PoL Physics of Life TU Dresden

CENTER FOR SYSTEMS BIOLOGY DRESDEN

PoL Bio-Image Analysis Symposium 2023
Training School Early Career Track

Introduction to Napari

Marcelo Leomil Zoccoler

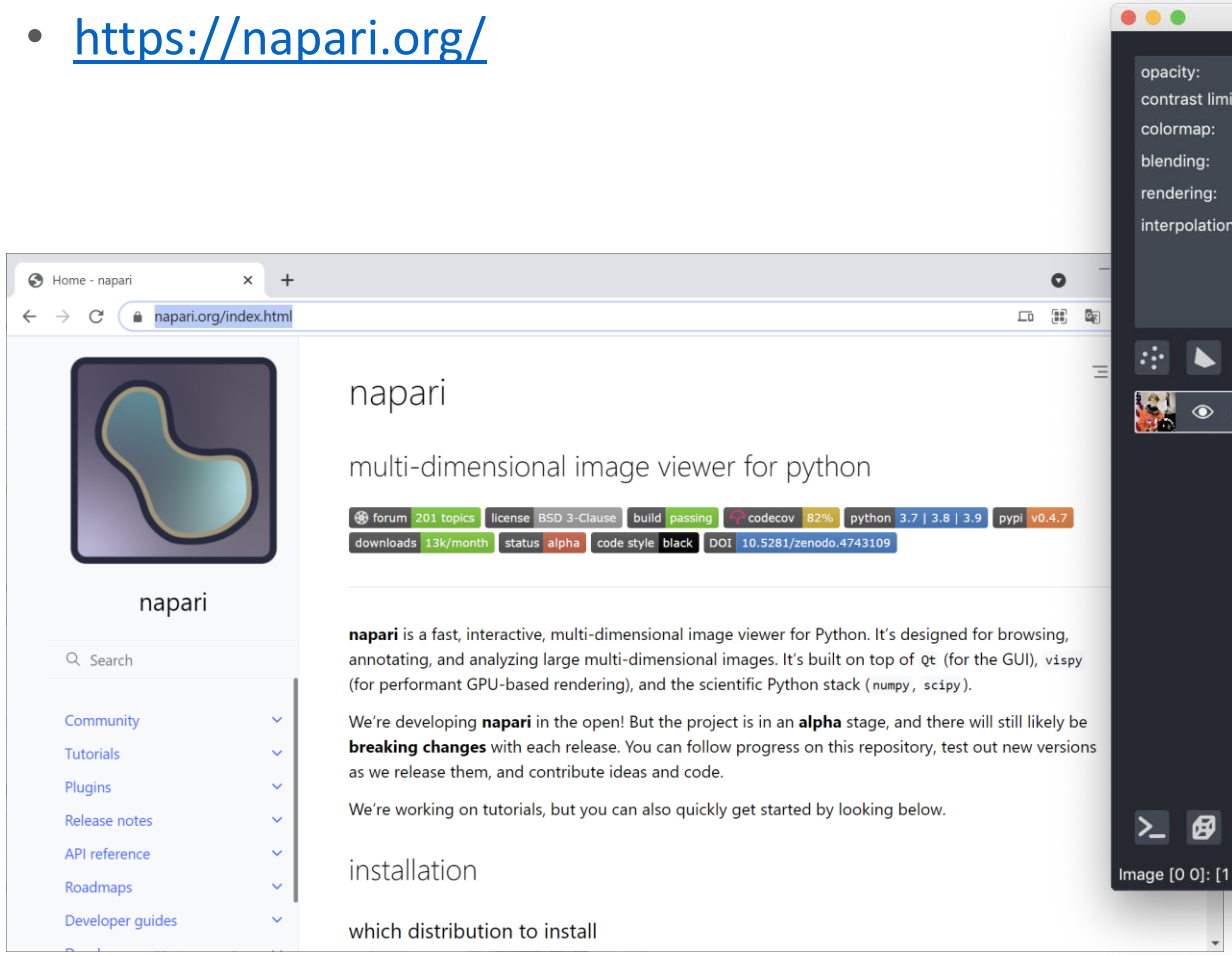
With material from:

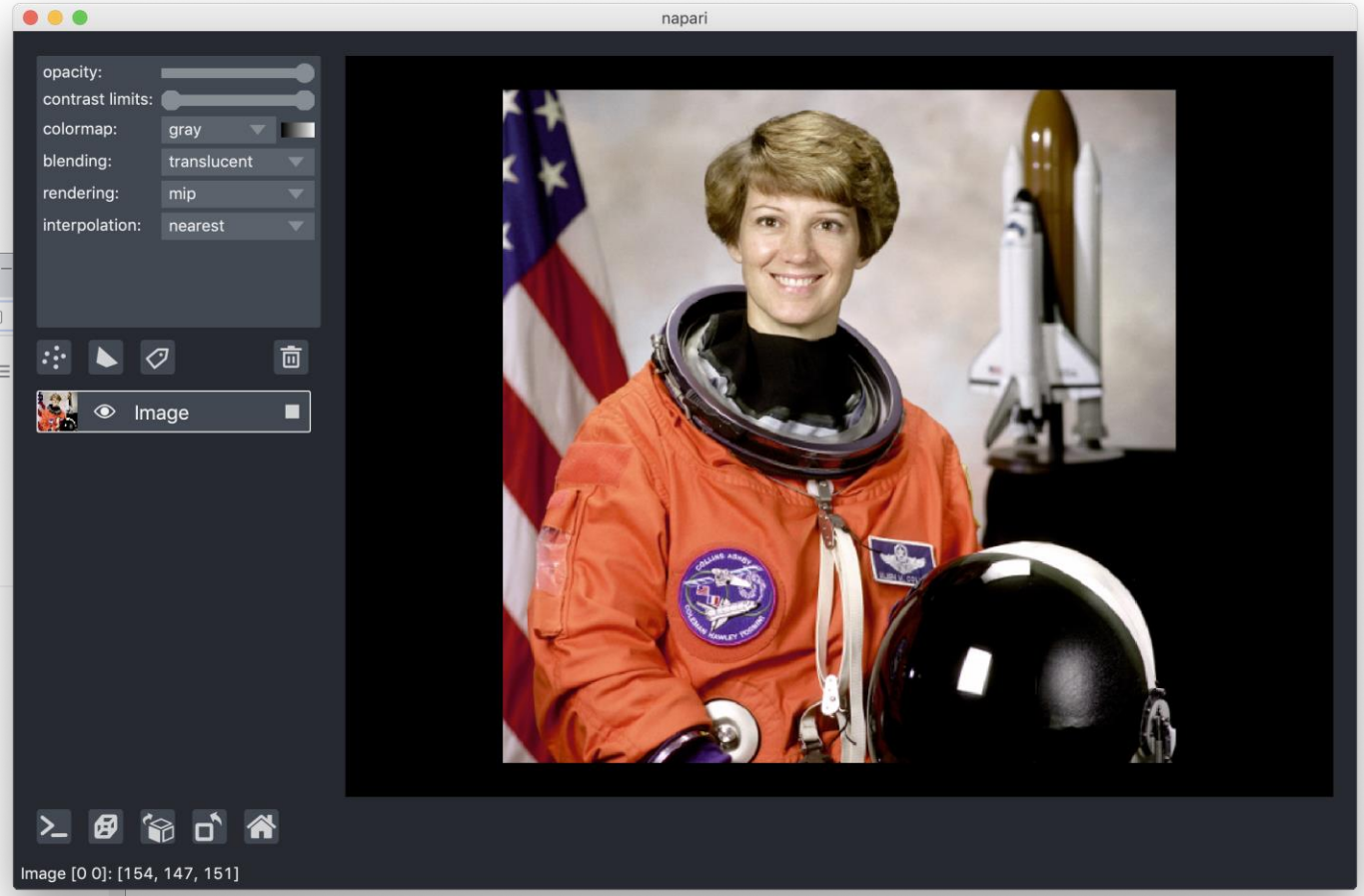
Robert Haase, PoL; Guillaume Witz, Universität Bern

