PoL Physics of Life TU Dresden

CENTER FOR SYSTEMS BIOLOGY DRESDEN

Quantiative Bio-image Analysis with Python and Napari

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@haesleinhuepf
@PoLDresden

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TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

The team

Marcelo Leomil Zoccoler

Robert Haase

Credits: Hagen

Napari-animation

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Making animations – as easy as it gets

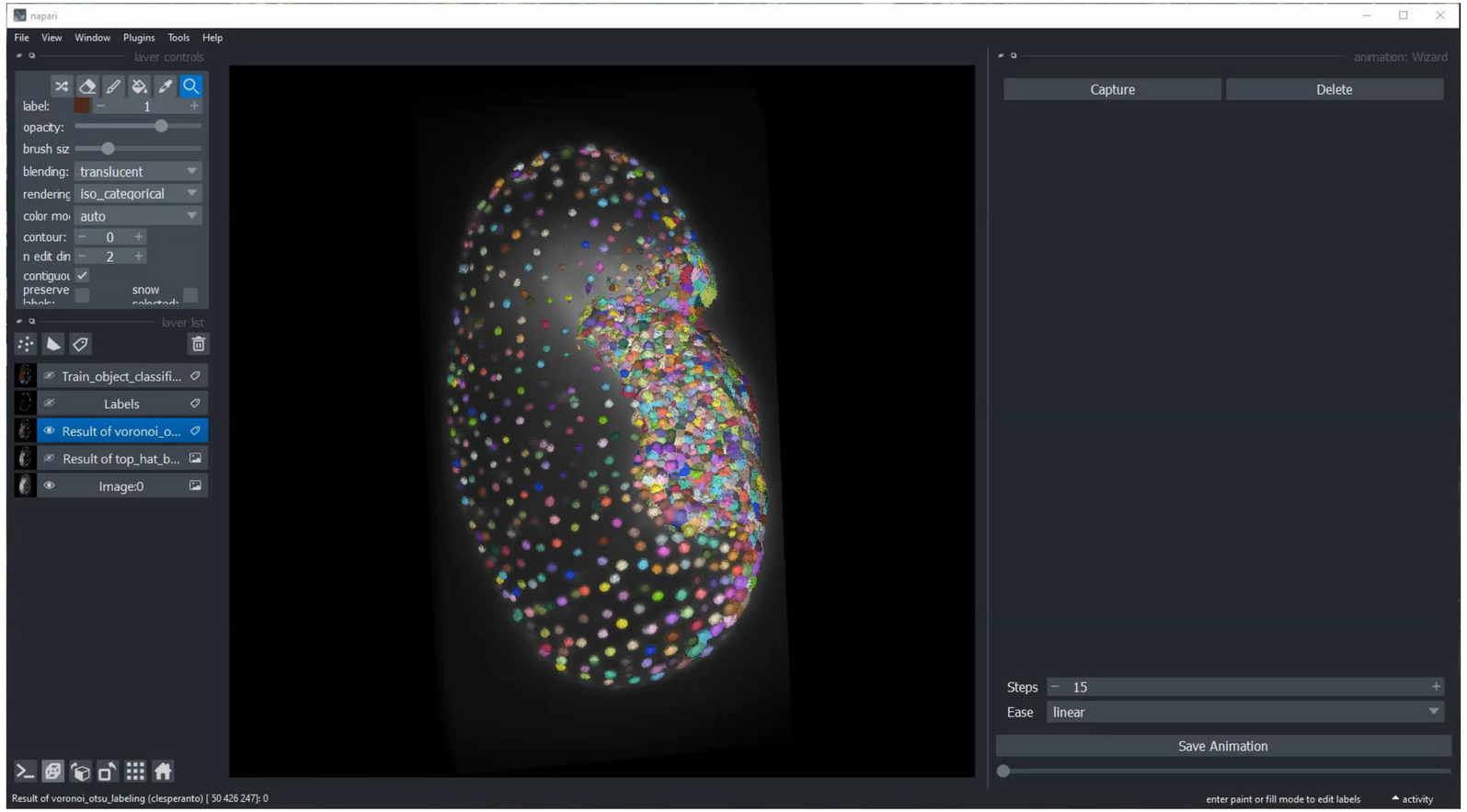

Image data source: Daniela Vorkel, Myers lab, MPI-CBG/CSBD

Napari-animation

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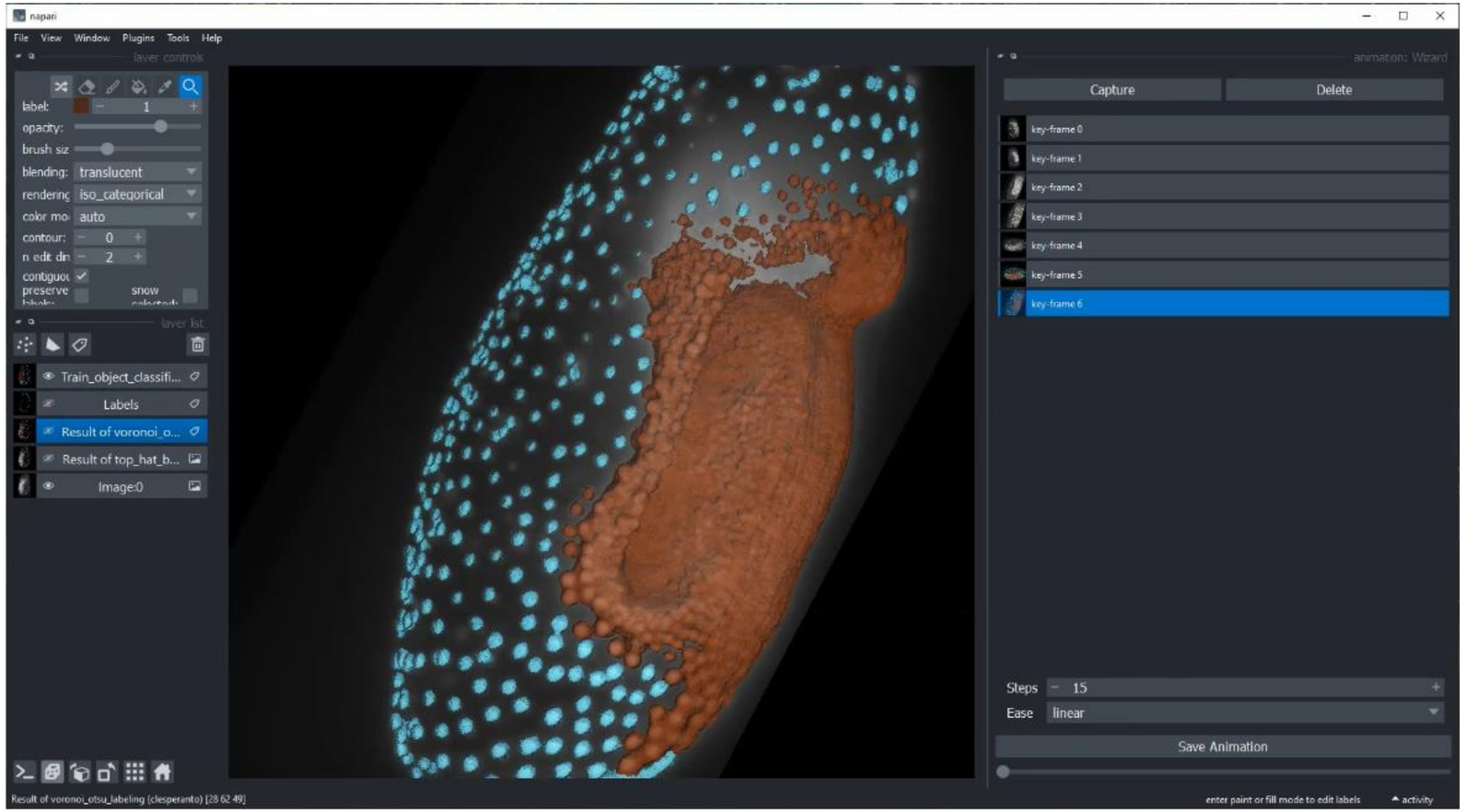
Making animations – as easy as it gets



