Elim Zhang
yilinz@andrew

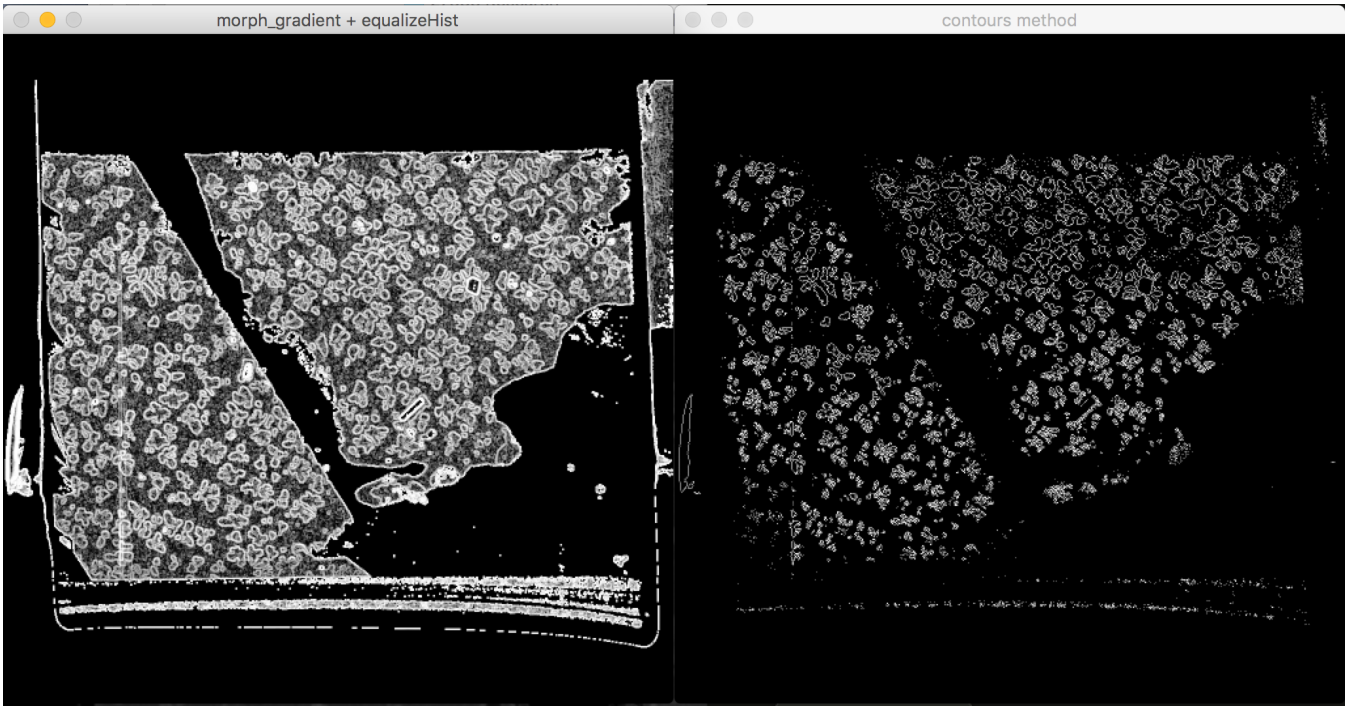
Progress Report 5
Mar. 21, 2017

Goal: - **Part I**: Improve segmentation in the normal region;
- **Part II**: Improve segmentation in the twin region, by changing the background into black, aiming to improve histogram equalization results;
- **Part III**: Get contours for the ground truth pictures ,and use checker_function to evaluate the results again;

Progress:

Part 1: Reduce background noises in both normal regions and twin regions;

- **Normal Region**: Using closing (dilation and then erosion) would help to find the cauliflower-shaped gamma prime phase;
- Current progress:



and Thresholding with (threshold_value = 190, maxVal = 255), yields great result shown below

