

(Advanced) deep learning

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Image segmentation: classify pixels

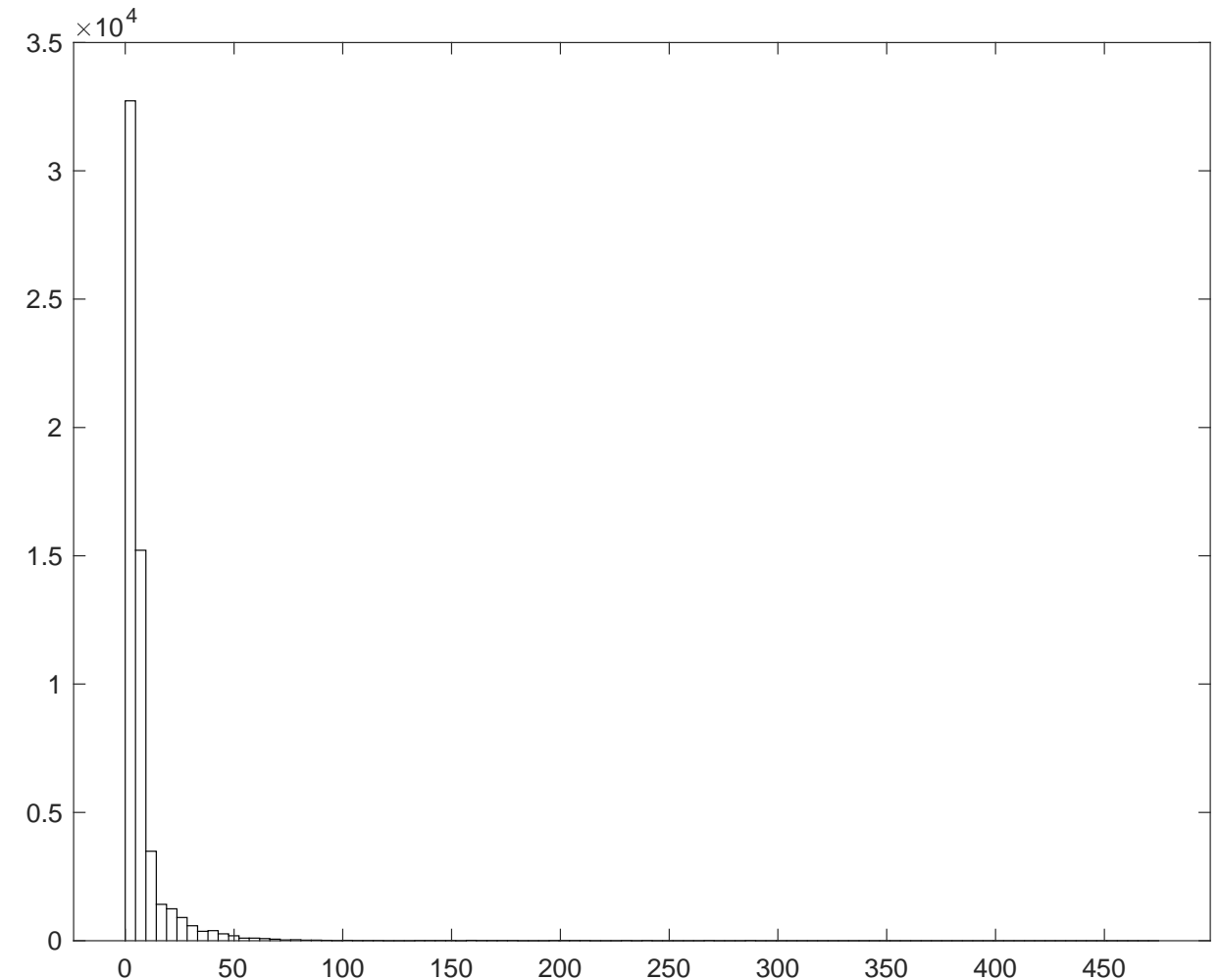
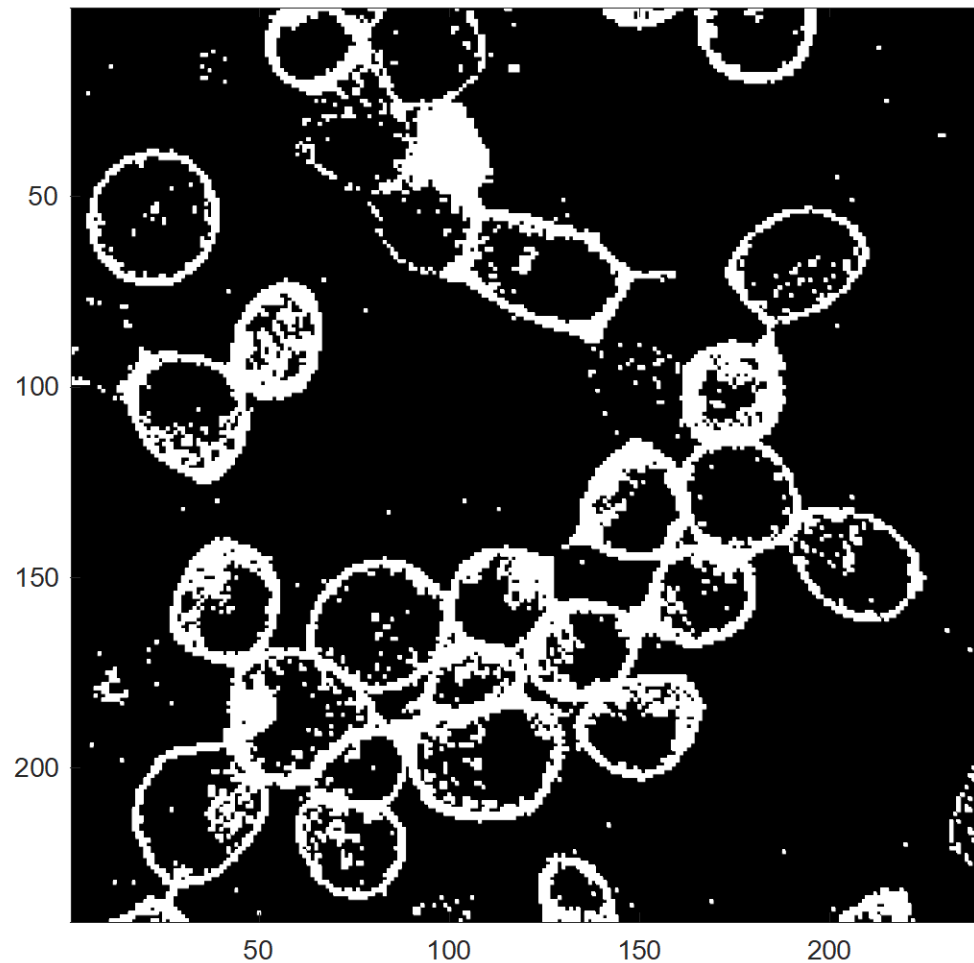
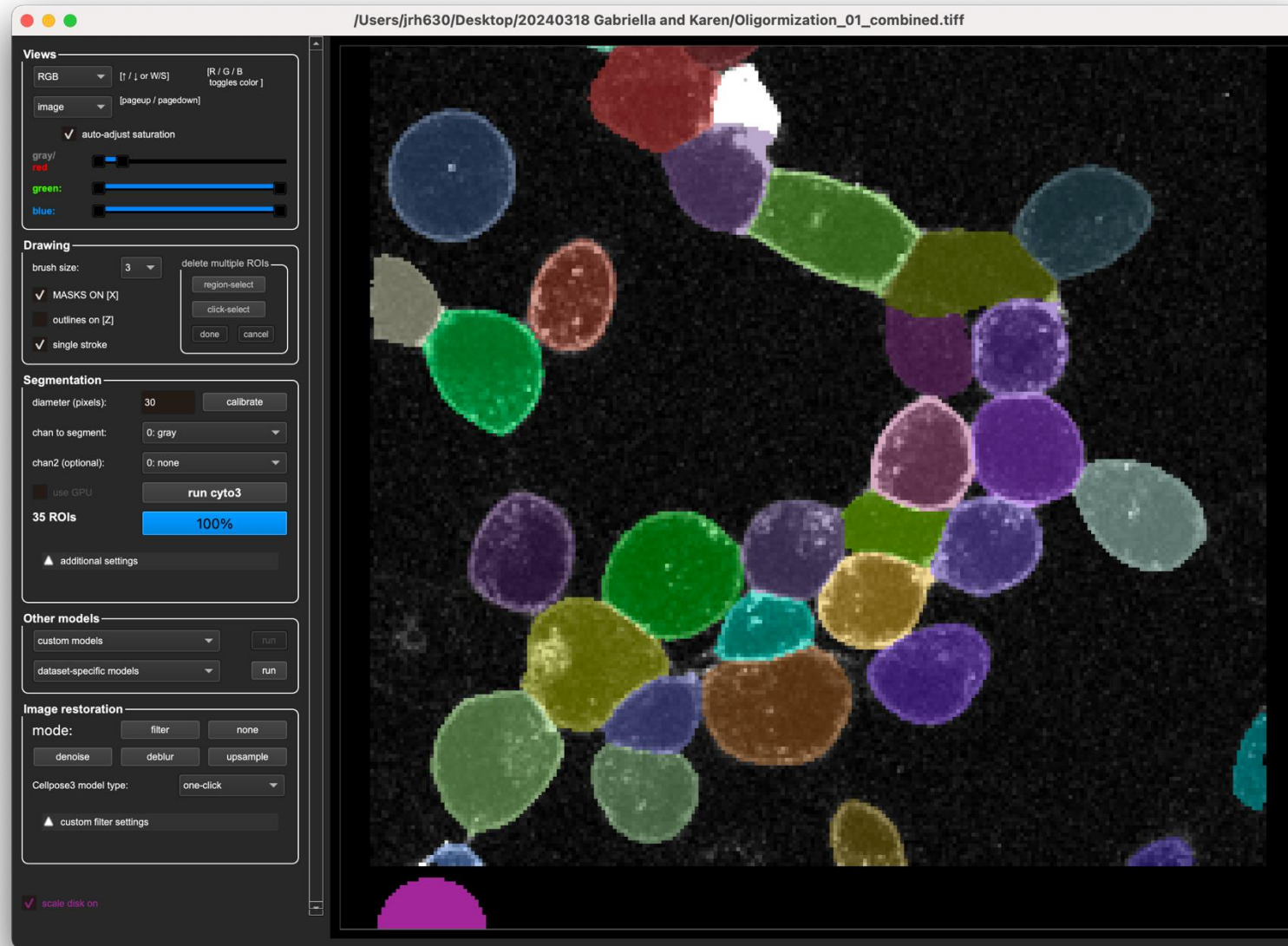