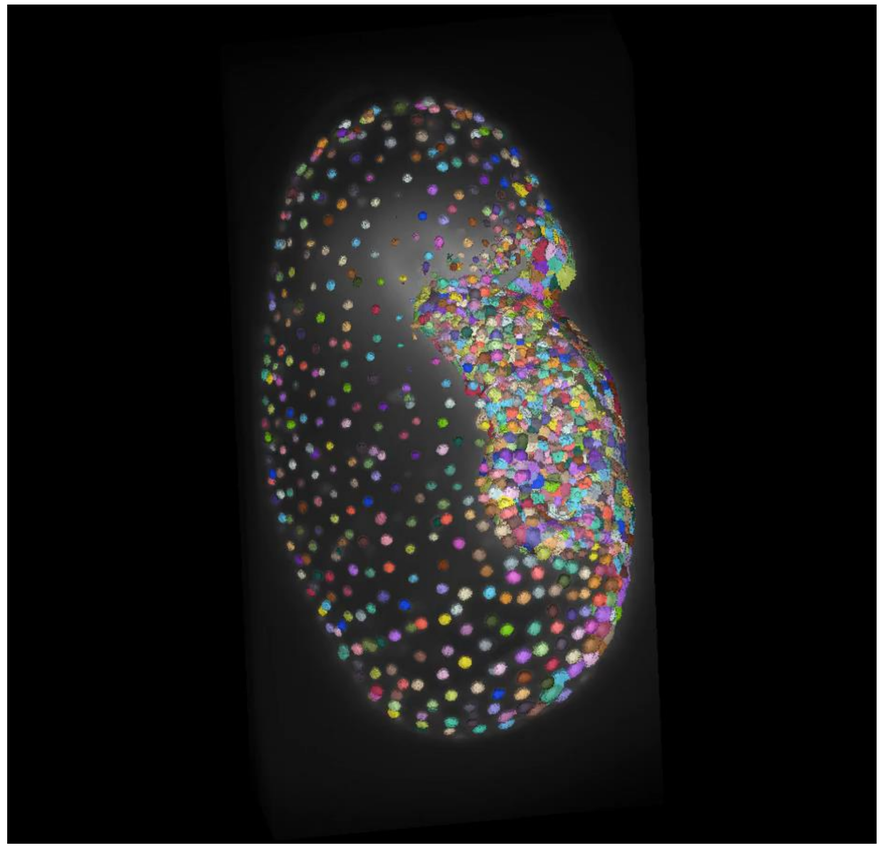


Image data source: Daniela Vorkel, Myers lab, MPI-CBG/CSBD

Napari, segment blobs and things with membranes!

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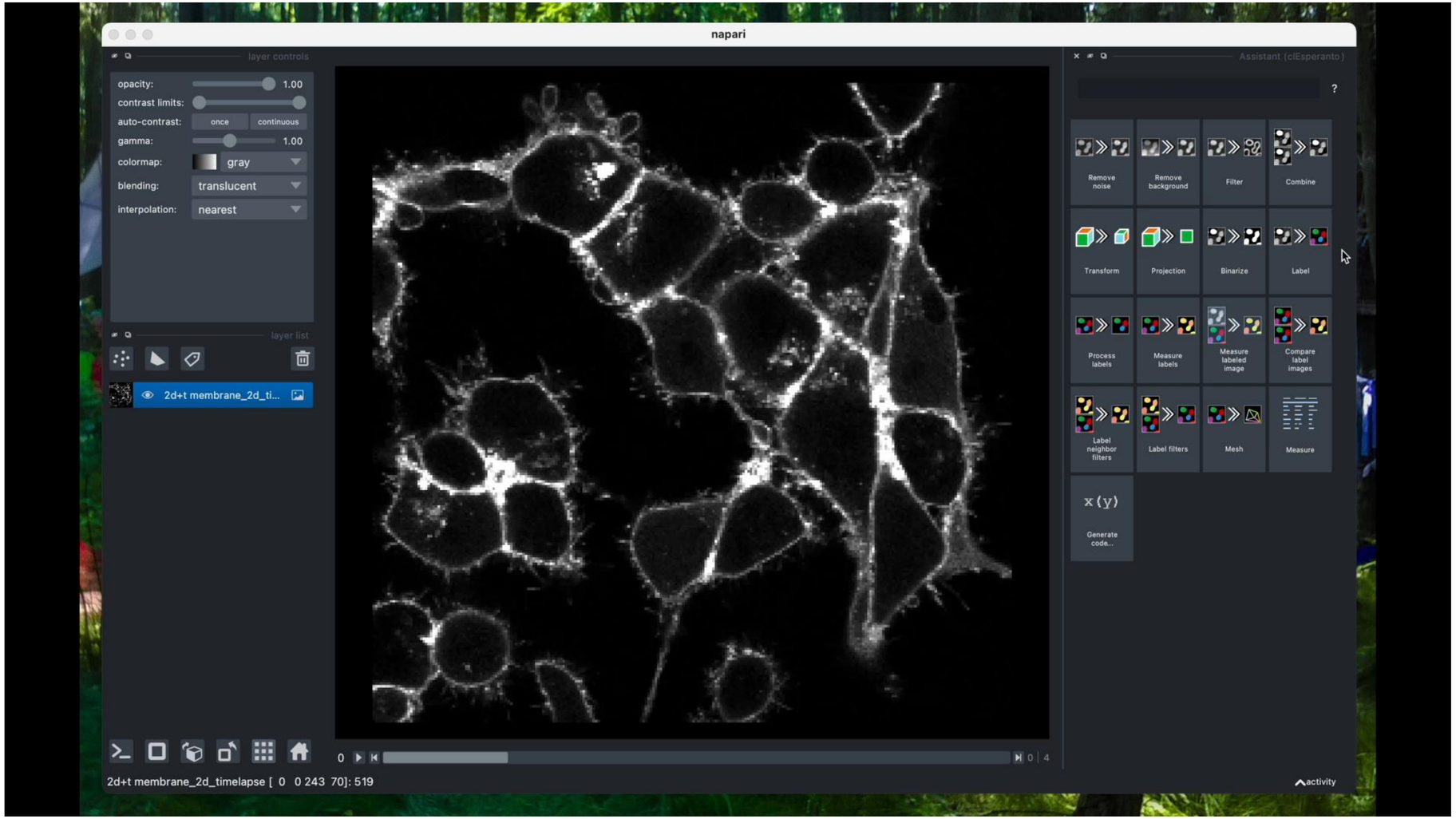
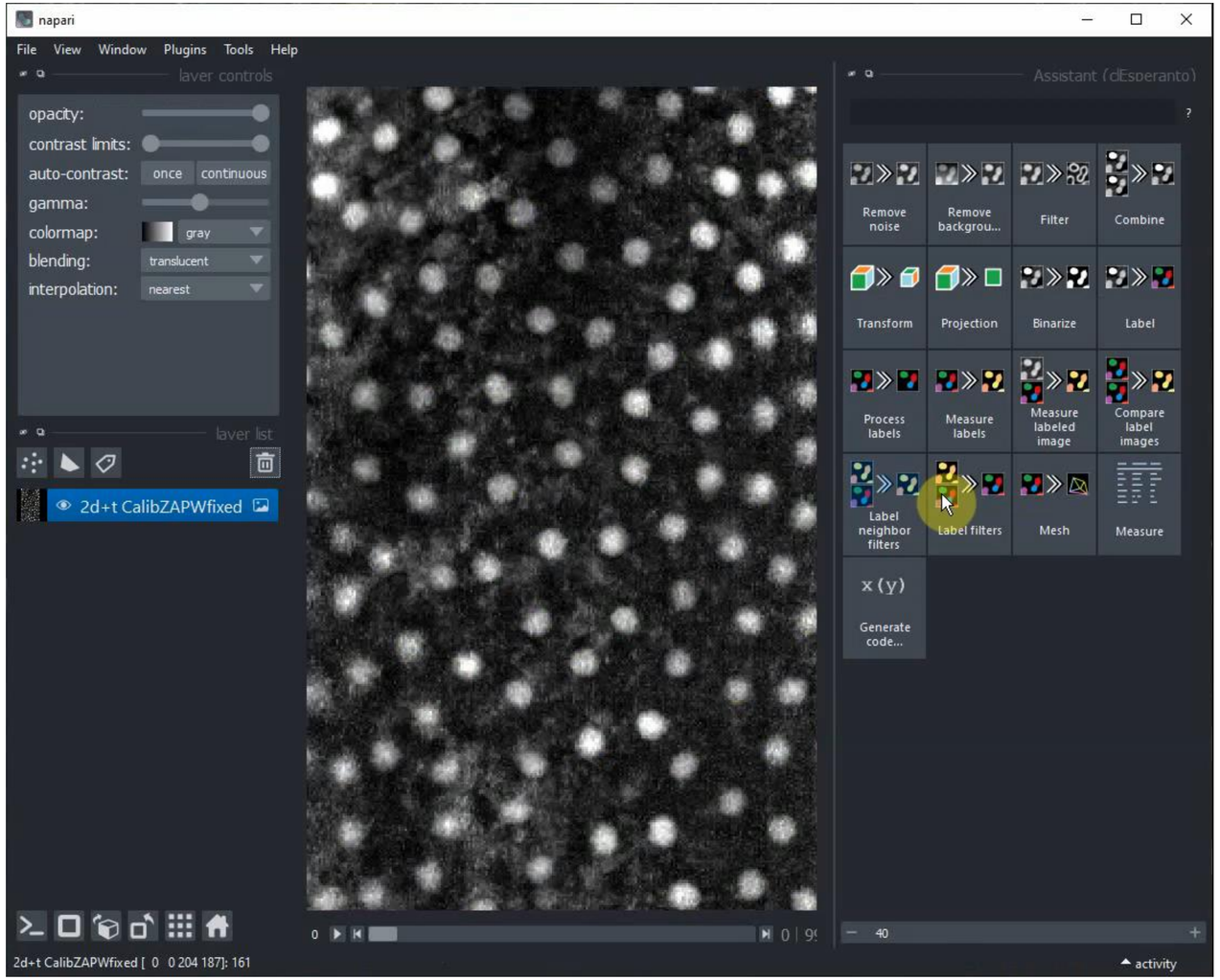
- Filtering,
- thresholding,
- spot detection,
- seeded watershed segmentation,
- Voronoi-Otsu-labeling