@zoccolermarcelo

Napari: 3D viewer for Python

- Multi-dimensional image viewer in python
- https://napari.org/





https://napari.org/

Napari: 3D viewer for Python

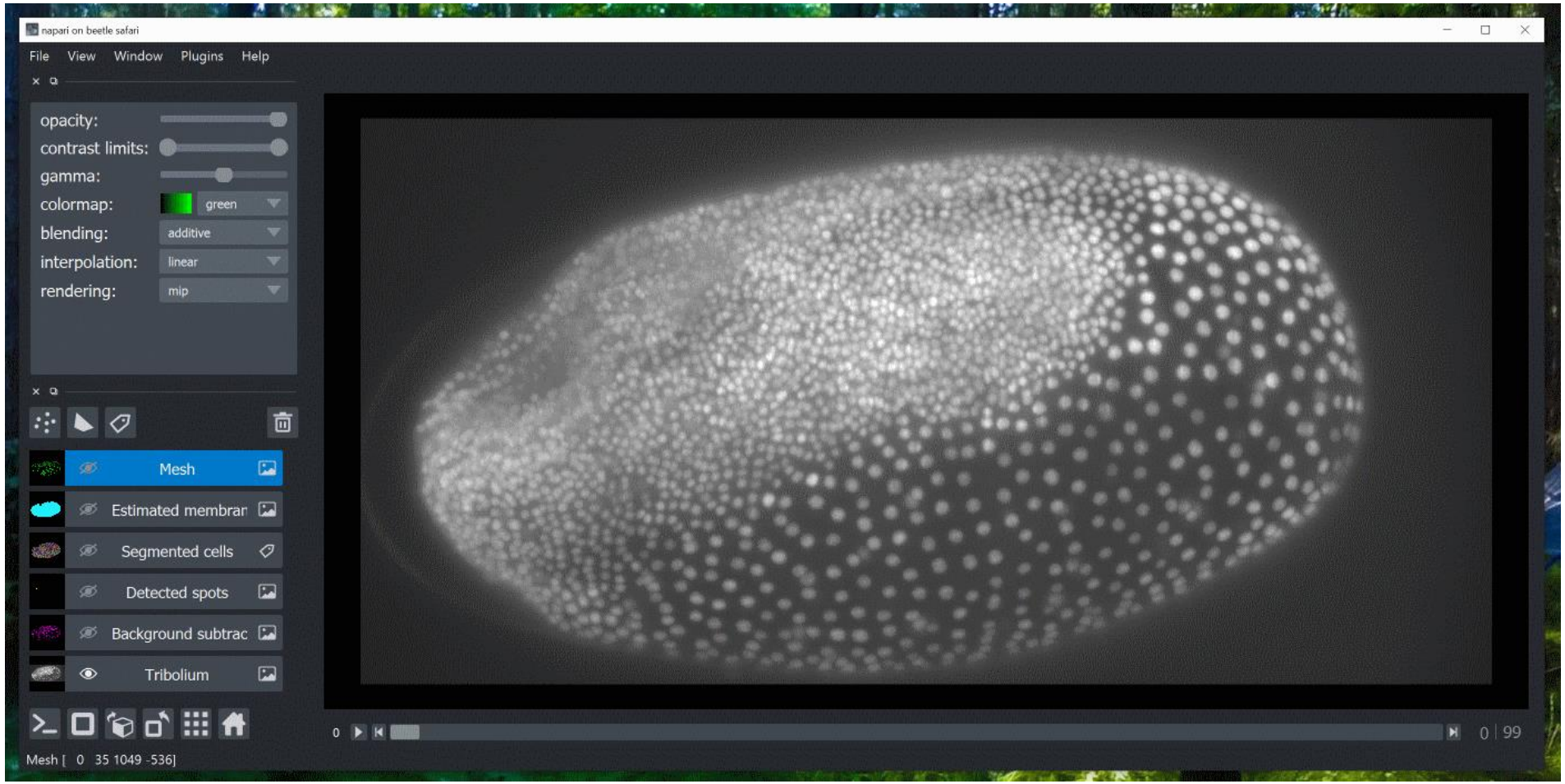


Image data source: Daniela Vorkel, Myers lab, MPI-CBG/CSBD

https://napari.org/

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Napari user interface

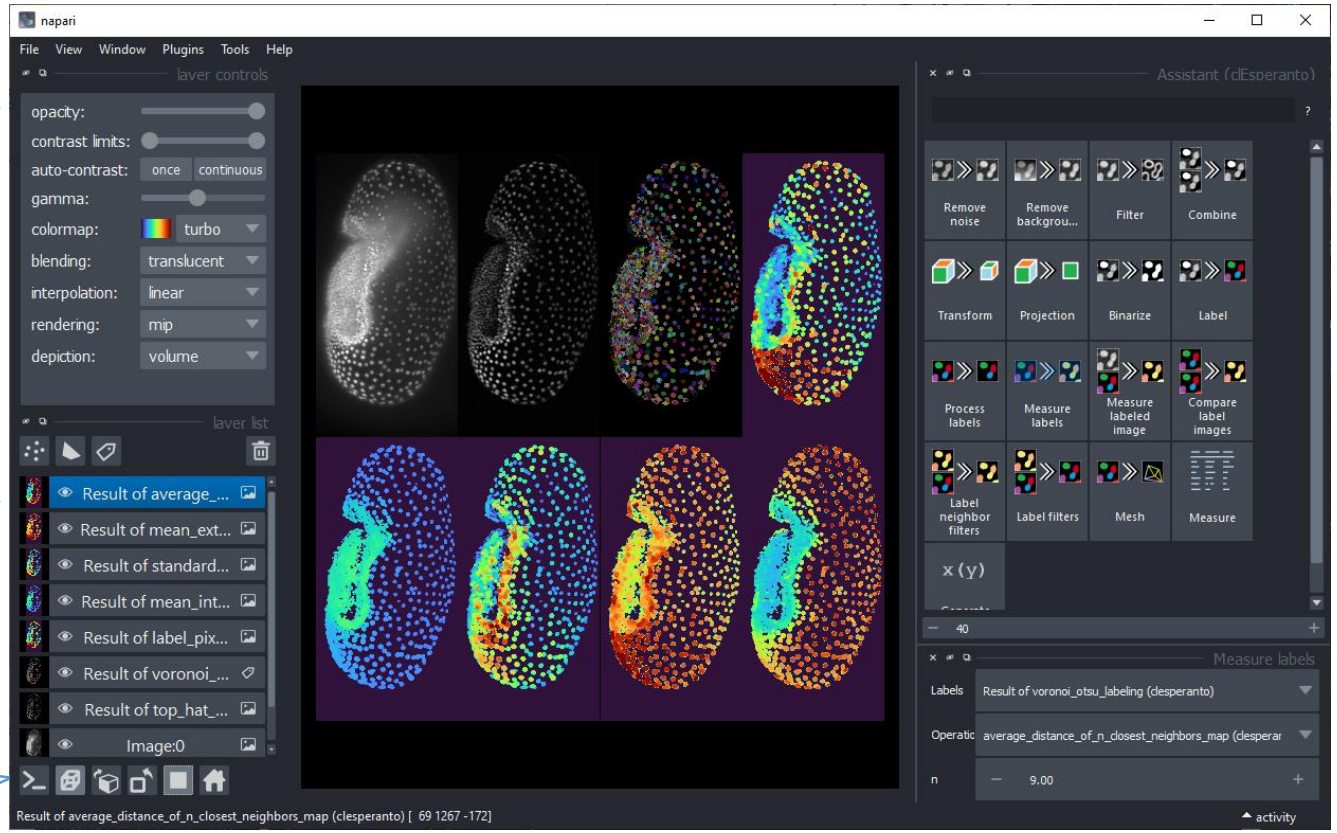
View configuration / tools

```
layer.opacity = 0.5
```

Layers

```
layer.visible = False
```

Viewer controls



Dock widgets (custom plugins)

