

Adaptation to orientation statistics in the visual cortex of awake mice

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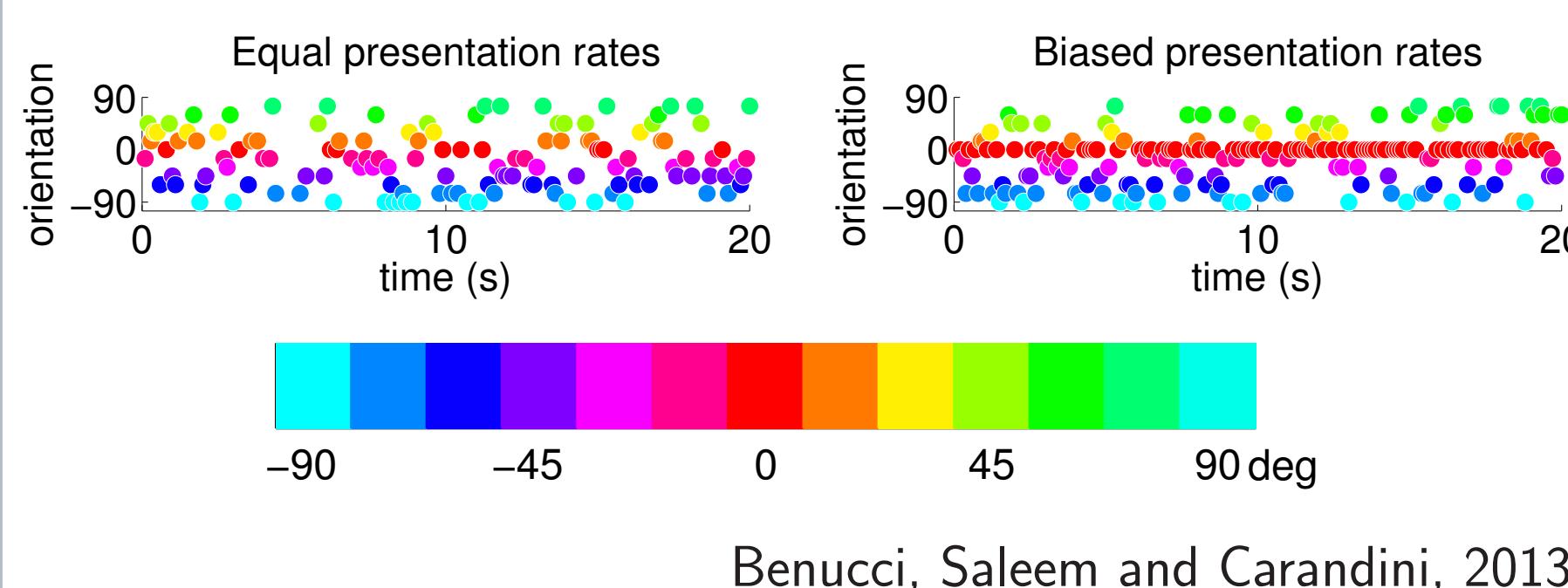
Introduction: adaptation in cortex

Orientation-specific adaptation in primary visual cortex has been demonstrated in anesthetized cats and primates.

Questions

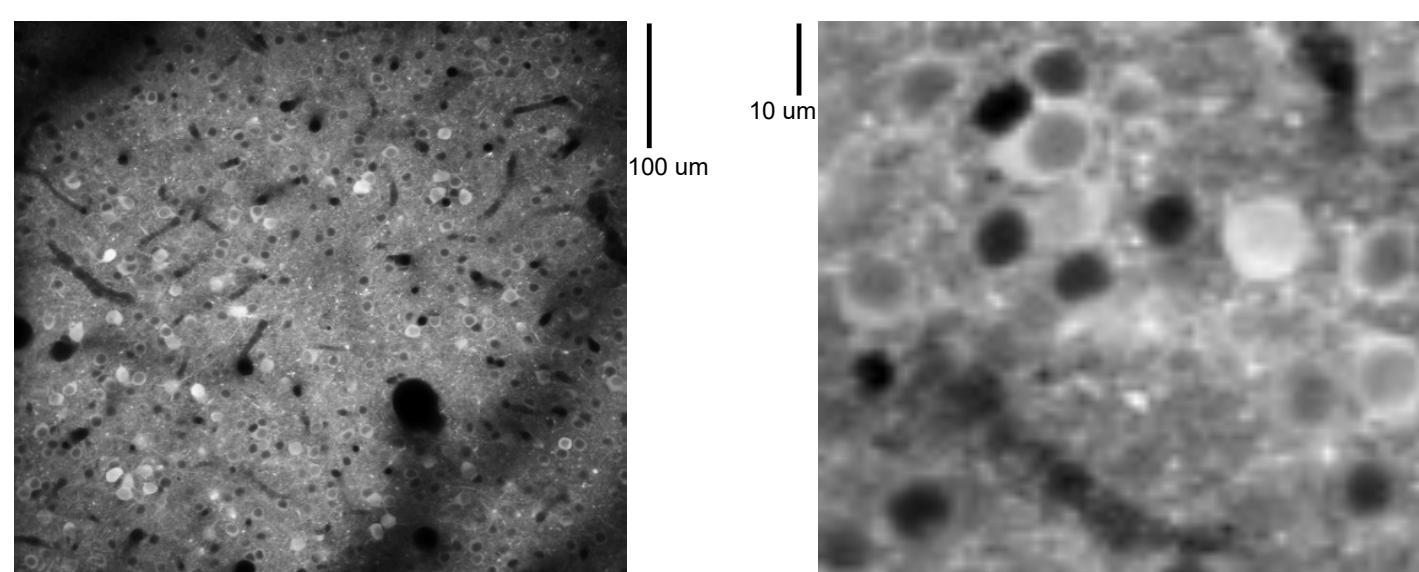
- Can we replicate it in awake mice using two-photon Calcium imaging?
- How is orientation-specific adaptation realized, can we model the data?