Napari + pyclesperanto + assistant

PoL
Physics of Life
TU Dresden

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



napari-simpleitk-image-processing

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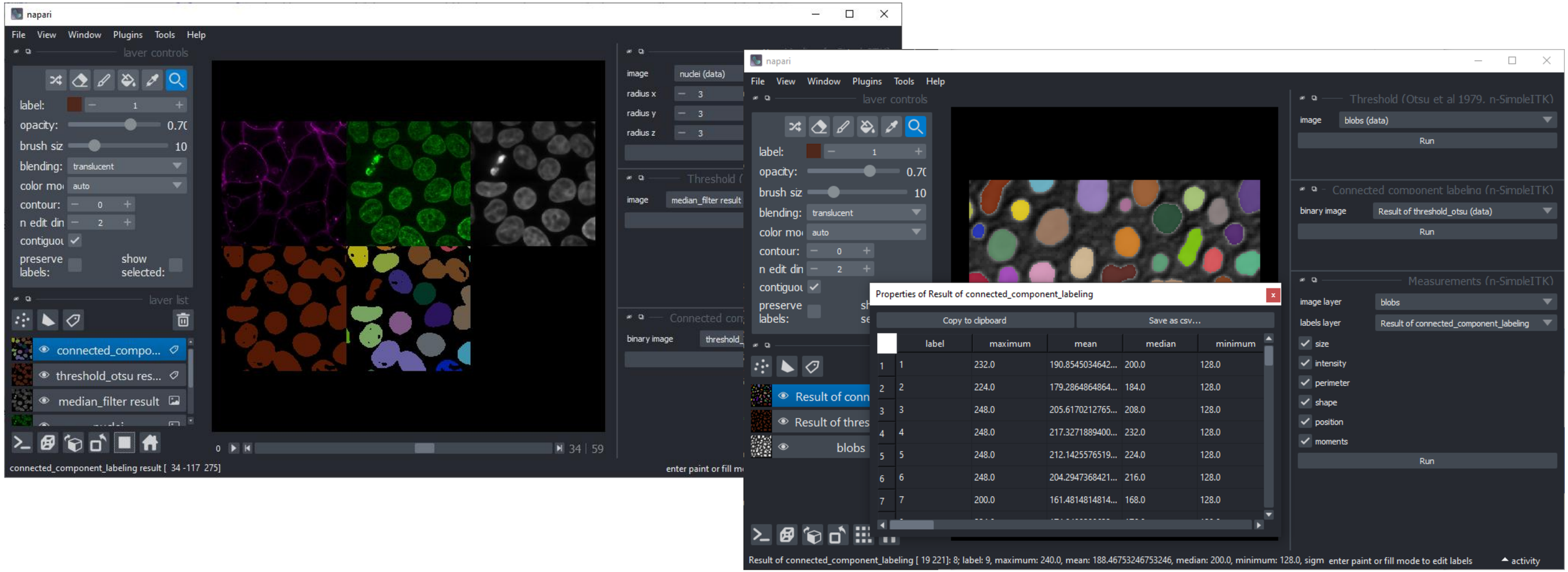
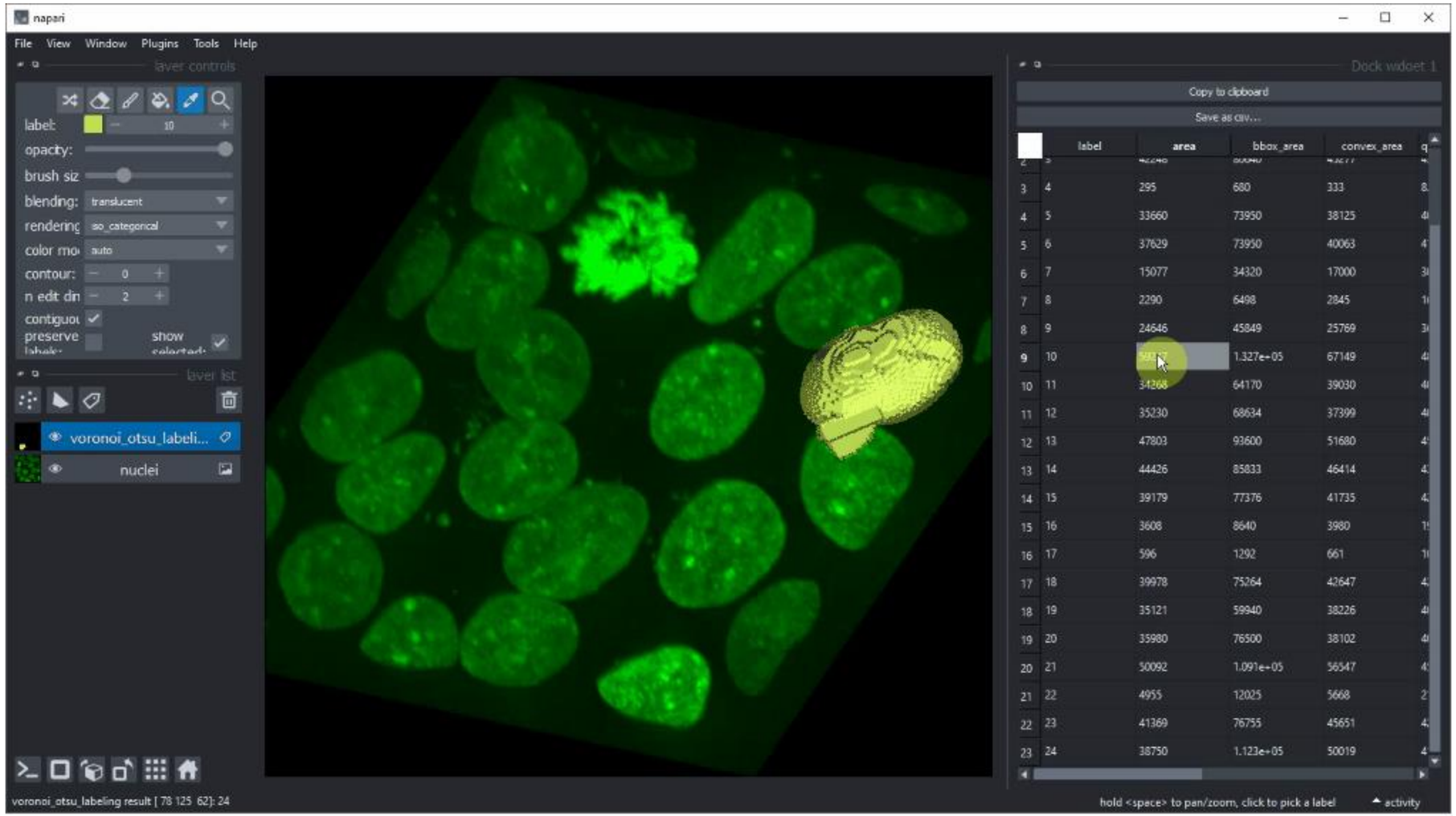
Recommended for 3D-measurements, based on the SimpleITK-project



