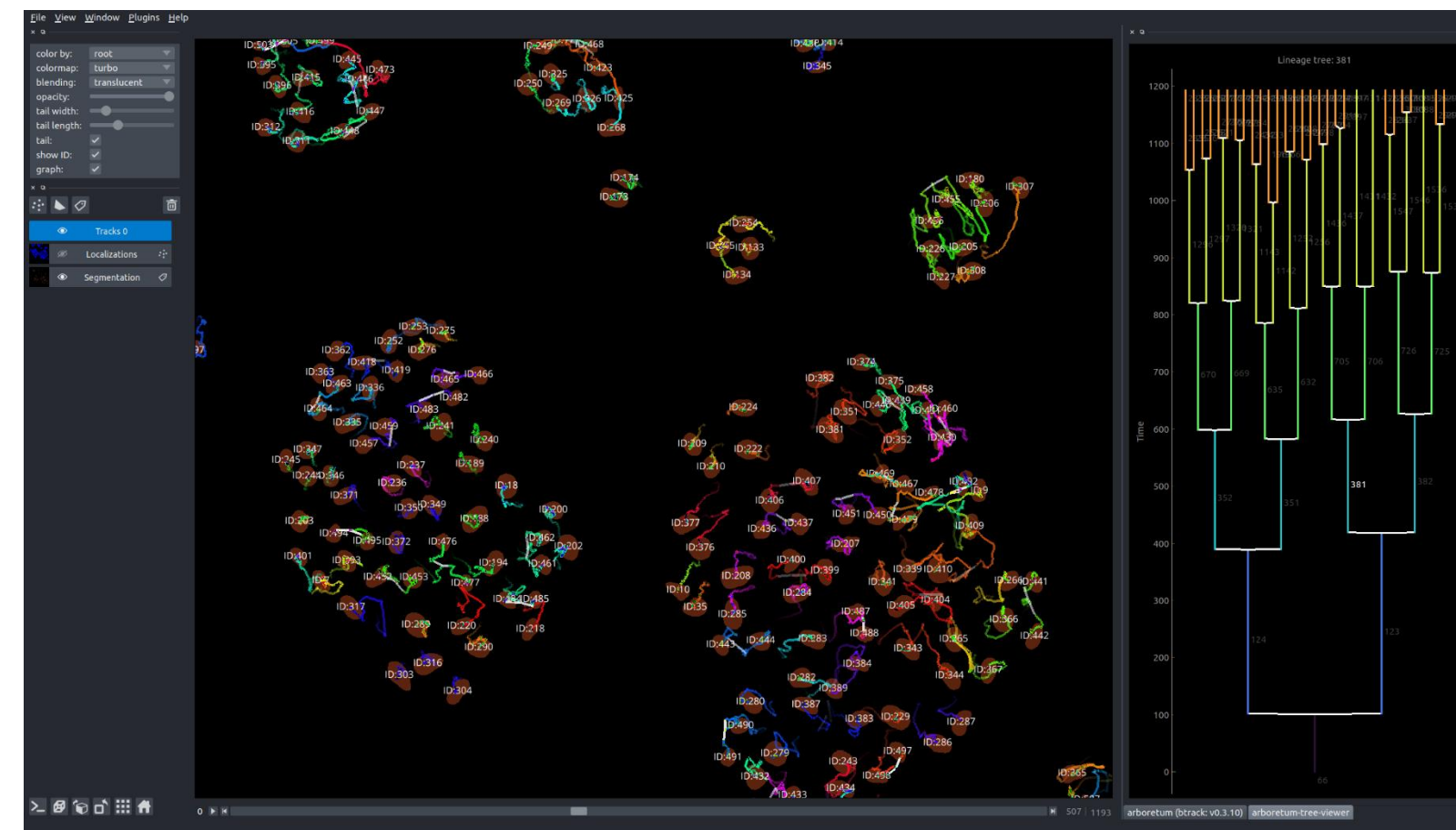
<https://github.com/brainlobe/napari-cellfinder>