Protocol for inducing adaptation

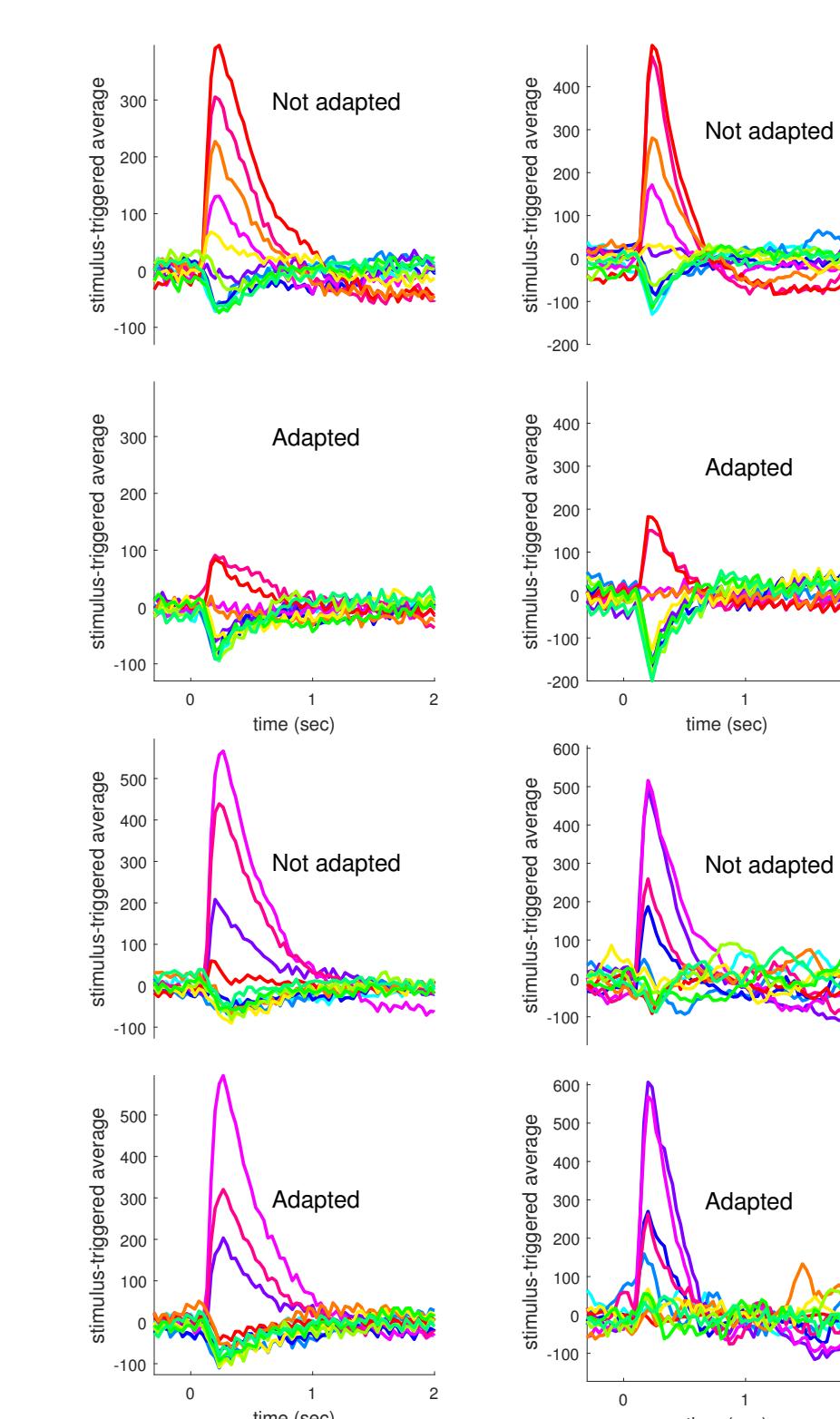


Benucci, Saleem and Carandini, 2013