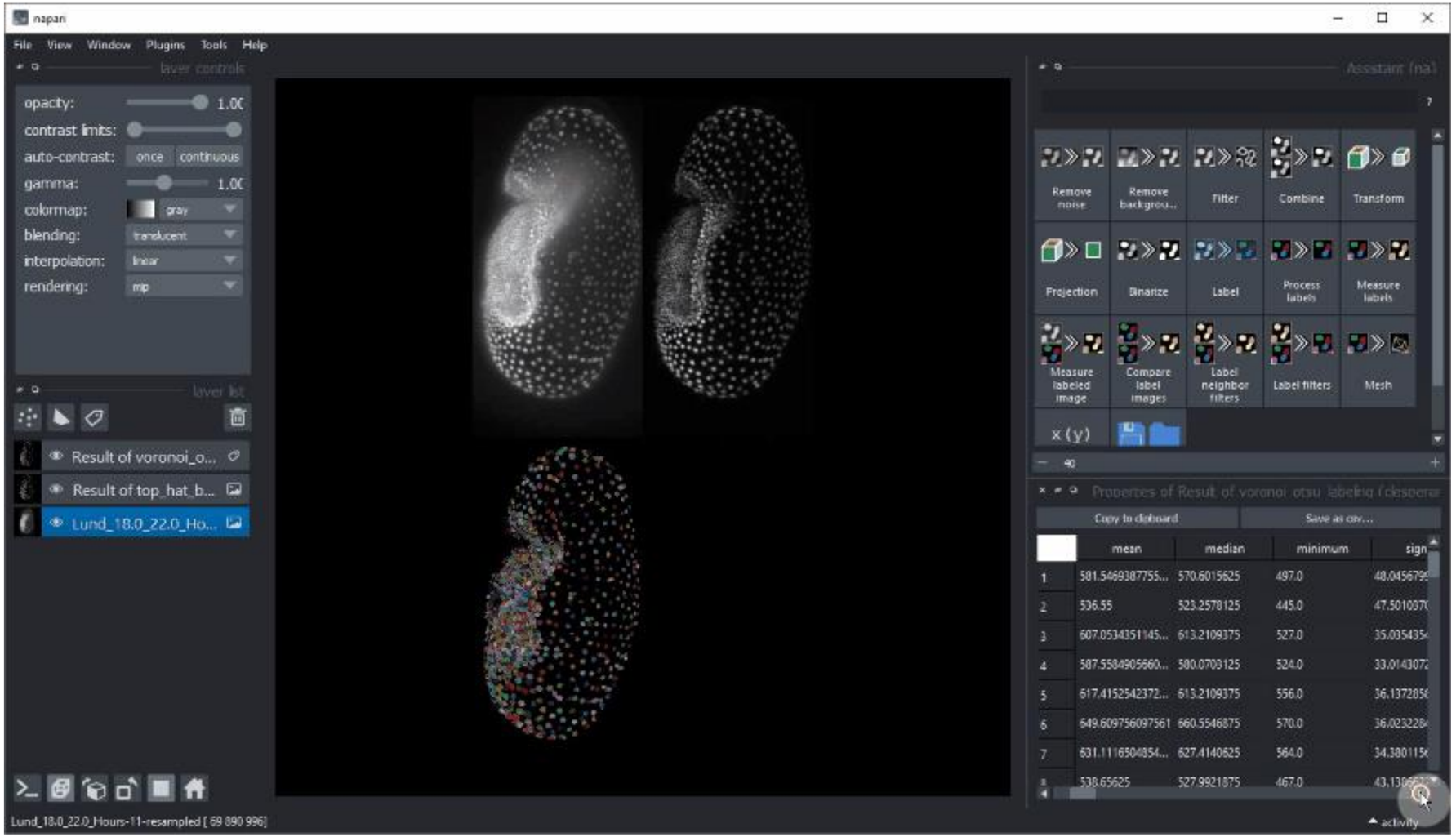
Data exploration

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



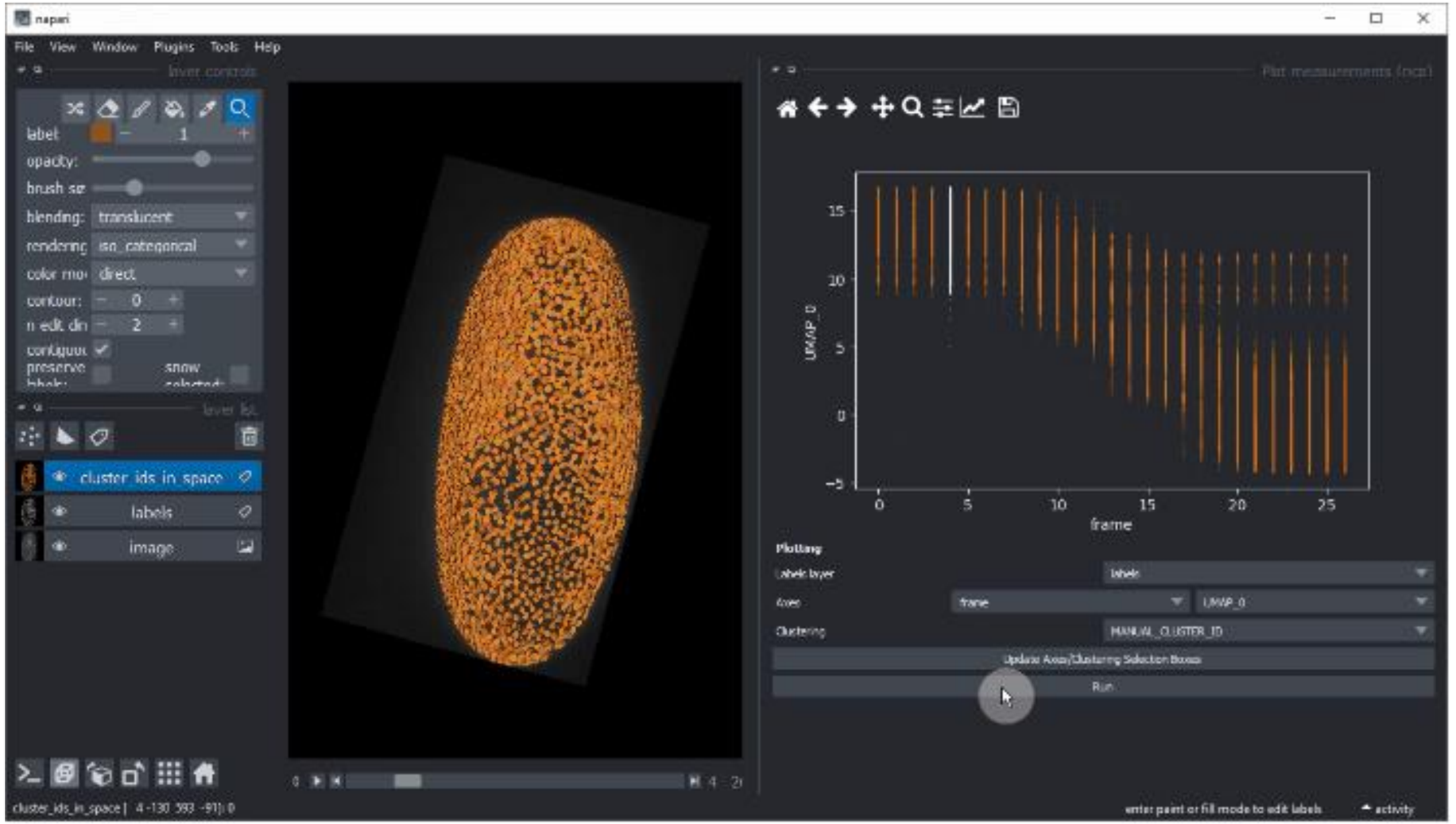
Data exploration

- 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

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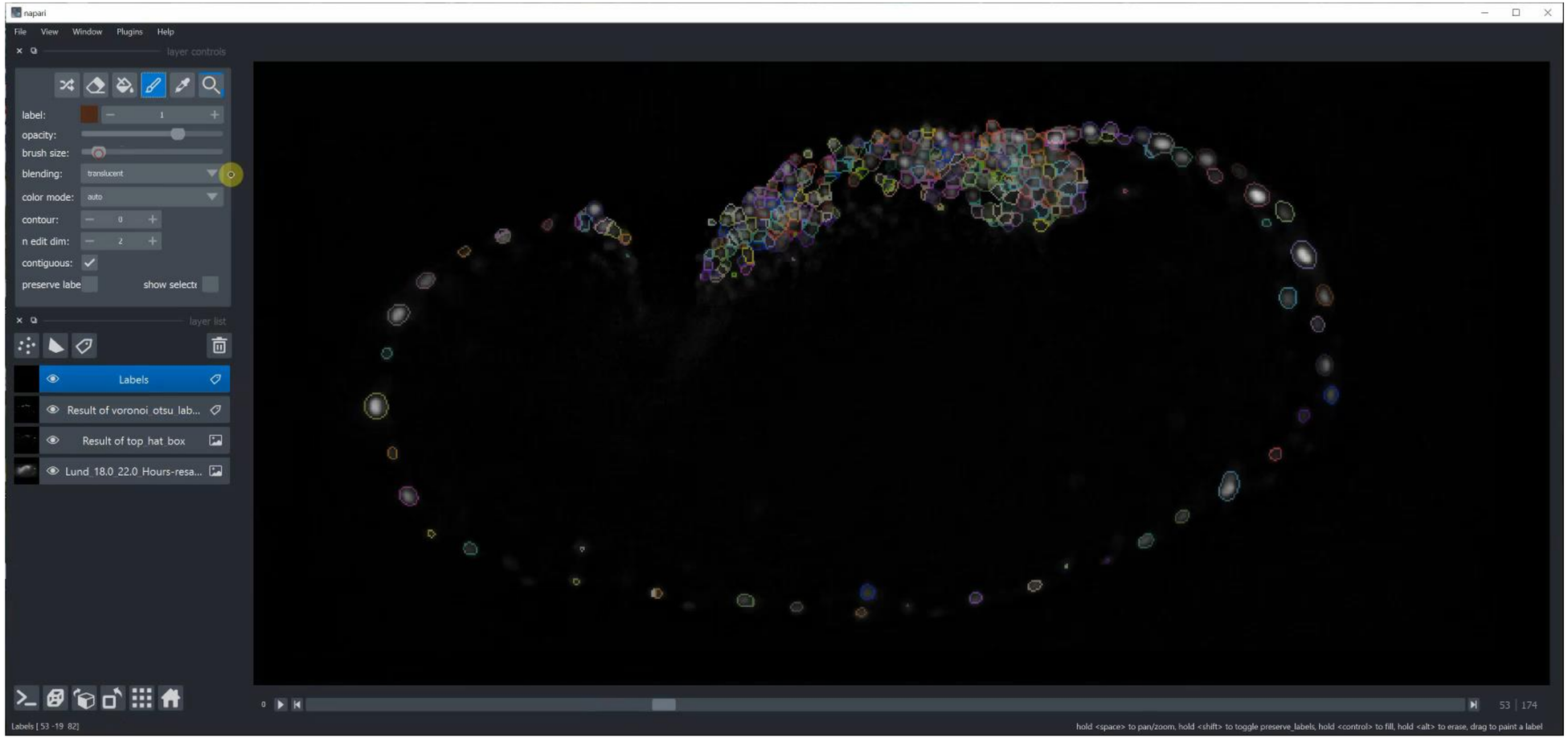