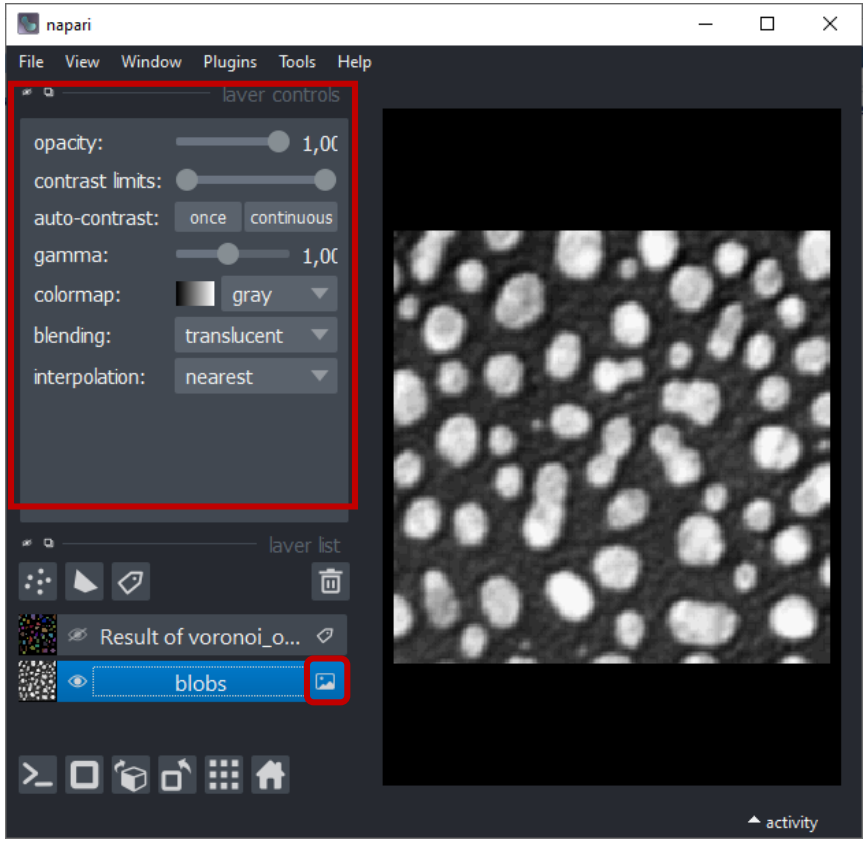
Function widgets (custom plugins)