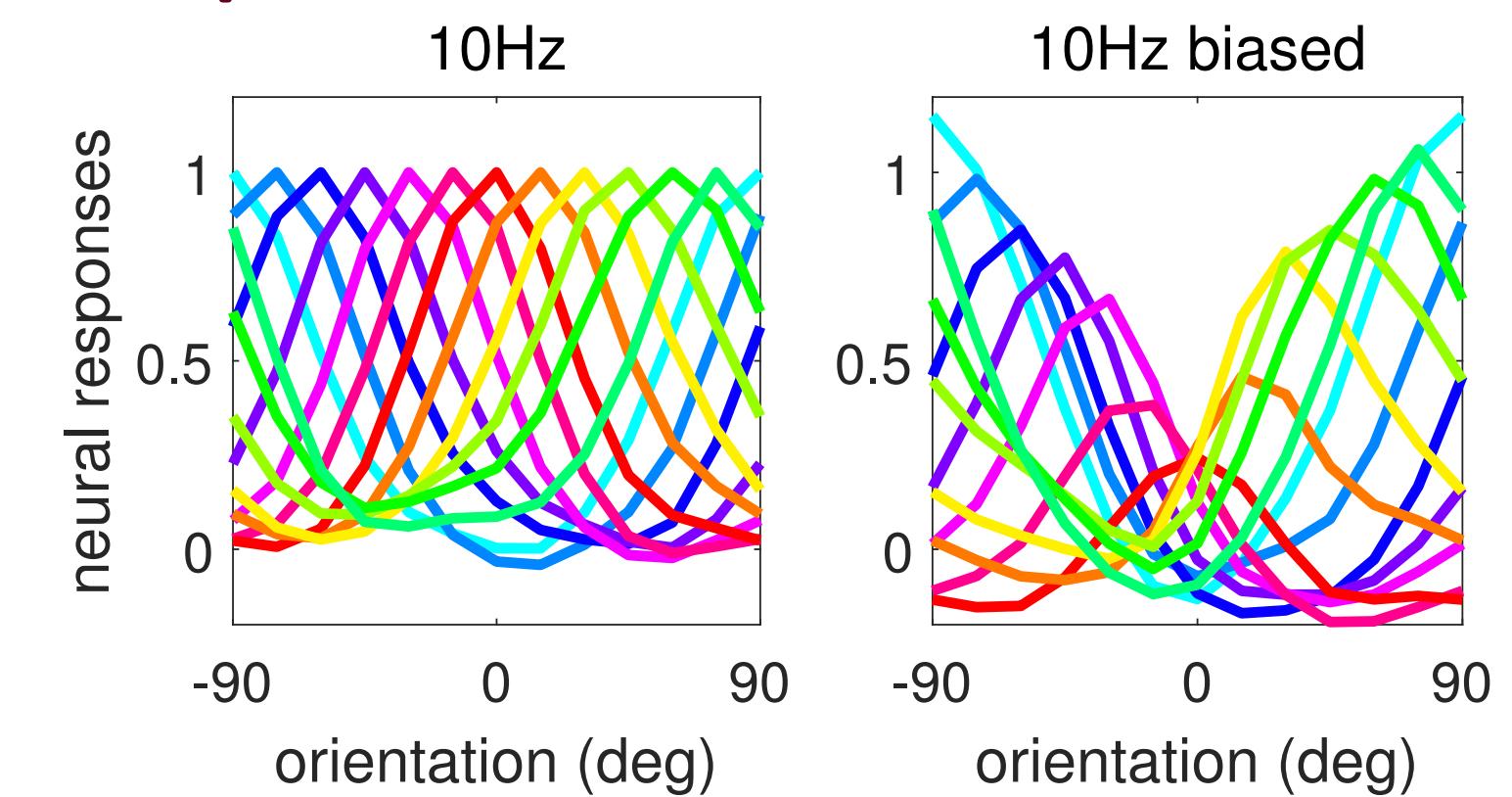
Recordings



Example cells

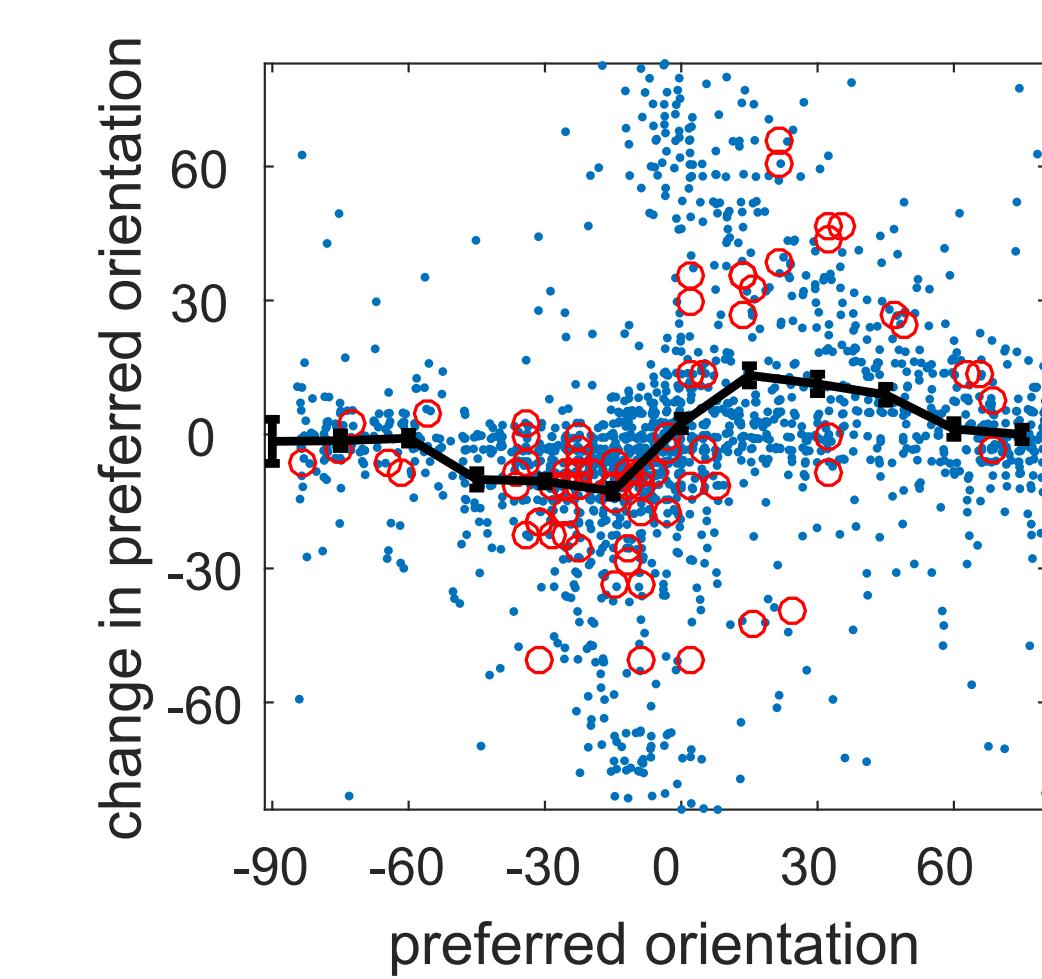
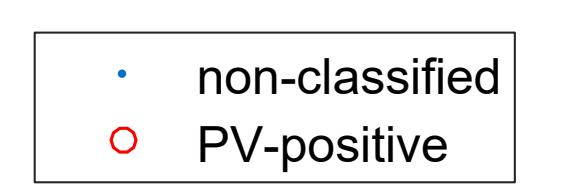