Random Forest Classifiers based on

- scikit-learn and
- clesperanto



Data exploration / supervised machine learning

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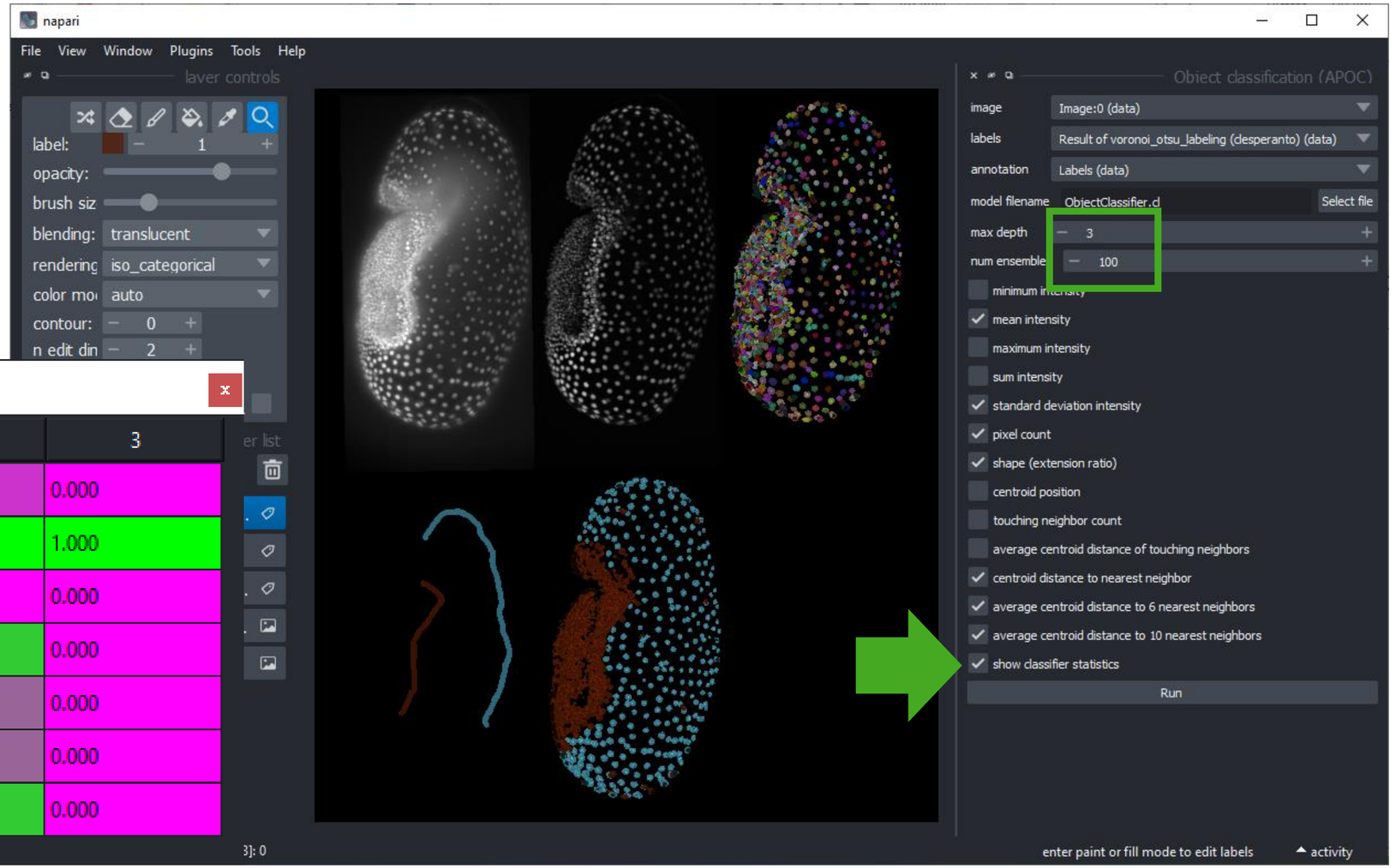
Inspect how the random forest classifier makes decisions