stardist



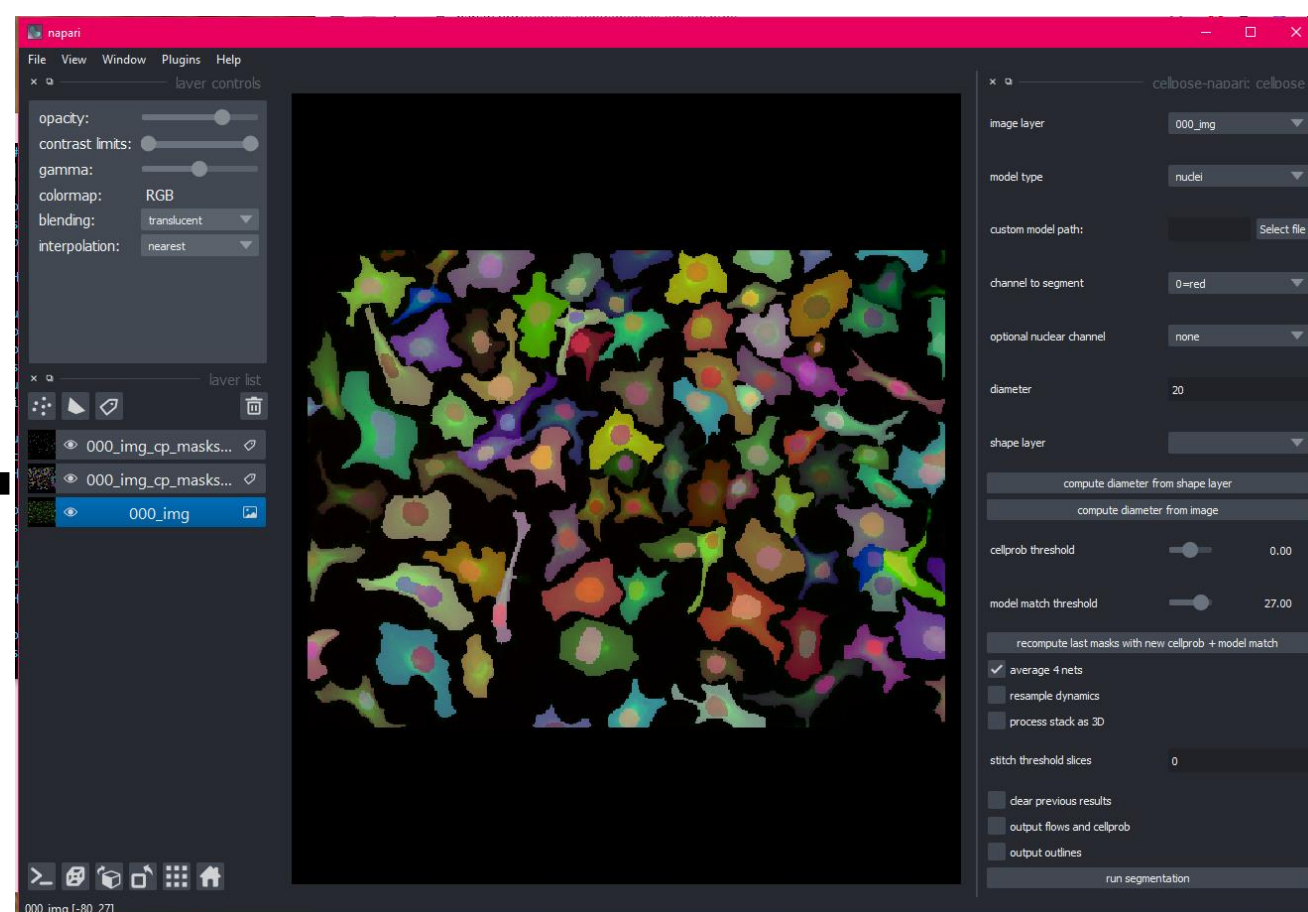
<https://github.com/stardist/stardist-napari>