Adaptation to orientation

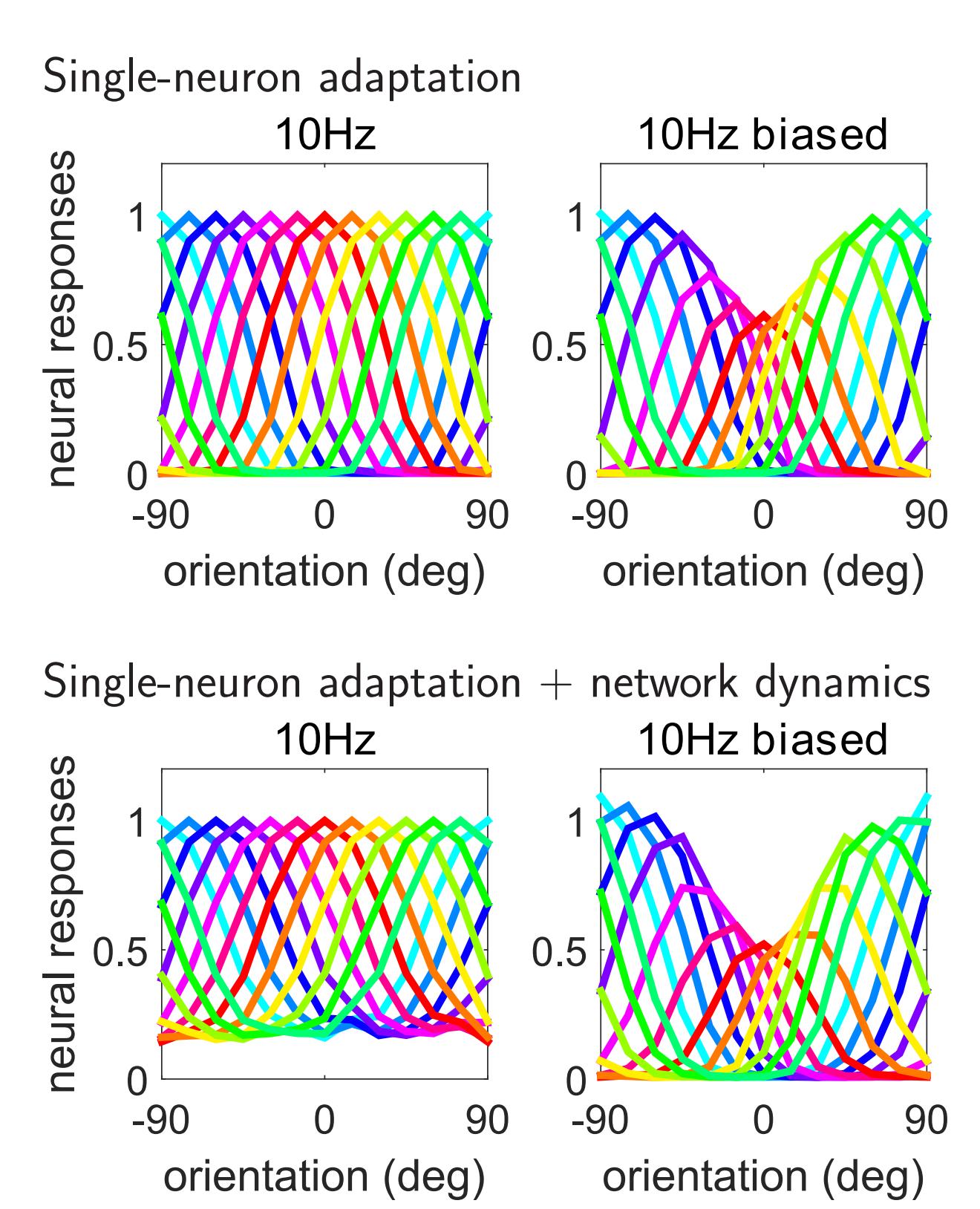


Tuning curve repulsions

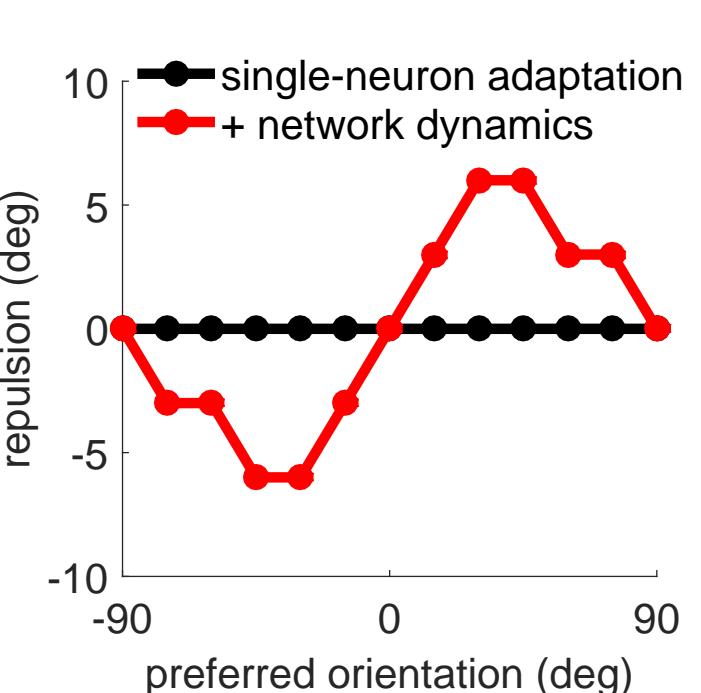
Preferred orientations shift away from adapted stimulus.



Model of adaptation in a network



Only the network model accounts for tuning curve repulsions.