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

PoL Physics of Life TU Dresden

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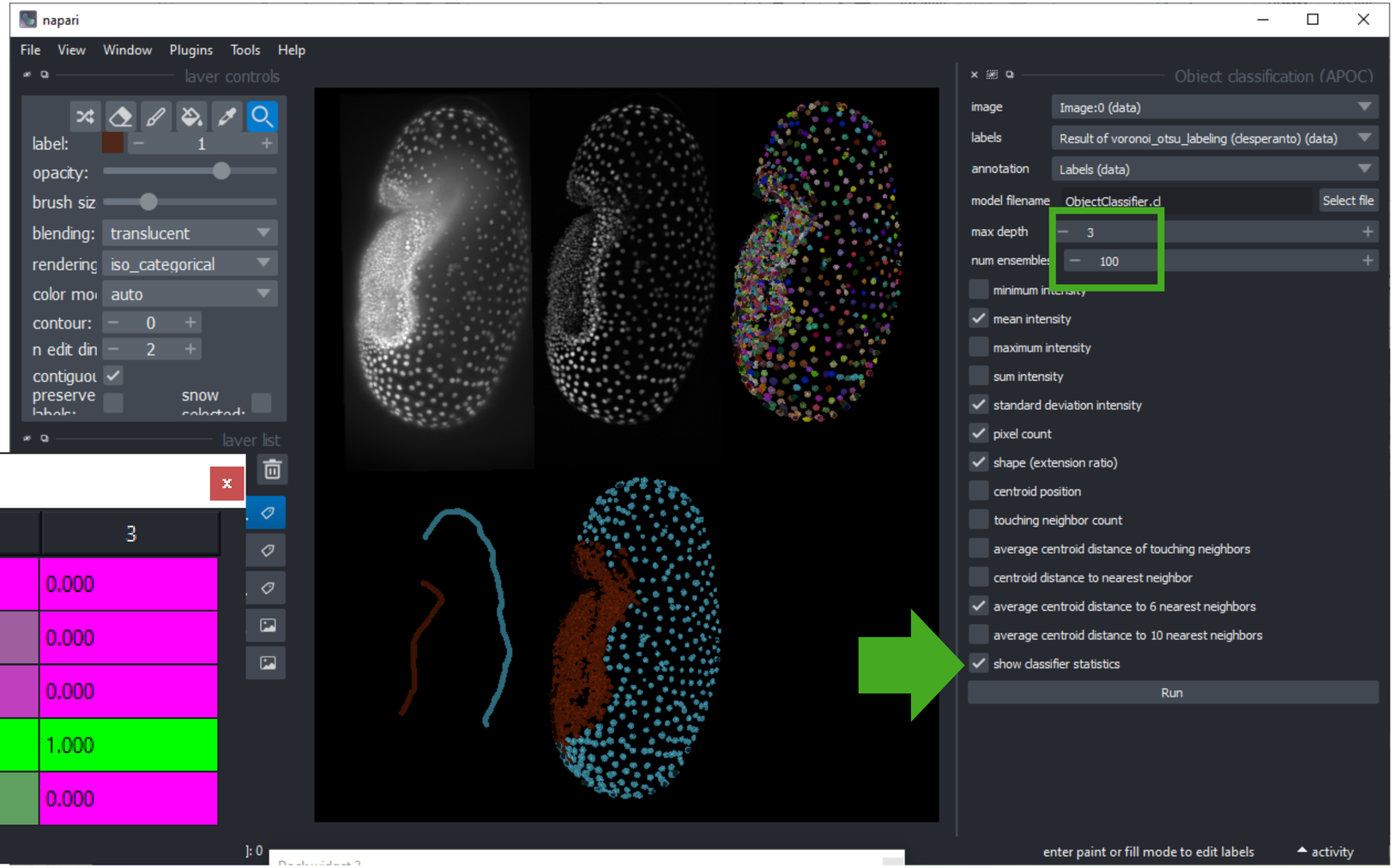

Dock widget 2

	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

Data exploration / supervised machine learning

PoL Physics of Life TU Dresden

Inspect how the random forest classifier makes decisions

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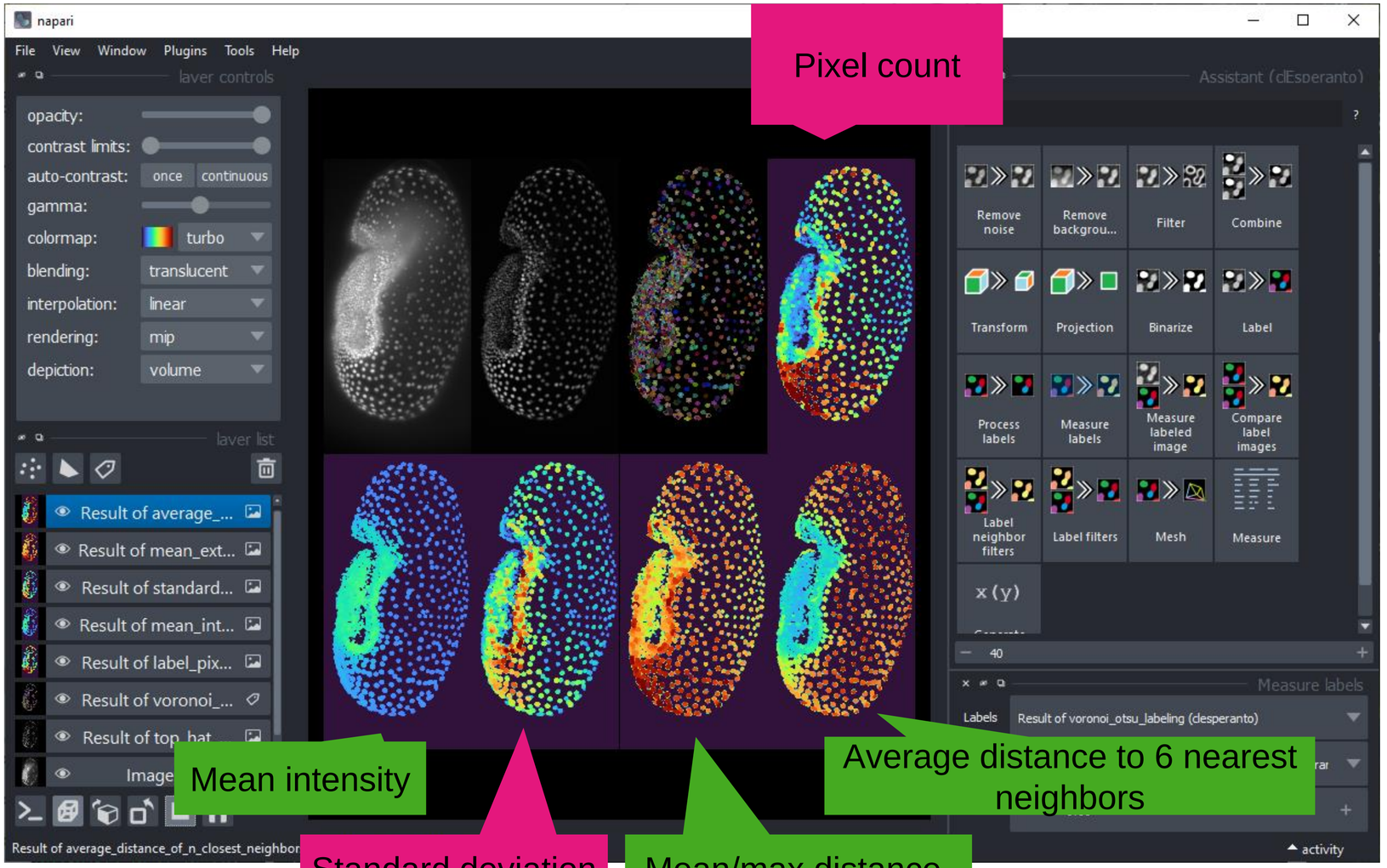

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The era of napari plugins has just begun

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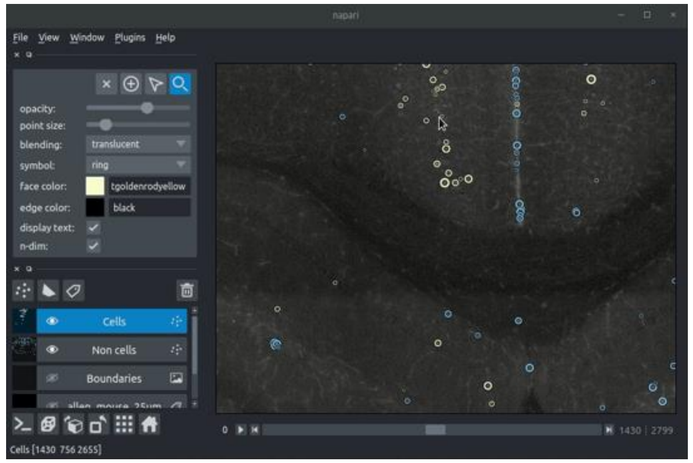
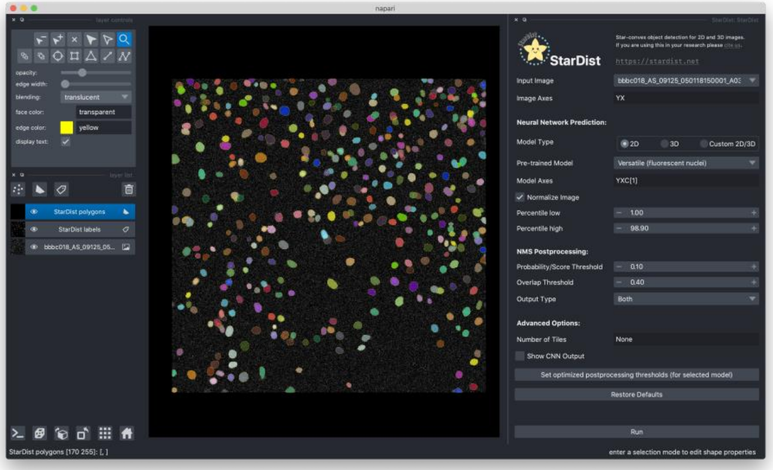
cellfinder