https://napari.org/tutorials/fundamentals/viewer.html

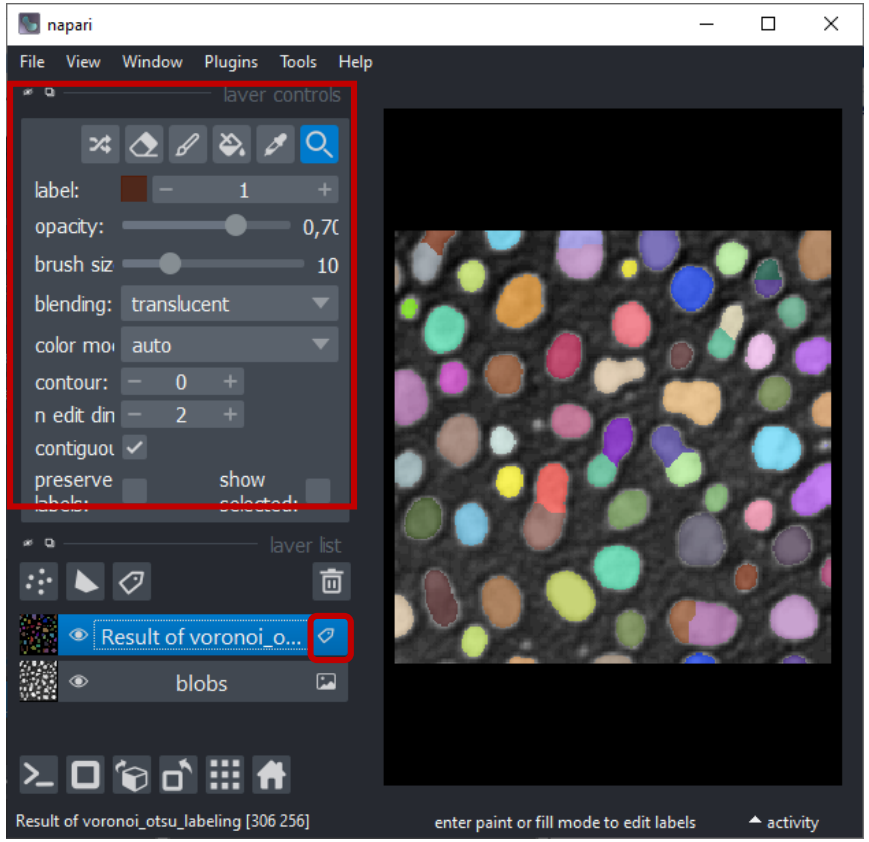
Layer types

- Different layers have different tools and options

Image Layer



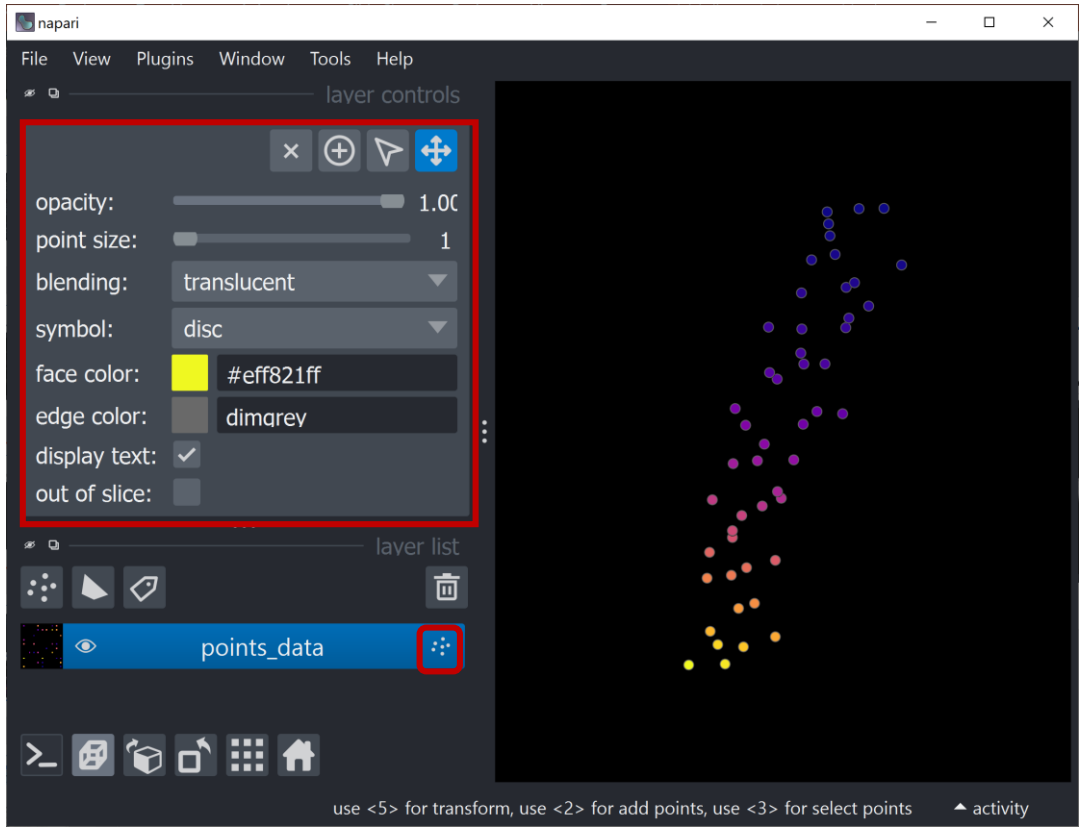
Labels Layer



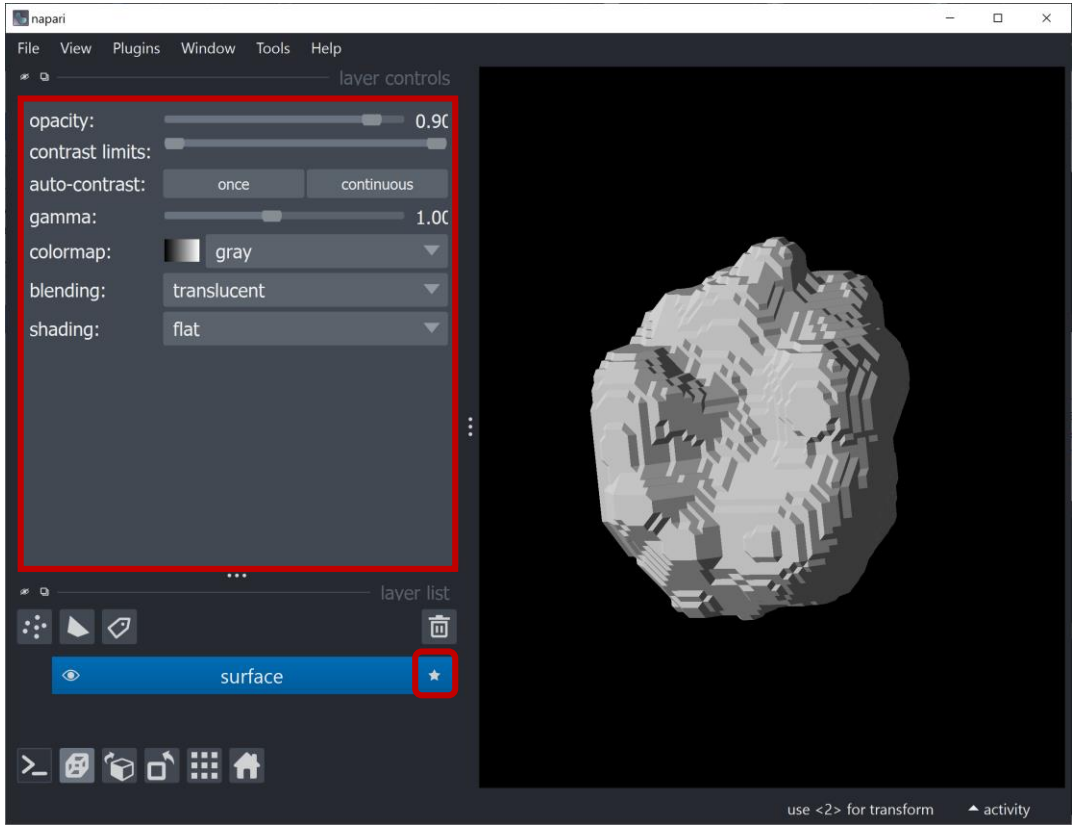
Layer types

- Different layers have different tools and options

Points Layer



Surface Layer



napari plugins

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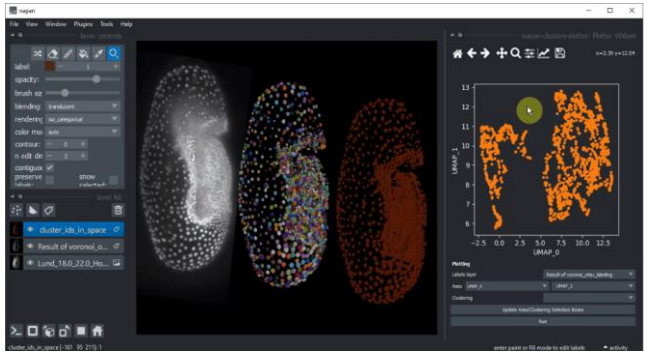
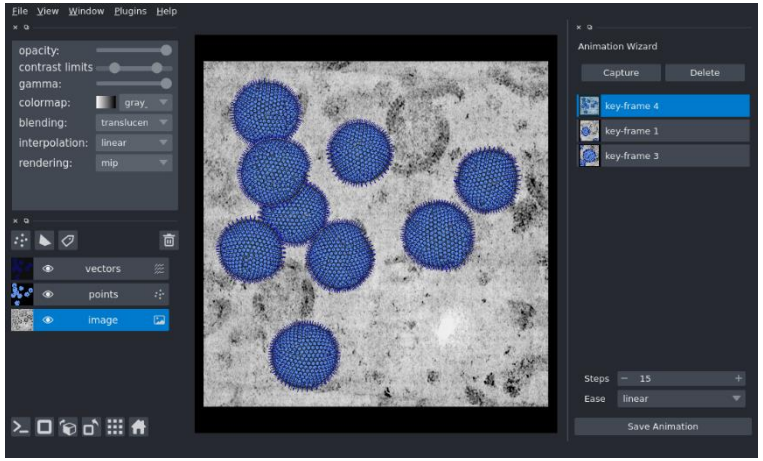
clusters-plotter



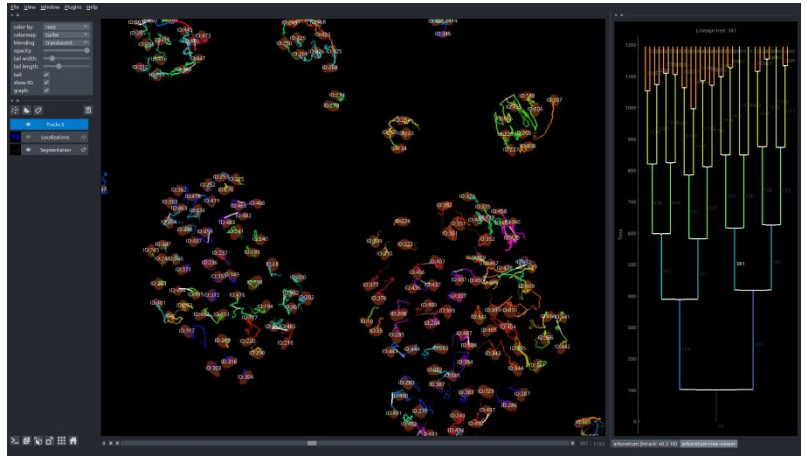
https://github.com/BiAPoL/napari-clusters-plotter

animation



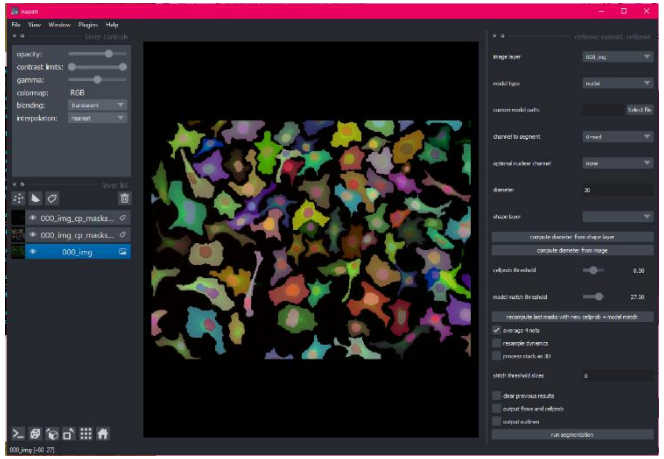
https://github.com/napari/napari-animation

arboretum



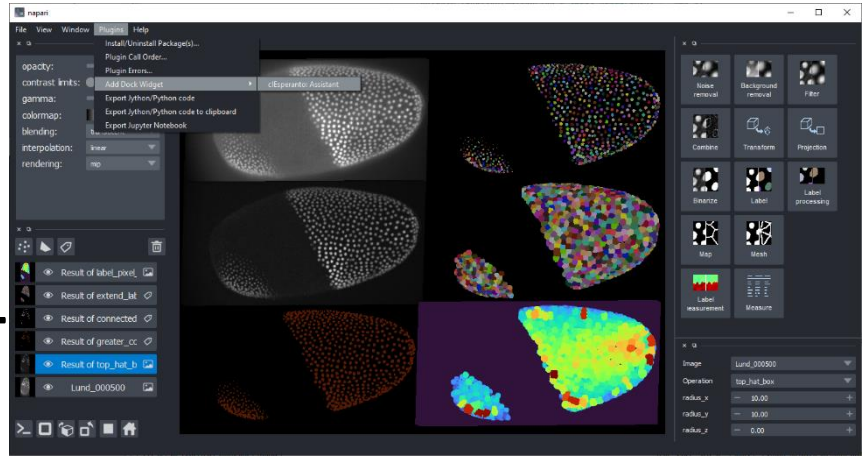
https://github.com/quantumjot/arboretum

cellpose



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

clesperanto



https://github.com/clEsperanto/napari_pyclesperanto_assistant

In development: https://github.com/topics/napari-plugin
Released: https://pypi.org/search/?q=&o=&c=Framework+%3A%3A+napari

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Correspondence | Published: 18 August 2023