Automated cell detection toolbox

Try it out!
<https://github.com/marius10p/Suite2>

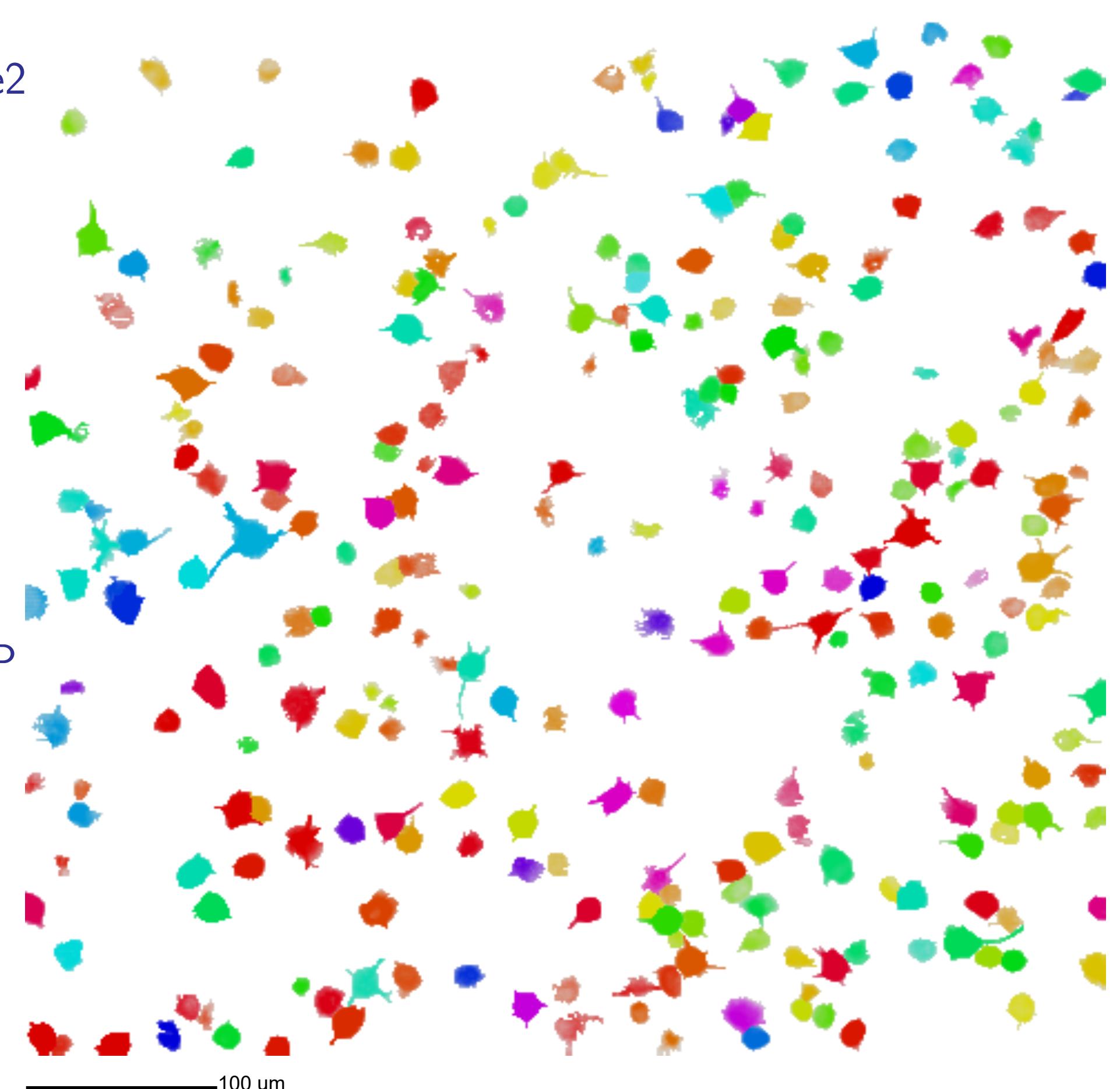
Advantages

- Very fast and automated
- Runs on entire movie: no partitioning of data