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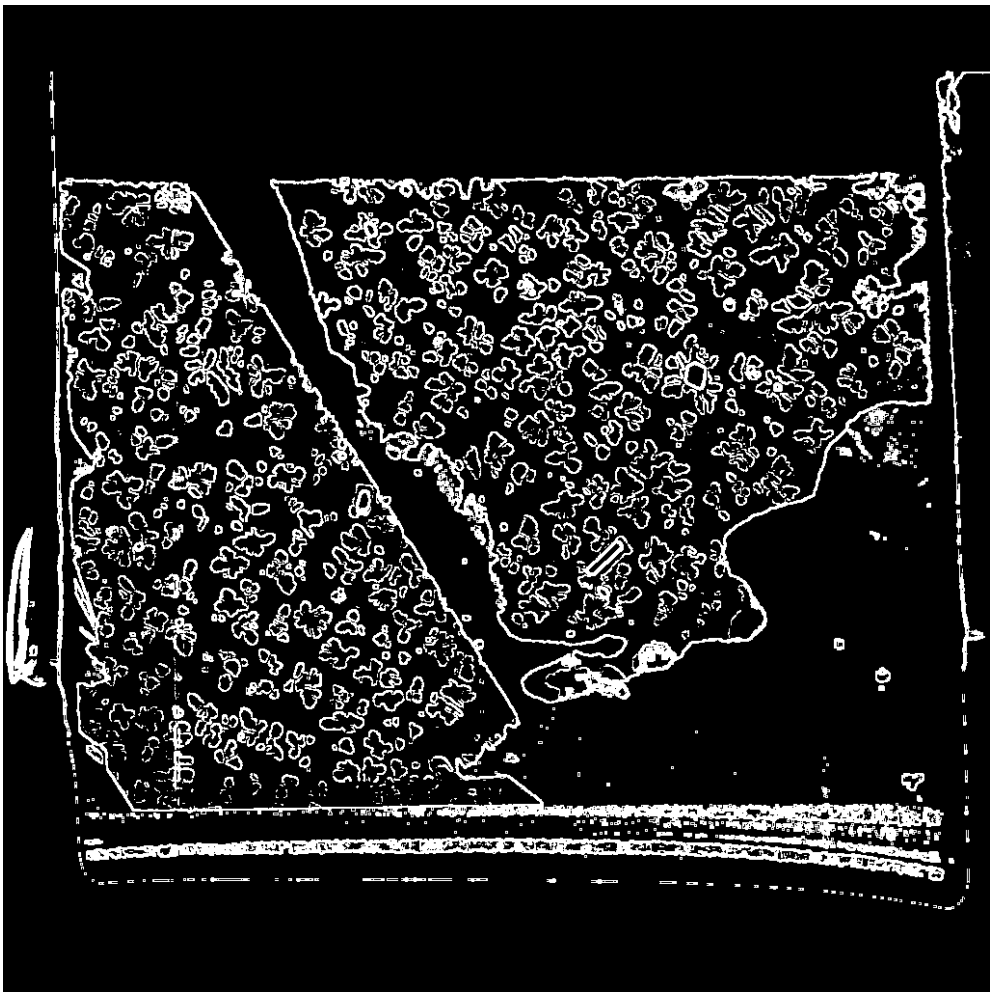

Checker function result: 20.44% differences, Mostly due to twin region differences.

For results above: Morphological transformation_gradient, kernel size (3,3), + histogram equalization, + binary threshold (thresh = 190, maxVal = 255).
Checker function result: 20.44% differences, possibly due to twin regions only

Previous attempts and thoughts:

- Error and trial shows that **Kernel size (3,3)** is the best kernel size; it picks out most of the features of interests, yet does not dilate too much to change the original shape of feature (as kernel (4,4) does).