arboretum



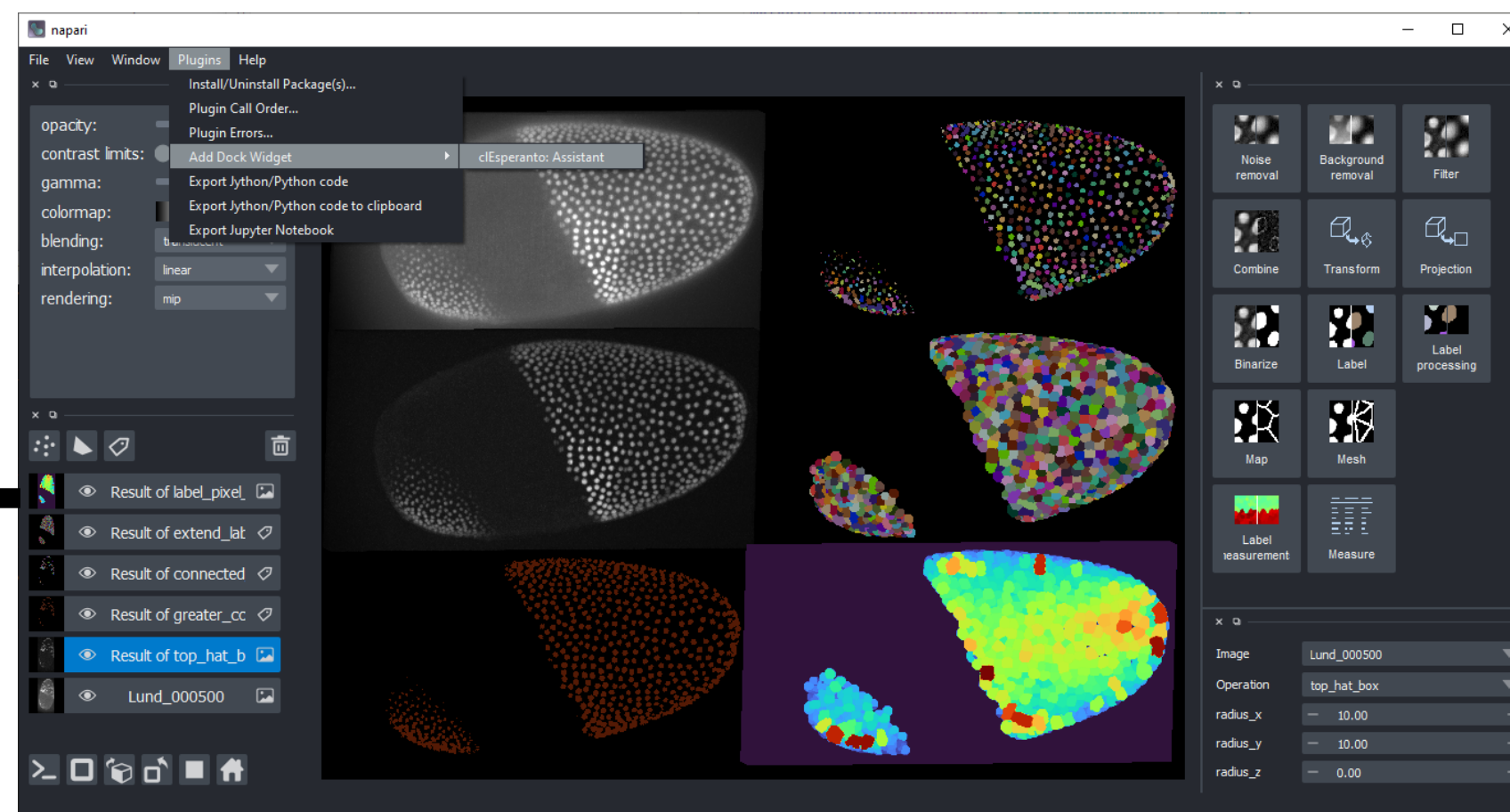
<https://github.com/quantumjot/arboretum>

cellpose



<https://cellpose-napari.readthedocs.io/en/latest/>

clesperanto



[https://github.com/clEsperanto/napari\\_pyclesperanto\\_assistant](https://github.com/clEsperanto/napari_pyclesperanto_assistant)