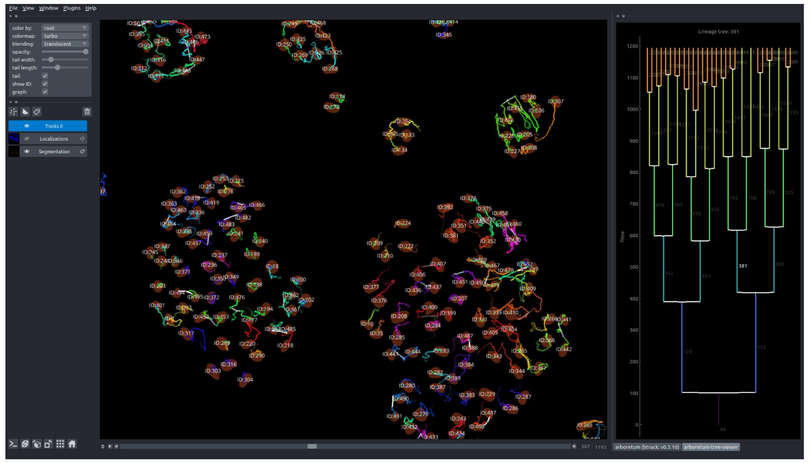
https://github.com/brainglobe/napari-cellfinder

stardist



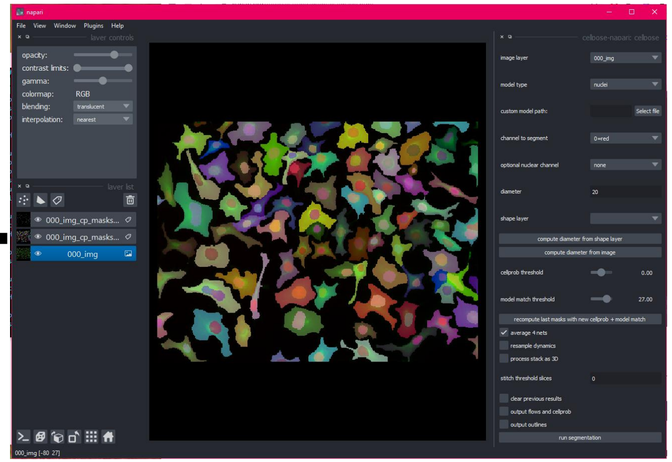
https://github.com/stardist/stardist-napari

arboretum



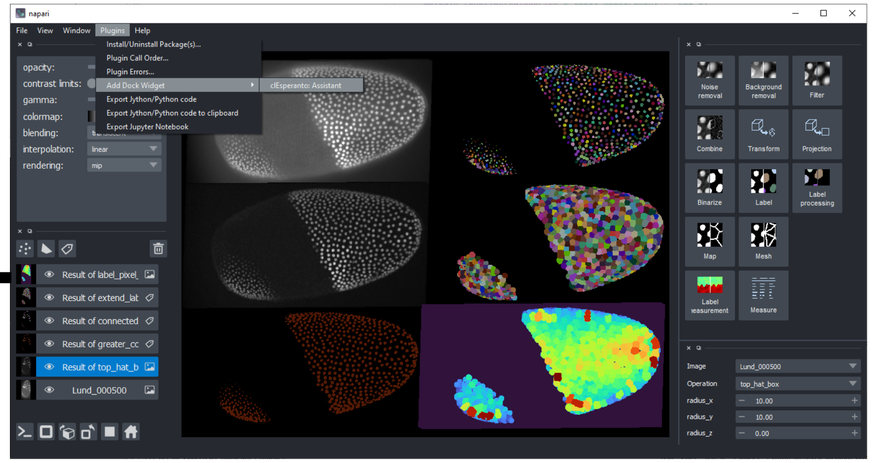
https://github.com/quantumjot/arboretum

cellpose



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

clesperanto



https://github.com/clEsperanto/napari_pyclesperanto_assistant

Exercises

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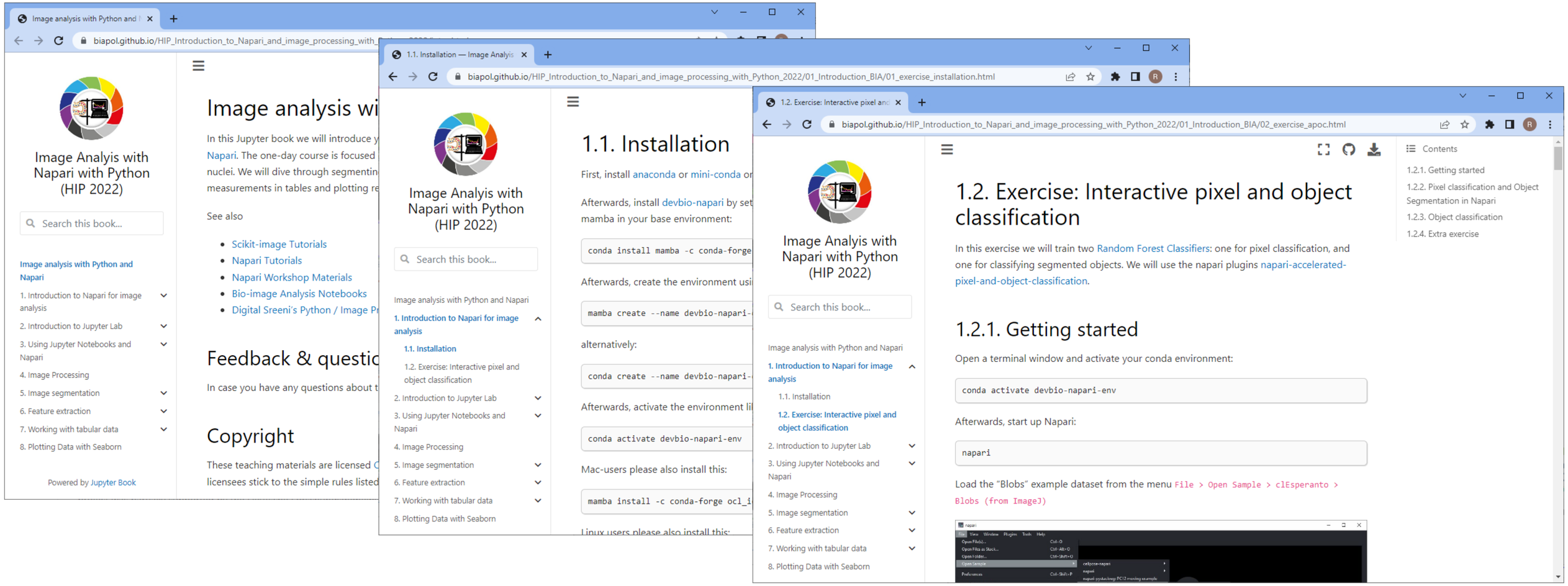
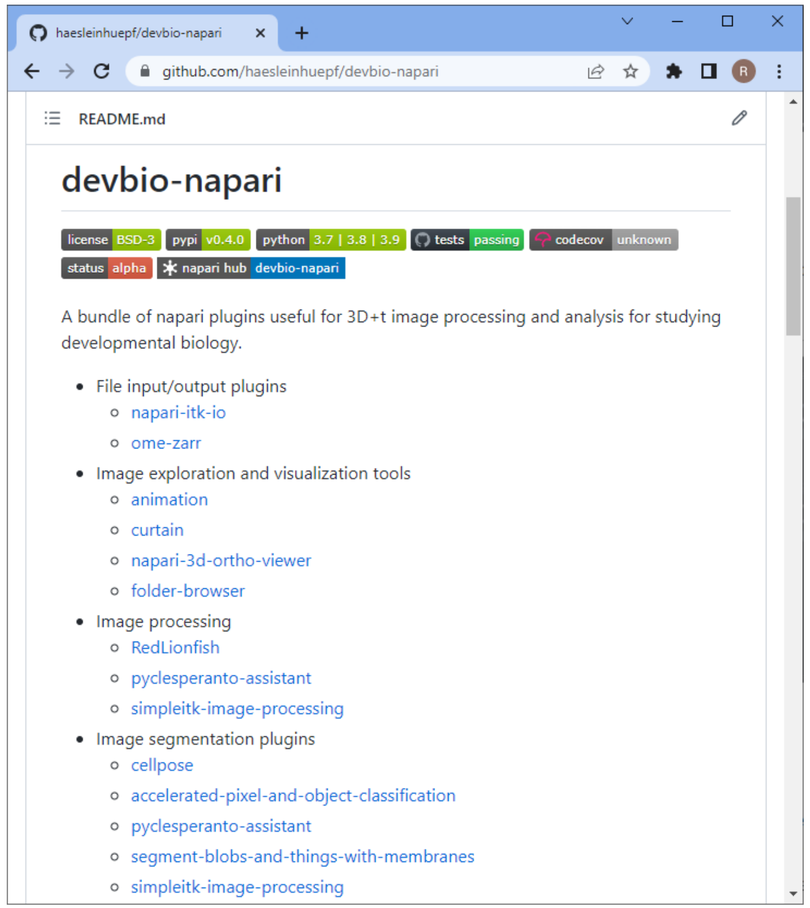
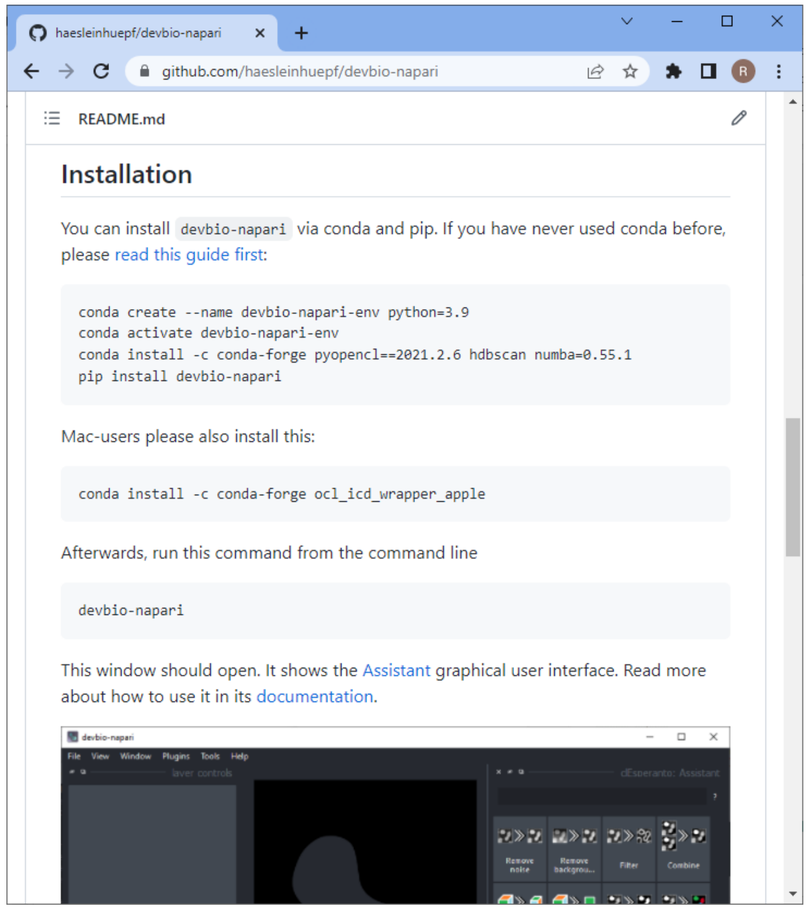
Explore the Jupyter Book for our course today