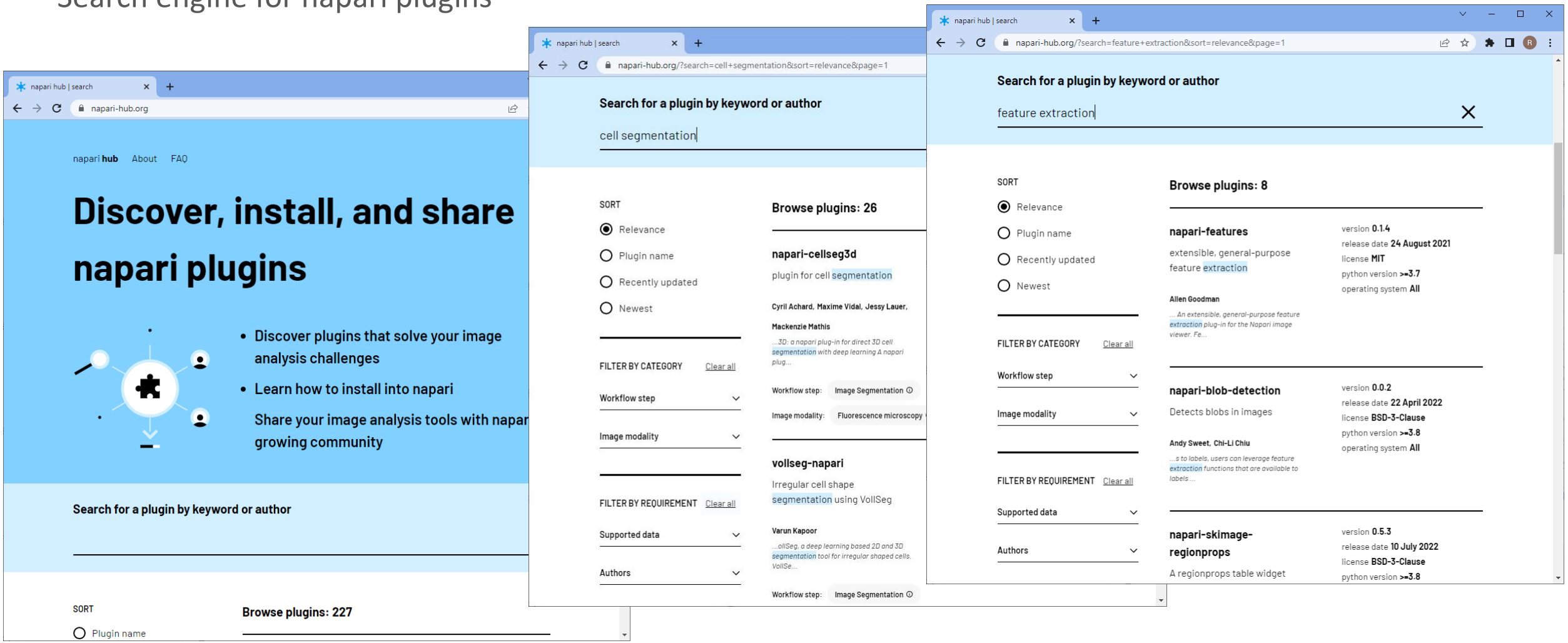
napari-imagej: ImageJ ecosystem access from napari

Gabriel J. Selzer, Curtis T. Rueden, Mark C. Hiner, Edward L. Evans III, Kyle I. S. Harrington & Kevin W. Eliceiri

Nature Methods (2023) | Cite this article

The Napari Hub

- The plugin you are looking for may be near you!
- Search engine for napari plugins



https://www.napari-hub.org/

Napari and Jupyter Notebooks

Napari from jupyter notebooks

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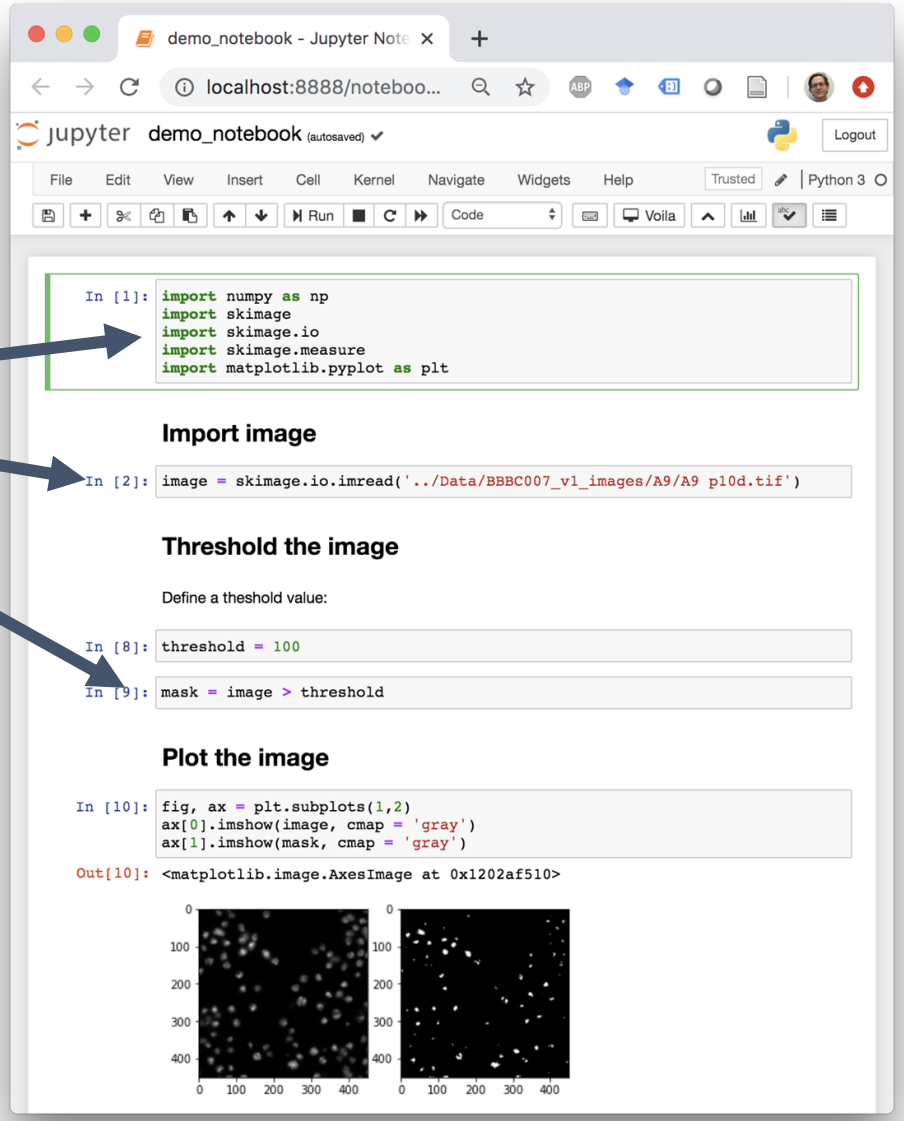
What is a jupyter notebook?

A text file (easily sent around)

Rendered by Jupyter in the browser

Split into sections called cells



Napari from jupyter notebooks

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Physics of Life
TU Dresden

What is a jupyter notebook?

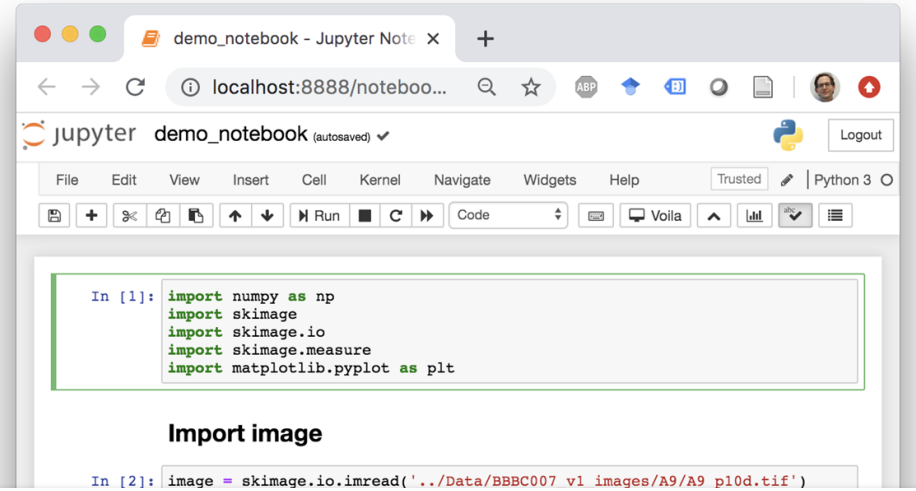
A text file (easily sent around)

Rendered by Jupyter in the browser

Split into sections called cells

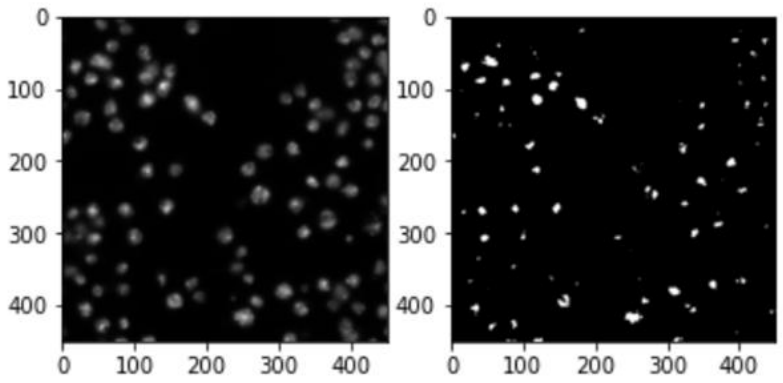
Cells can contain:

- Code
- Formatted text
- Rich output




```
In [2]: imag
```

```
In [10]: fig, ax = plt.subplots(1,2)
         ax[0].imshow(image, cmap = 'gray')
         ax[1].imshow(mask, cmap = 'gray')
Out[10]: <matplotlib.image.AxesImage at 0x1202af510>
```



Why using notebooks?