@haesleinhuepf  
@PoLDresden

In development: <https://github.com/topics/napari-plugin>

Released: <https://pypi.org/search/?q=&o=&c=Framework+%3A%3A+napari>



**TECHNISCHE  
UNIVERSITÄT  
DRESDEN**

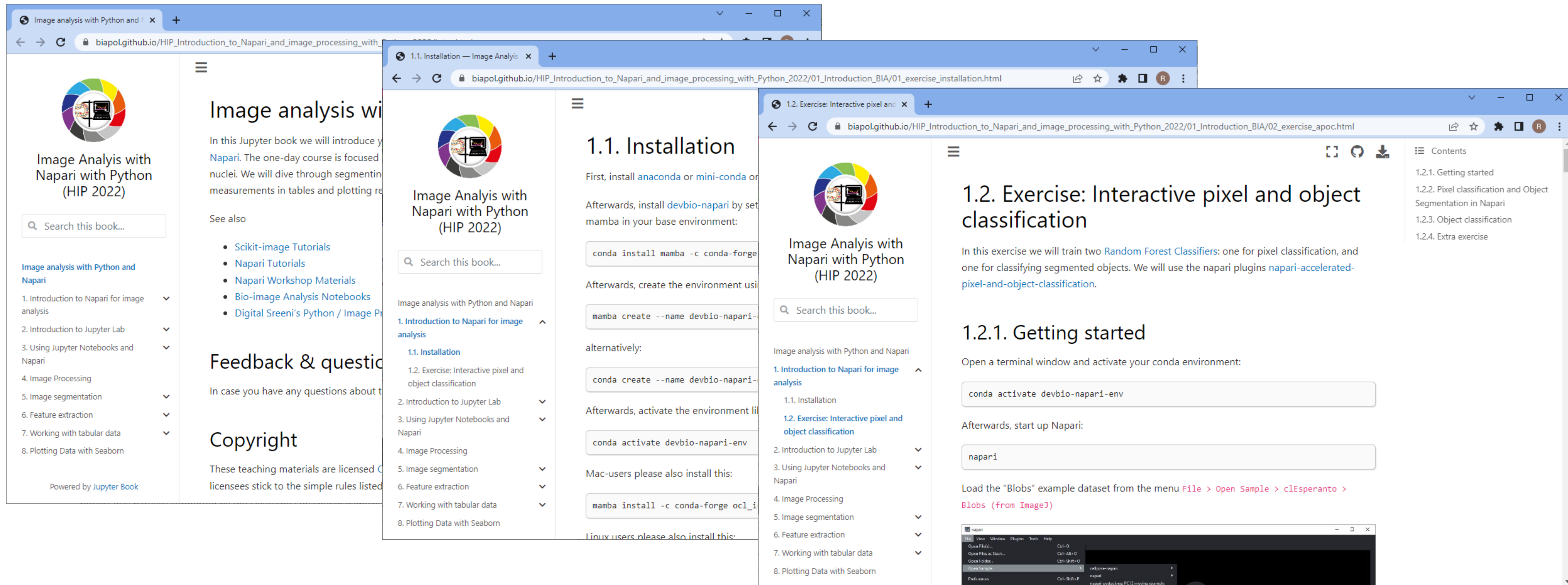
DRESDEN  
concept





# Exercises

Explore the Jupyter Book for our course today



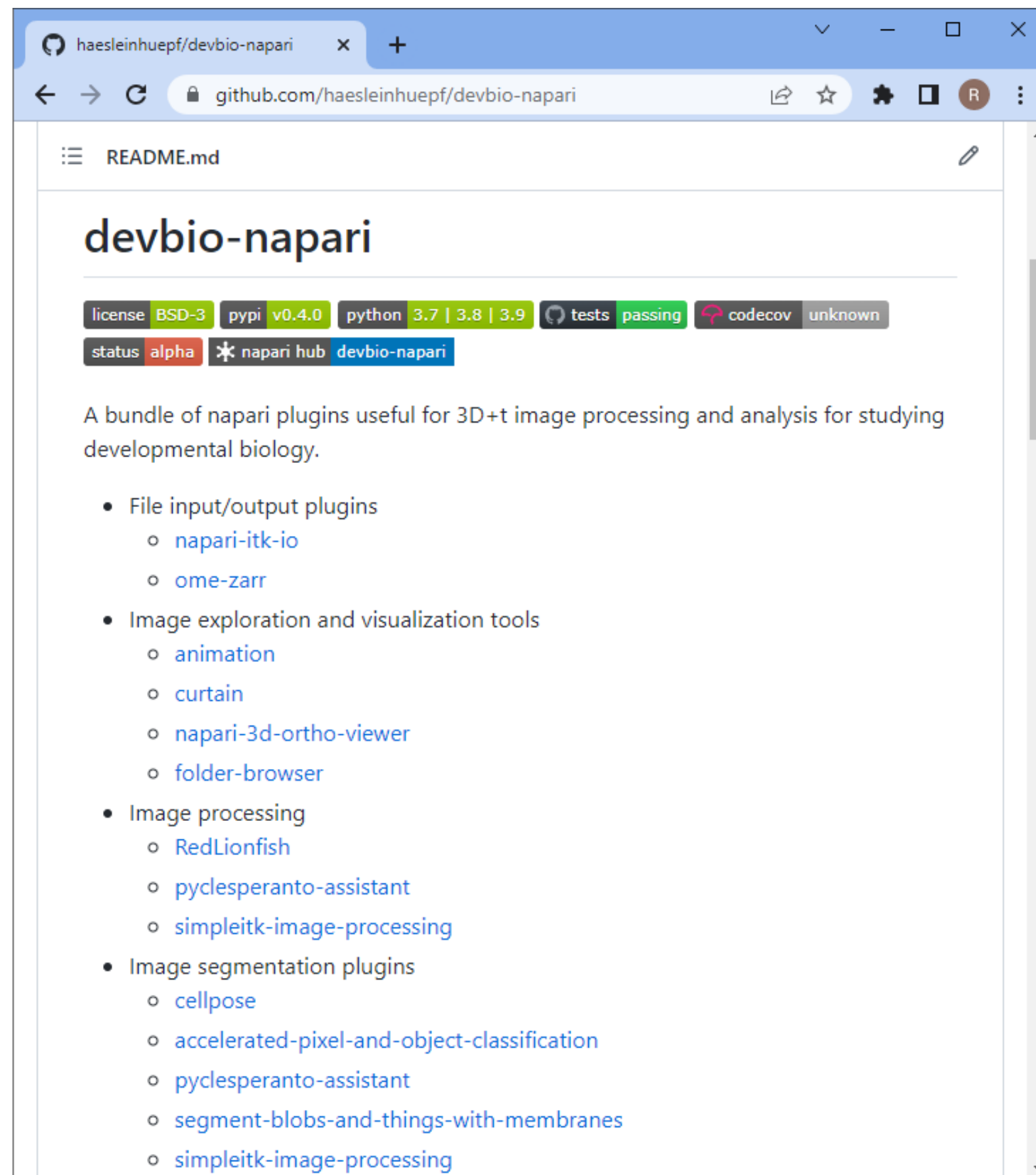
The image shows a collage of four browser windows displaying the Jupyter Book interface for "Image Analysis with Napari with Python (HIP 2022)".

- The top-left window shows the main book page with the title "Image Analysis with Napari with Python (HIP 2022)" and a search bar.
- The top-right window shows the "1.1. Installation" section, detailing the steps to install the environment using conda or mamba, and providing code snippets for creating and activating the environment.
- The bottom-left window shows the "1.2. Exercise: Interactive pixel and object classification" section, which includes instructions on how to start the exercise and a terminal window showing the execution of the 'napari' command.
- The bottom-right window shows the "1.2.1. Getting started" subsection, which provides further instructions on how to load the "Blobs" example dataset.