- non-local: traces processes
- groups well-isolated pixels into ROIs: less neuropil contamination

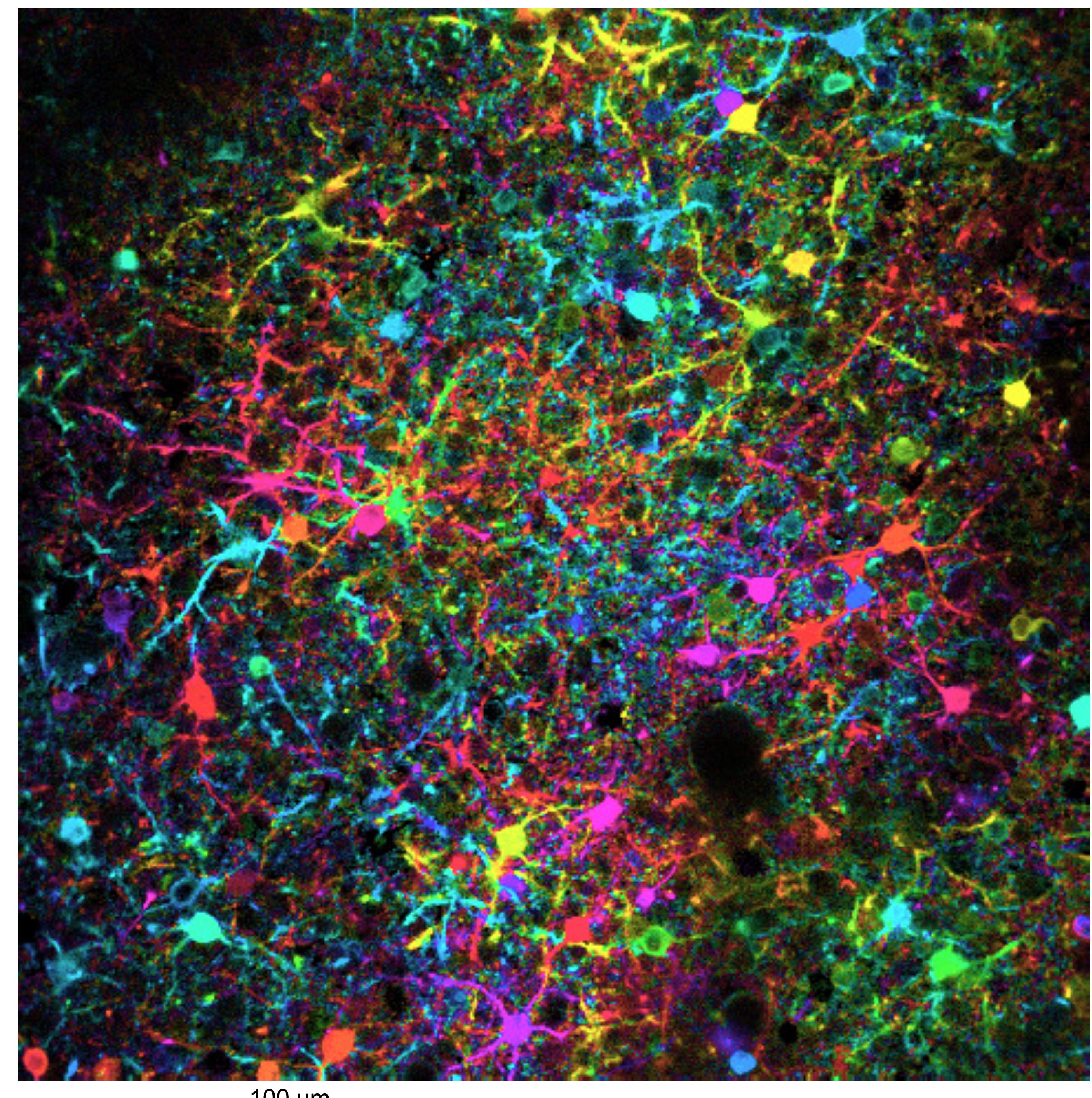
Manual clean-up of results via GUI at
<https://github.com/marius10p/gui2P>