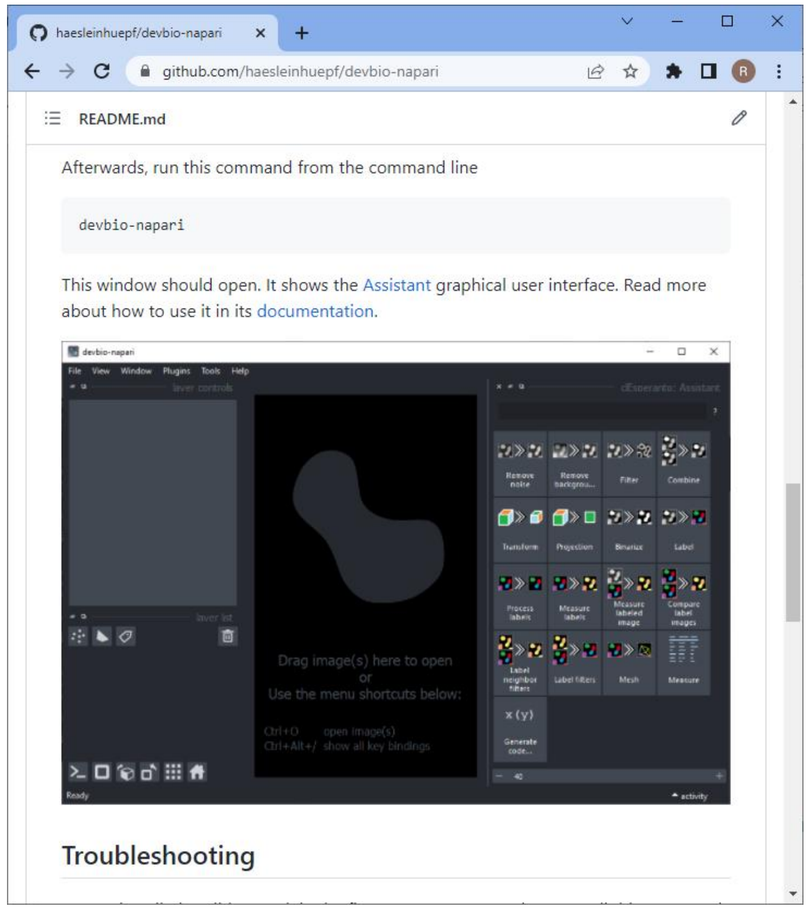


Exercise: Install devbio-napari

A collection of napari plugins for developmental biologists







Exercise: Pixel and object classification

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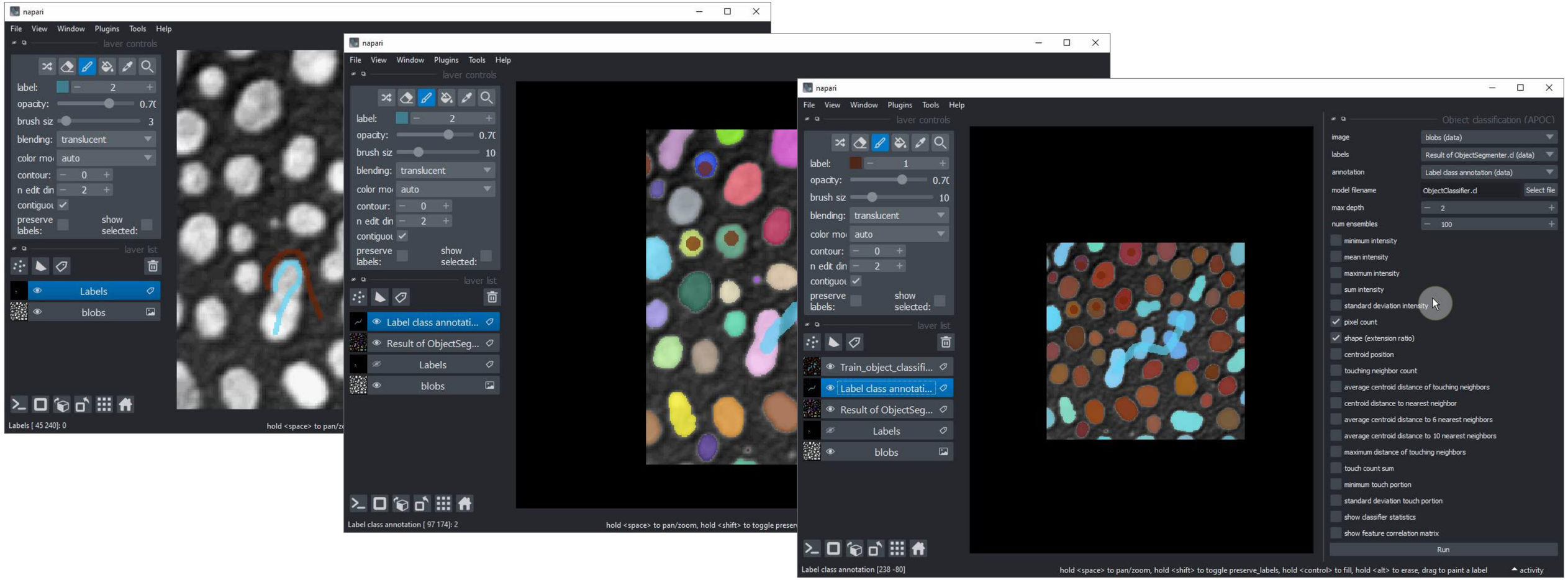
Segment and classify the blobs in this image.