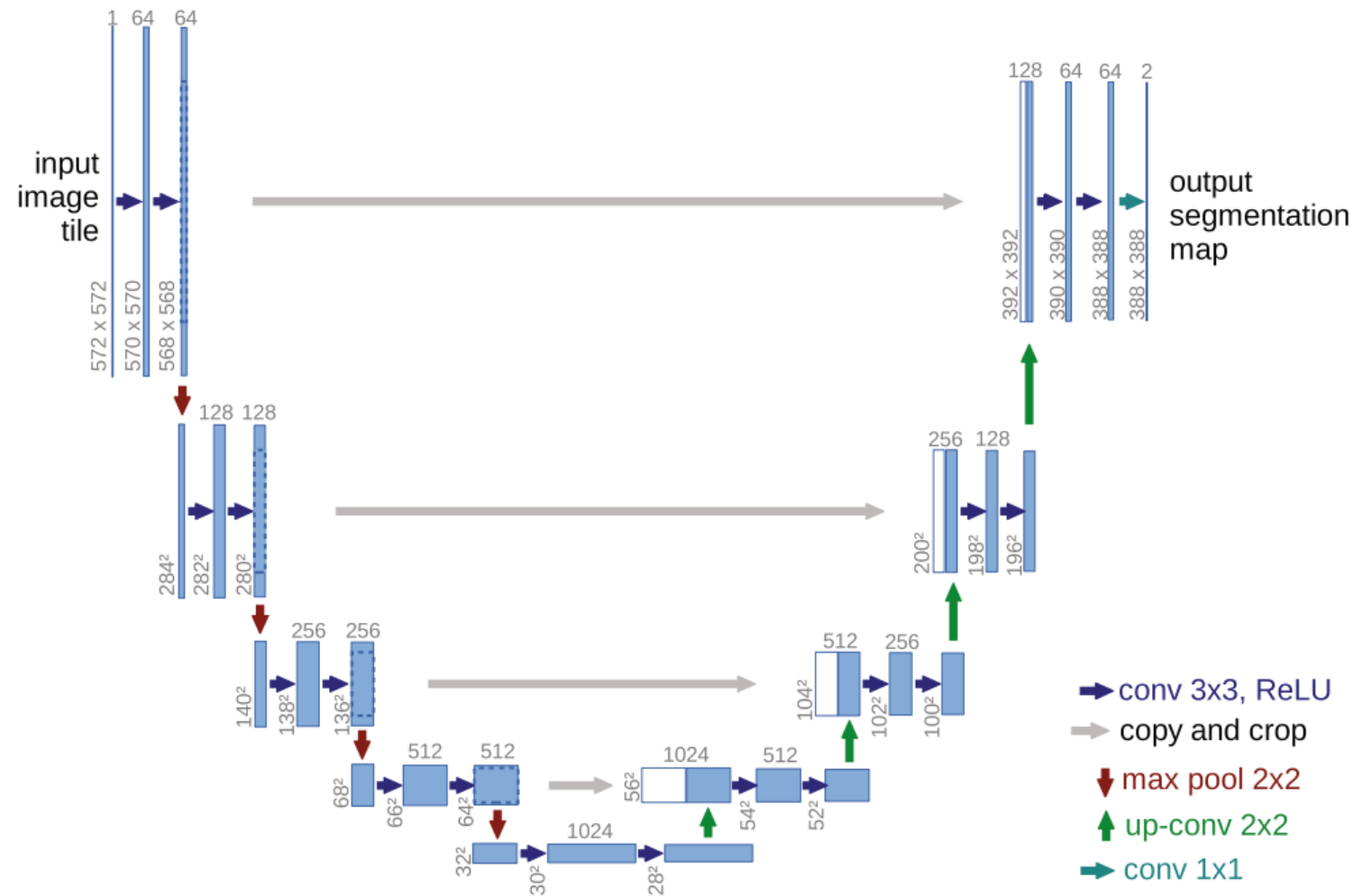
Image courtesy: Karen Martinez & Gabriella von Scheel von Rosing; AI: <http://www.cellpose.org/>