Fast and improved subpixel registration through regularized phase correlation.

Efficient SVD decomposition for single-pixel tuning resolution.

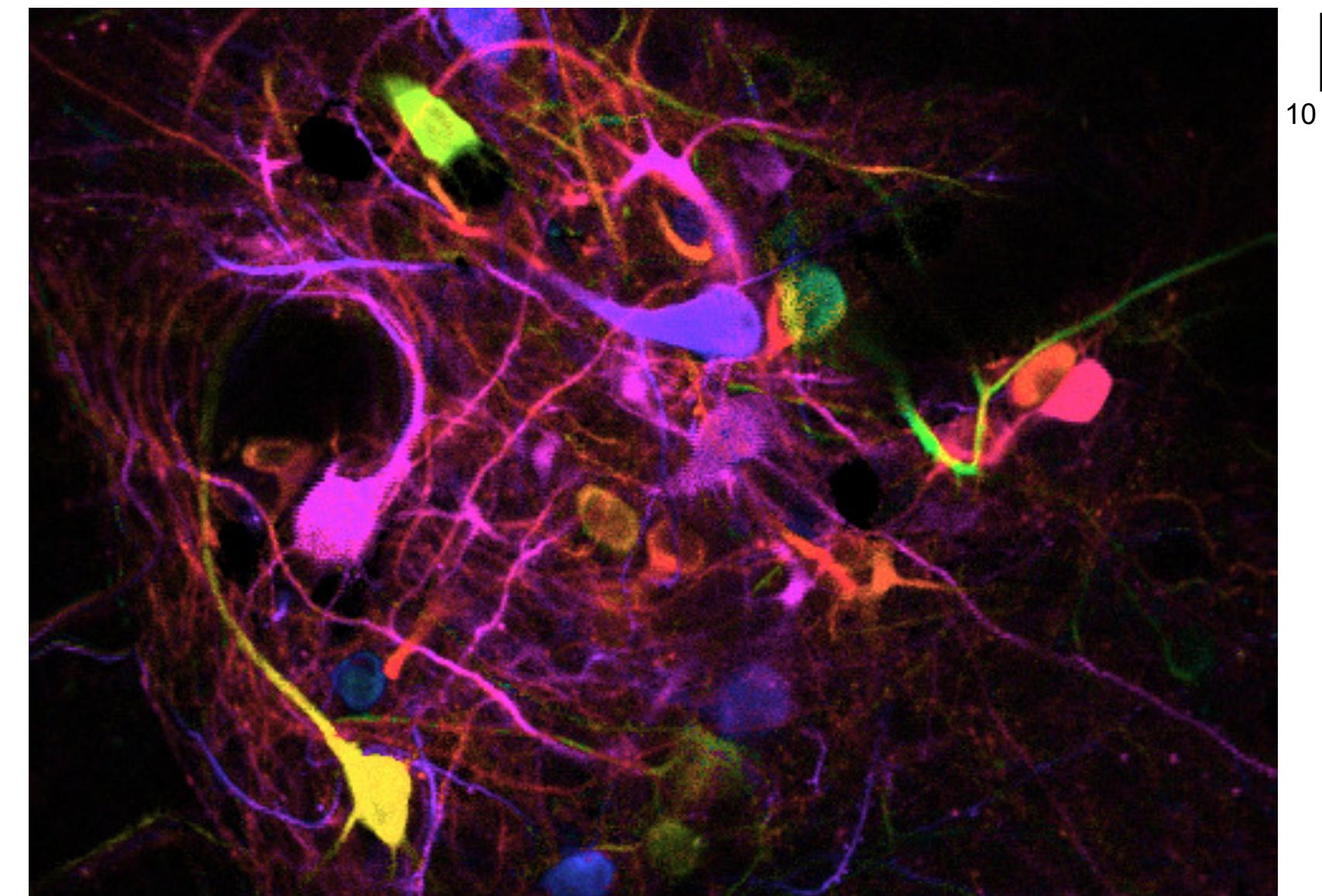


Orientation tuning of single pixels via SVD



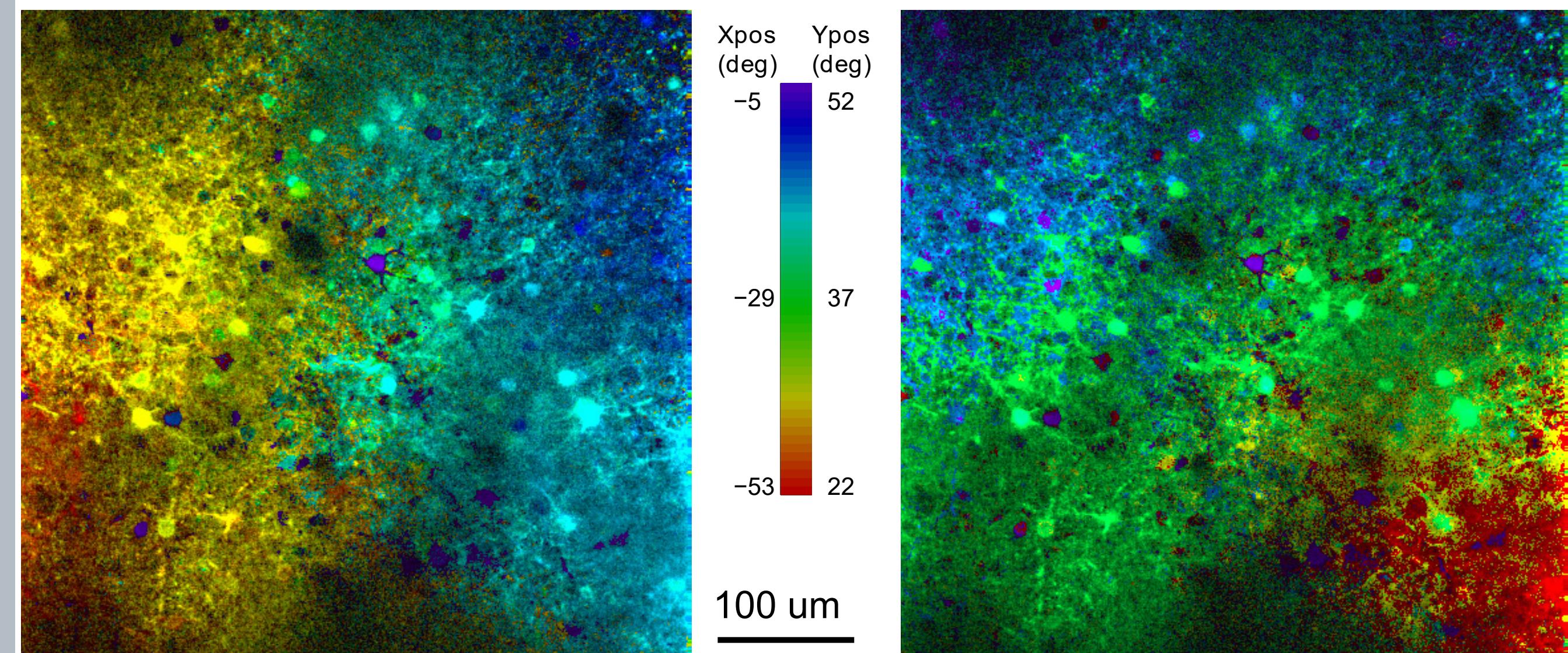
Orientation tuning of single pixels

ZOOM IN



High-resolution retinotopy from short recordings (5 min)

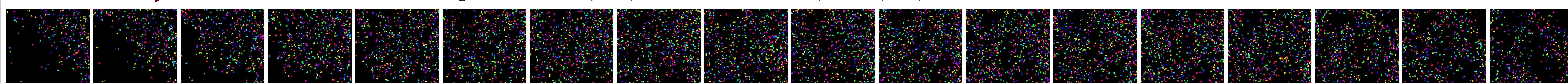
horizontal



wellcome trust
Investigator

We thank Mario Dipoppa and Michael Krumin for technical assistance with the microscope and Charu Reddy and Miles Wells for animal husbandry and help with the surgeries.

9000 simultaneously-recorded neurons.



Automatic cell segmentation

Acquisition parameters: scan rate 1.5Hz, number of planes = 19, plane separation = 15μm, FOV = 900μm x 900μm.