# Exercise: Install devbio-napari

A collection of napari plugins for developmental biologists



haesleinhuepf/devbio-napari

github.com/haesleinhuepf/devbio-napari

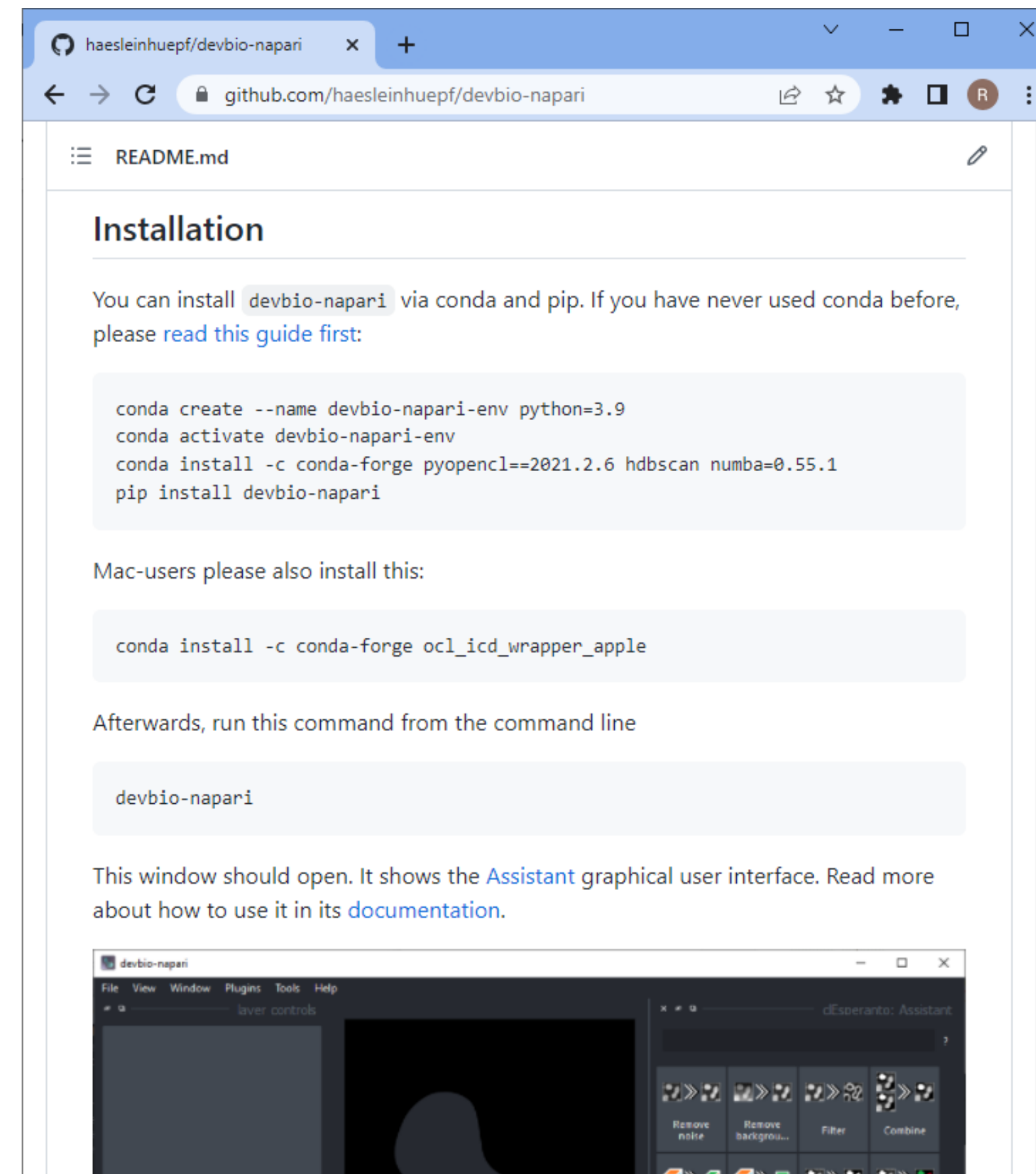
## devbio-napari

license BSD-3 pypi v0.4.0 python 3.7 | 3.8 | 3.9 tests passing codecov unknown

status alpha \* napari hub devbio-napari

A bundle of napari plugins useful for 3D+t image processing and analysis for studying developmental biology.

- File input/output plugins
  - napari-itk-io
  - ome-zarr
- Image exploration and visualization tools
  - animation
  - curtain
  - napari-3d-ortho-viewer
  - folder-browser
- Image processing
  - RedLionfish
  - pyclesperanto-assistant
  - simpleitk-image-processing
- Image segmentation plugins
  - cellpose
  - accelerated-pixel-and-object-classification
  - pyclesperanto-assistant
  - segment-blobs-and-things-with-membranes
  - simpleitk-image-processing



haesleinhuepf/devbio-napari

github.com/haesleinhuepf/devbio-napari

## Installation

You can install `devbio-napari` via conda and pip. If you have never used conda before, please [read this guide first](#):

```
conda create --name devbio-napari-env python=3.9
conda activate devbio-napari-env
conda install -c conda-forge pyopenc1==2021.2.6 hdbscan numba=0.55.1
pip install devbio-napari
```