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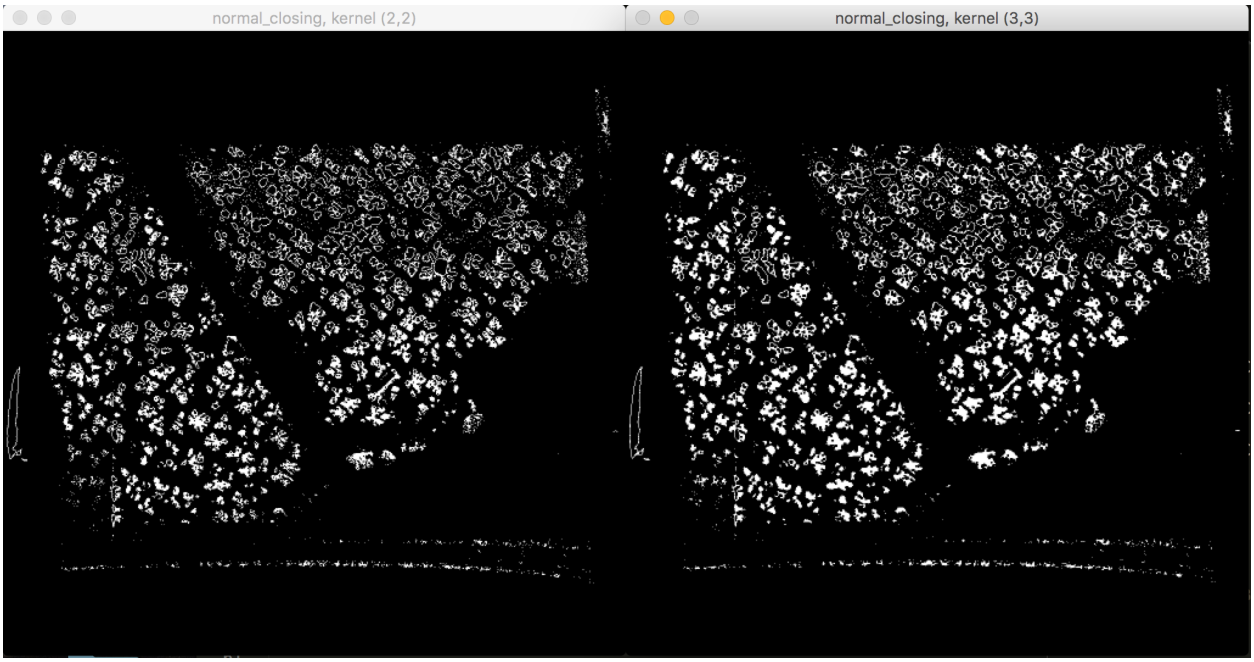
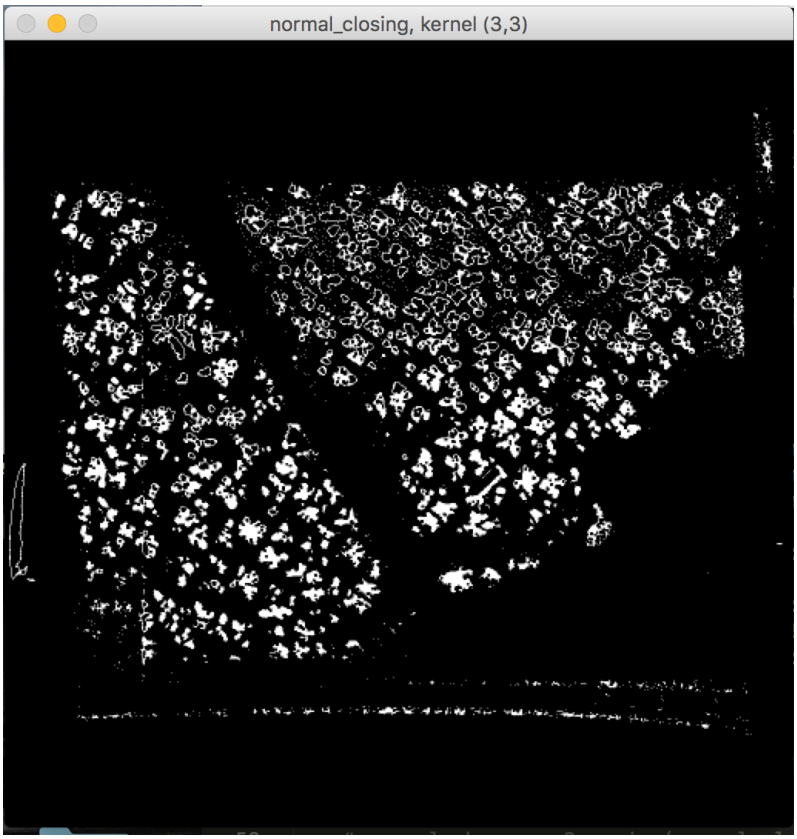
Below:



Comparison between kernel (2,2) and kernel size (3,3)



Trial 1: Opening: Eroding and then dilating;