Stardist: UNet + fully connected



Software: <http://www.cellpose.org/>

Unet: Convolutional network – encoding and decoding



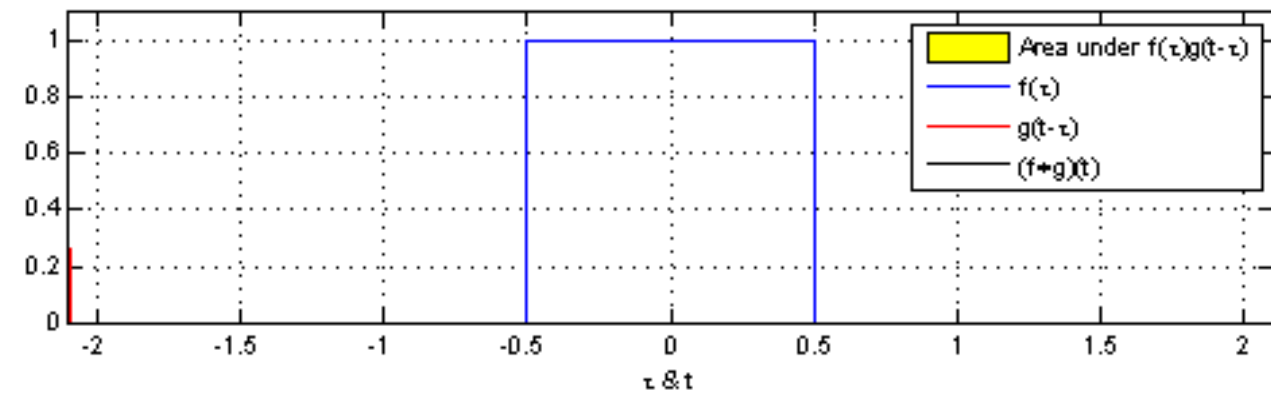
Convolution 1D

$$f, k: \mathbb{R} \rightarrow \mathbb{R}$$

$$g(x) = (f * k)(x) = \int_{-\infty}^{\infty} f(\alpha) k(\alpha - x) d\alpha$$

$$f, k \in \mathbb{R}^M$$

$$g(i) = (f * k)(i) = \sum_{m=1}^M f(m)k(m - i)$$



By Convolution_of_box_signal_with_itself.gif: Brian Ambergderivative work: Tinos (talk) - Convolution_of_box_signal_with_itself.gif, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=11003835>

Convolution 2D

$$(f * k)(x, y) = \iint_{-\infty}^{\infty} f(\alpha, \beta) k(\alpha - x, \beta - y) d\alpha d\beta$$

$f, k: \mathbb{R}^2 \rightarrow \mathbb{R}^2$

$$(f * k)(i, j) = \sum_{m=1}^M \sum_{n=1}^N f(m, n) k(m - i, n - j)$$

$f, k \in \mathbb{R}^{M \times N}$