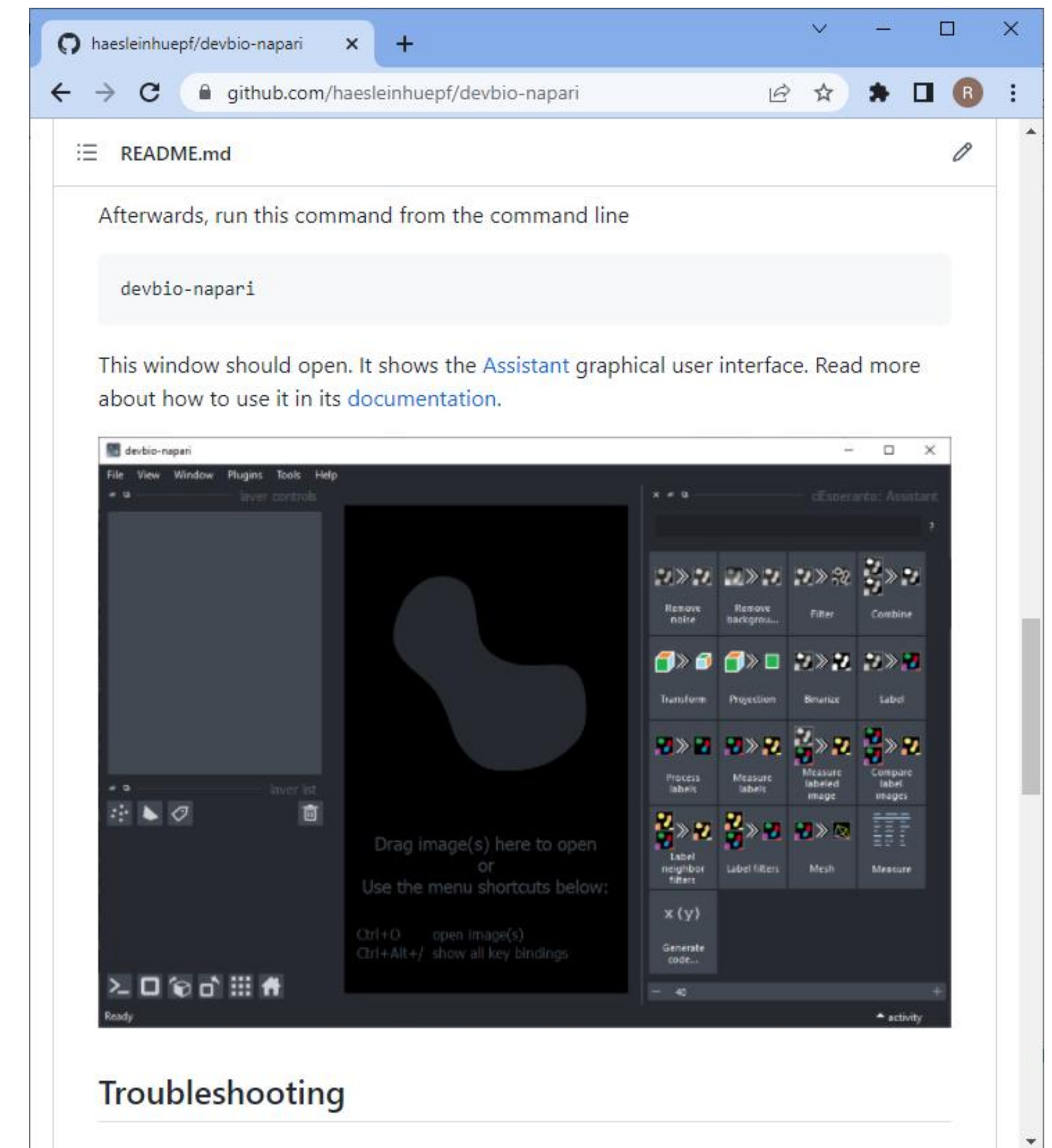

Mac-users please also install this:

```
conda install -c conda-forge ocl_icd_wrapper_apple
```

Afterwards, run this command from the command line

```
devbio-napari
```

This window should open. It shows the [Assistant](#) graphical user interface. Read more about how to use it in its [documentation](#).