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- Keep all the benefits from using code:

  - Batch processing

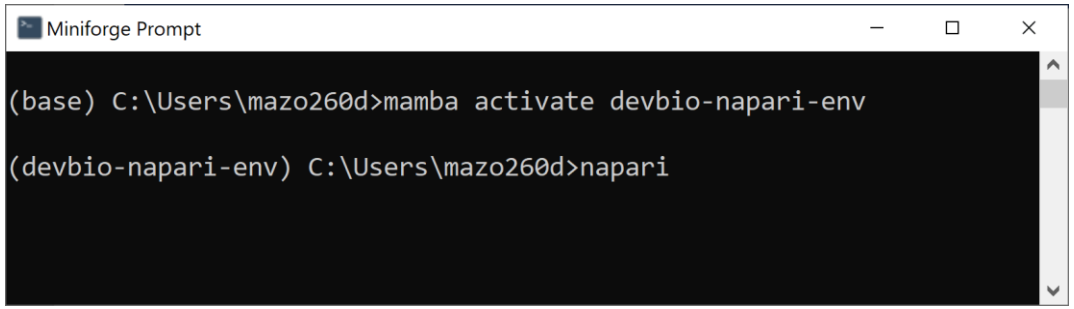
  - Running python functions/tools still unavailable as plugins

Why using notebooks with napari?

- Easy data interaction and visualization with napari:
    - Great for visualizing 3D (and more) data
    - Each processing step result can be displayed as a separate layer
- Data annotation

Opening napari

- From command line:

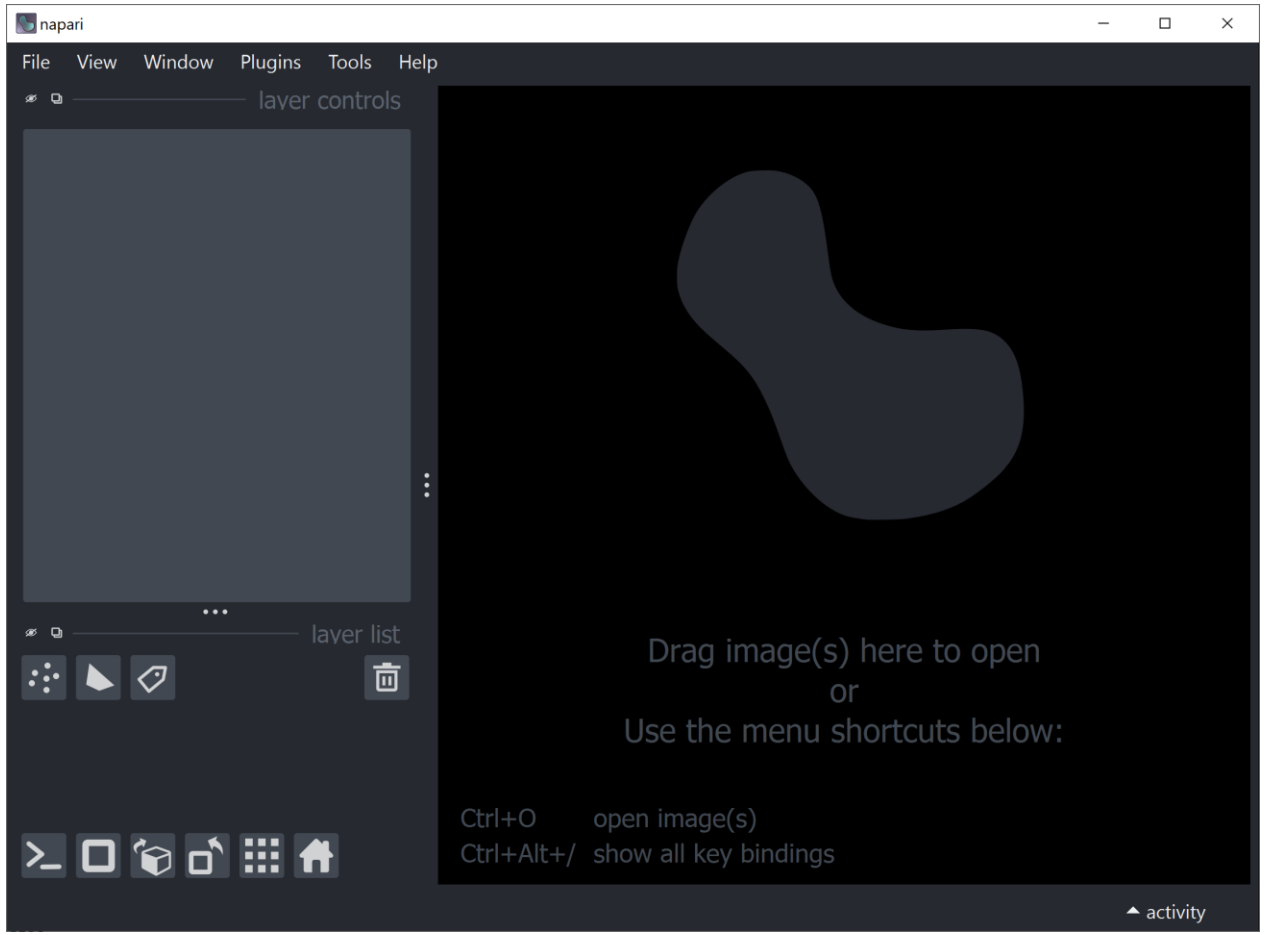


- From code (jupyter notebook):

```
[1]: import napari

[*]: viewer = napari.Viewer()

[ ]:
```



Opening Images in napari

- Drag and drop

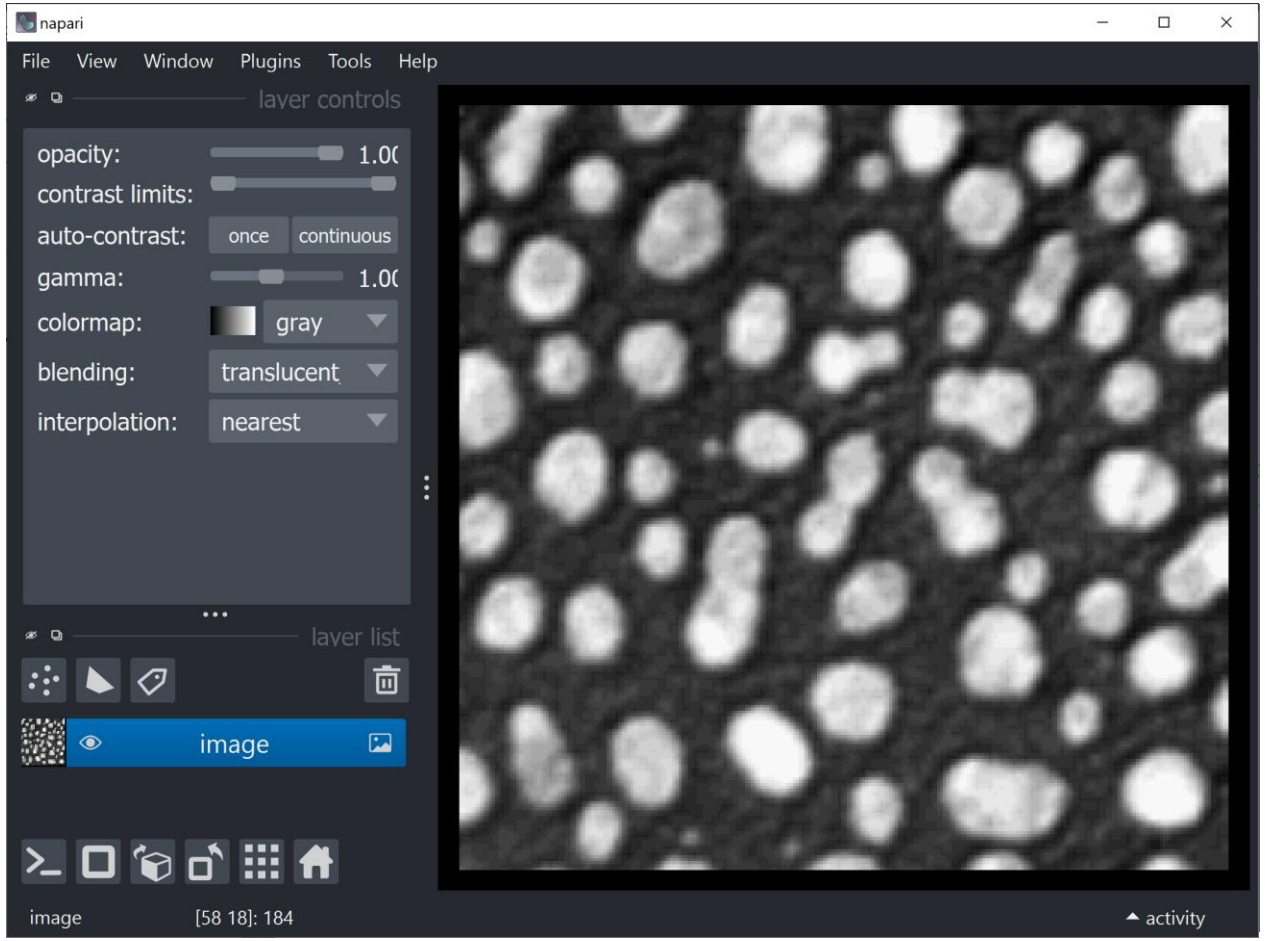
- File > Open File…

- From code:
  - Open an image with an “imread” function

```
image = imread(“image.tif”)
```