haesleinhuepf/devbio-napari

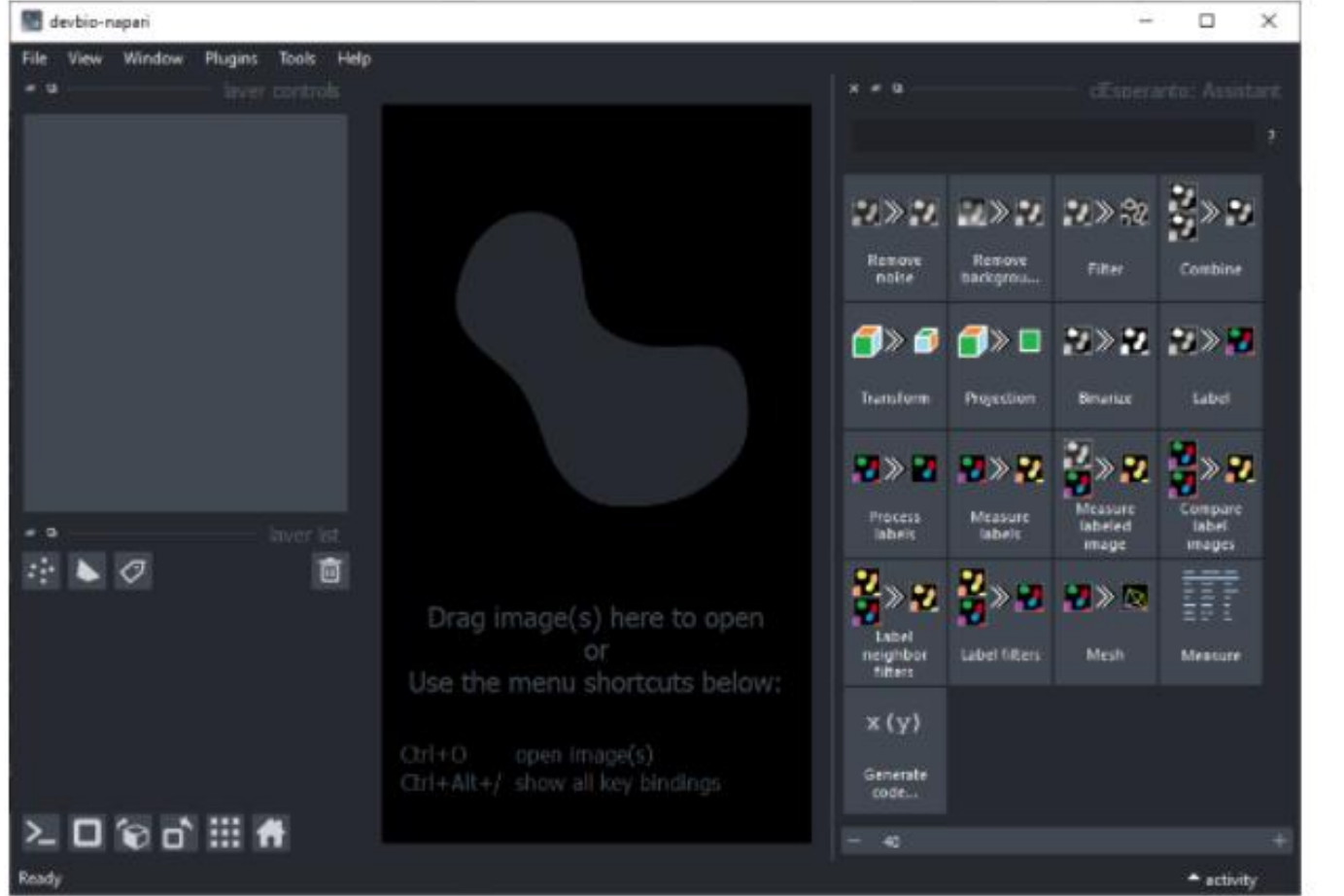
github.com/haesleinhuepf/devbio-napari

## Troubleshooting

Afterwards, run this command from the command line

```
devbio-napari
```

This window should open. It shows the [Assistant](#) graphical user interface. Read more about how to use it in its [documentation](#).





# Exercise: Pixel and object classification

Segment and classify the blobs in this image.