  - Load the image to the viewer

```
viewer.add_image(image)
```



Scripting napari in notebooks

- Add layers to napari to visualize intermediate processing results on top of each other or side by side.
- Change layer visualization within napari…

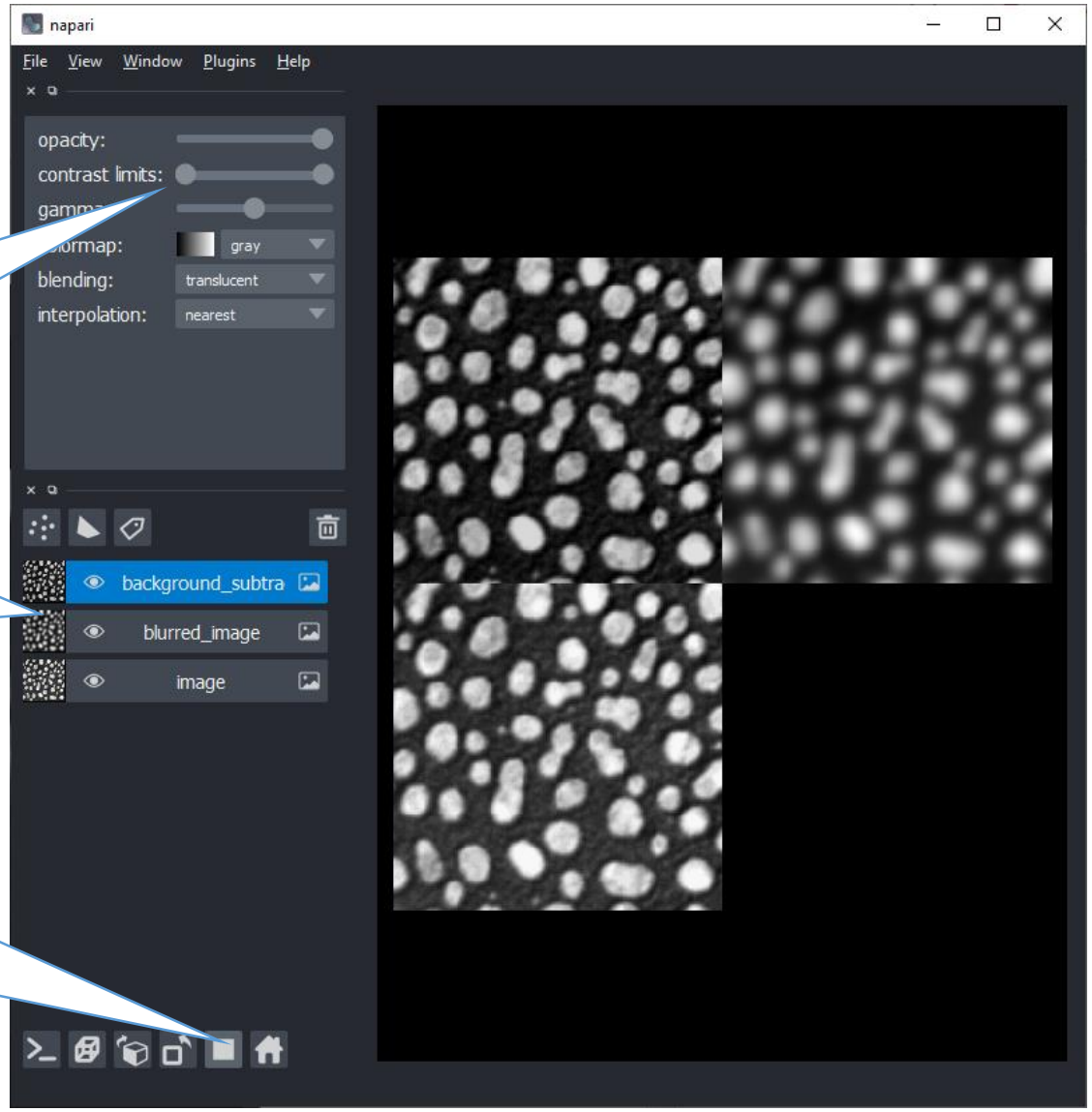
  … or via code in a jupyter notebook:

```
viewer.layers[0].contrast_limits
```

```
[0, 255]
```

1. Access the viewer
2. Access the layers
3. Choose a layer (by index or name)
4. “Press TAB” and check out available properties

```
viewer.layers[0].contrast_limits = [30,170]
```



Change Brightness and contrast here

Toggle visualization of layers here

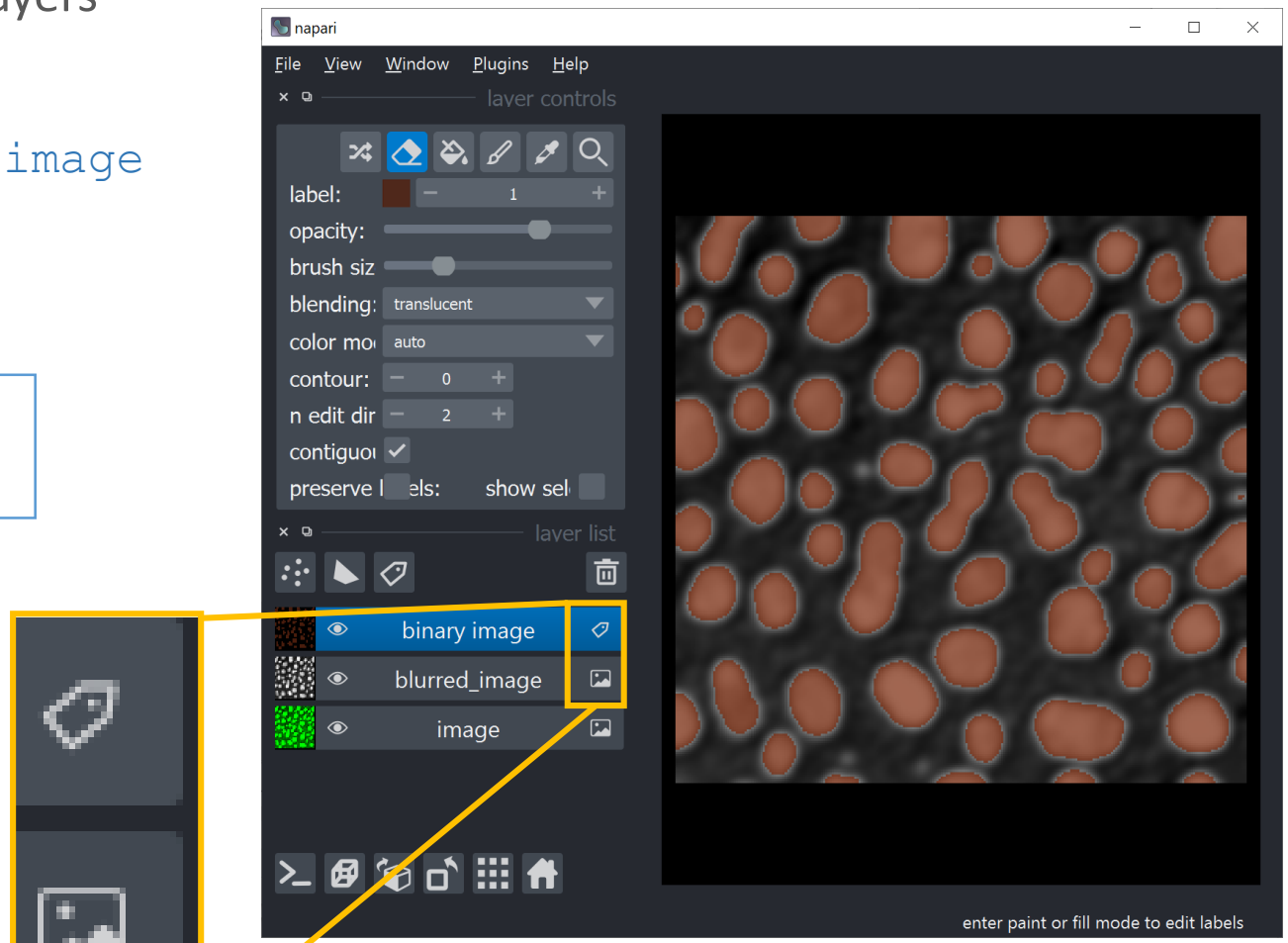
Gallery view

Visualizing image segmentation

- Binary images and label images visualized as label layers

```
# Add a new labels layer containing an image
viewer.add_labels(binary_image,
                  name="binary image")
```

Name your layers to keep track of what they contain



Labels Layer

Image Layer

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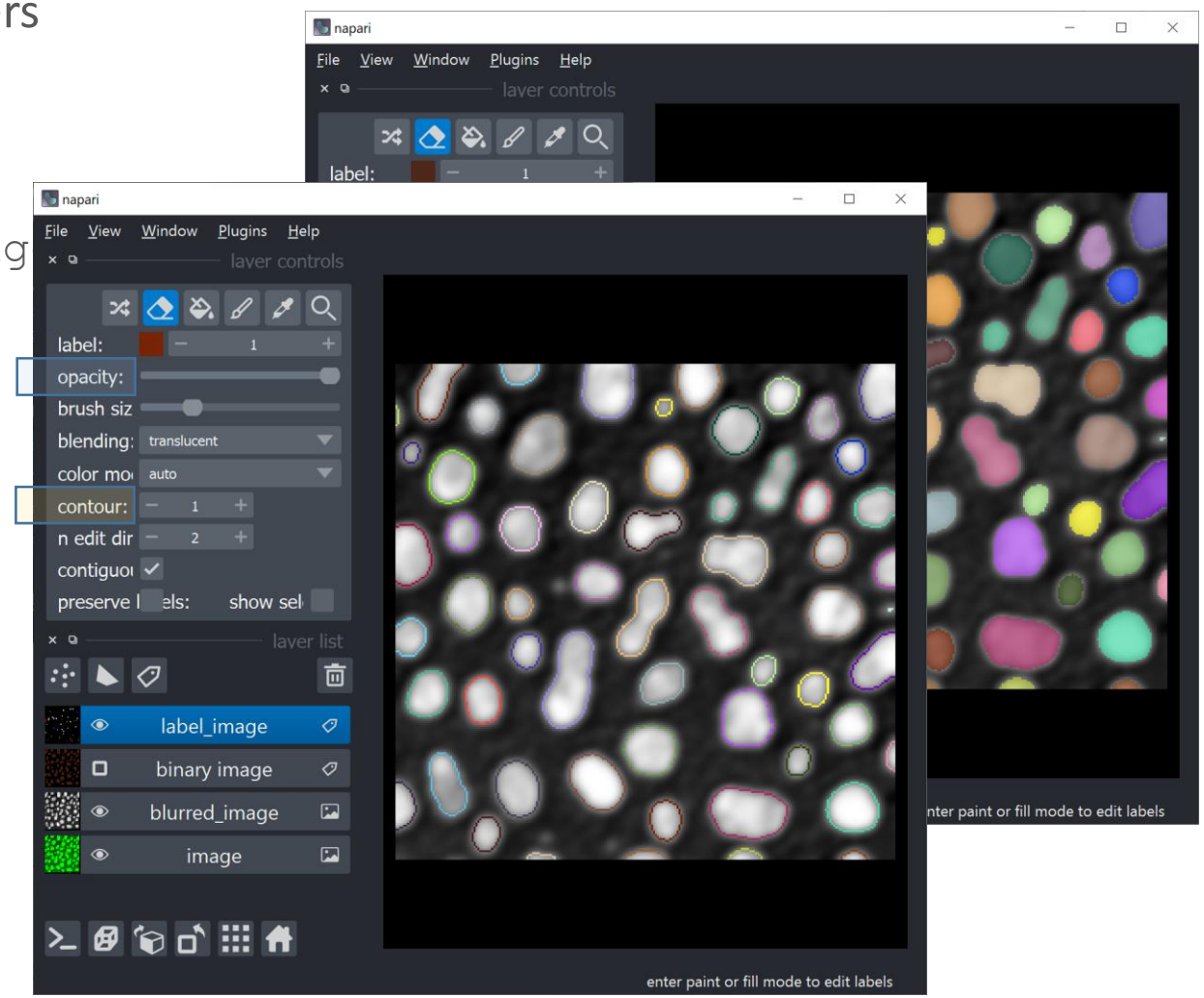
Visualizing image segmentation

- Binary images and label images visualized as label layers

- `# add labels to viewer`
- `label_layer = viewer.add_labels(label_imag`

- Visualize contours instead of the overlay
- `label_layer.contour = 1`
- `label_layer.opacity = 1`

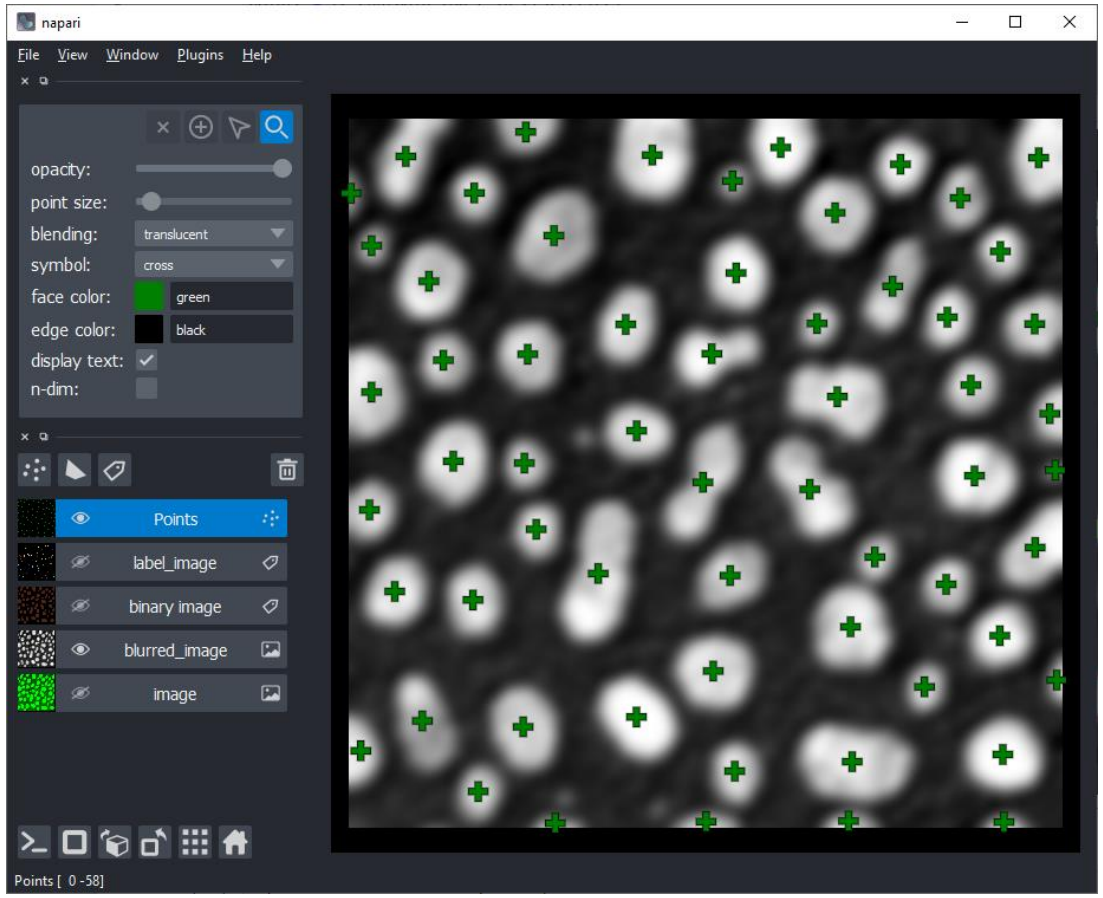


http://nbviewer.jupyter.org/github/BiAPoL/on_the_fly_image_processing_napari/blob/master/01_napari.ipynb

Points layers

- There is also other layer types
  - Shapes
  - Points
  - Surfaces
  - Tracks
  - Vectors

```
# add points to viewer
label_layer = viewer.add_points(points,
  face_color='green', symbol='cross', size=5)
```



Acknowledgements

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- Laura Zigutyte

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image.sc

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