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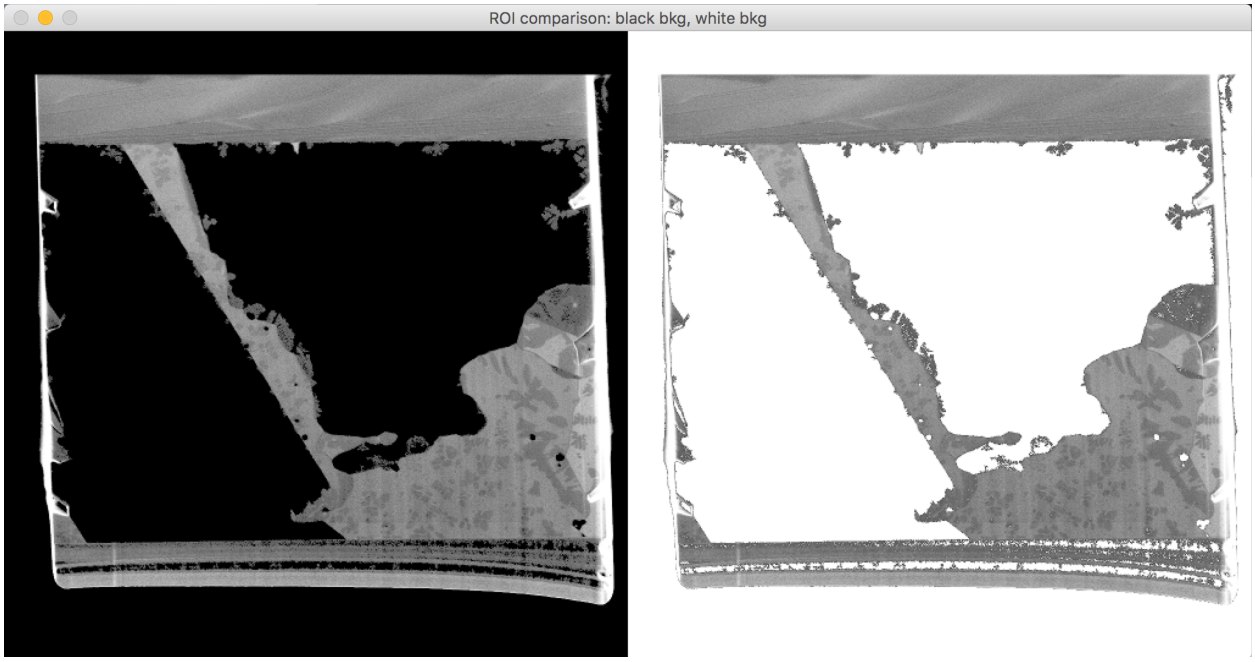
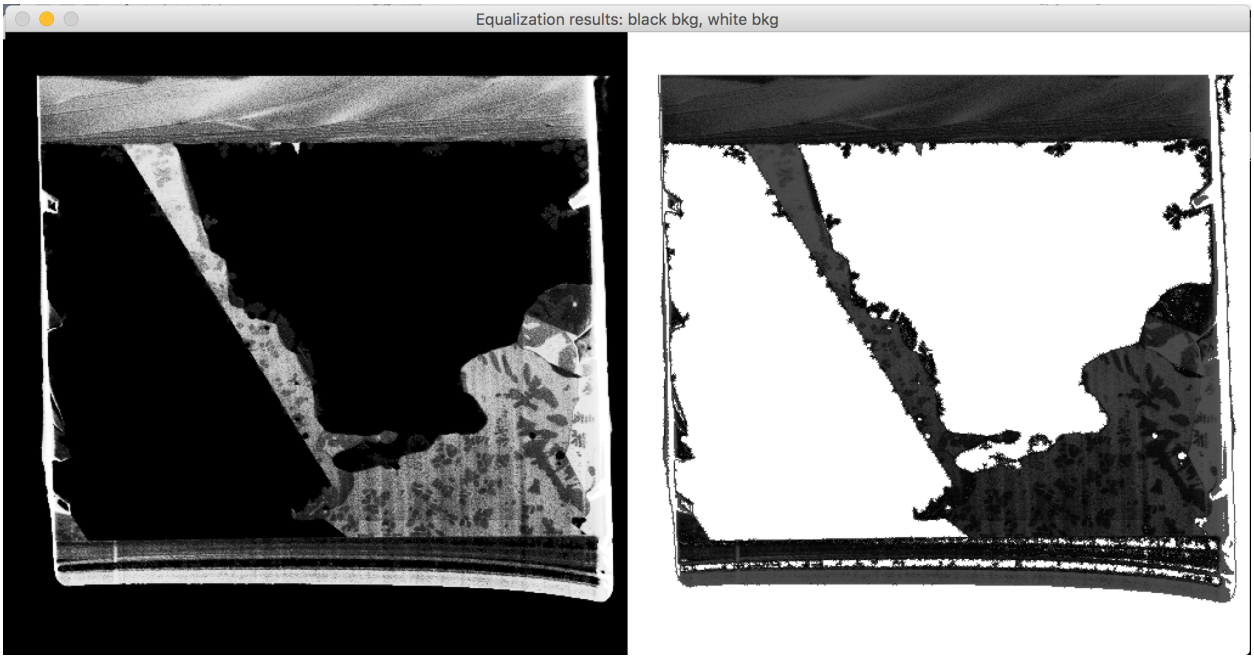
Part 2: working on improving the segmentation results of twin regions

- After Region of Interest was selected, the unselected was by default black. I changed the unselected regions to white, to see if that improves the histogram equalization results;



- Histogram Equalization comparison: ROI with black and white backgrounds



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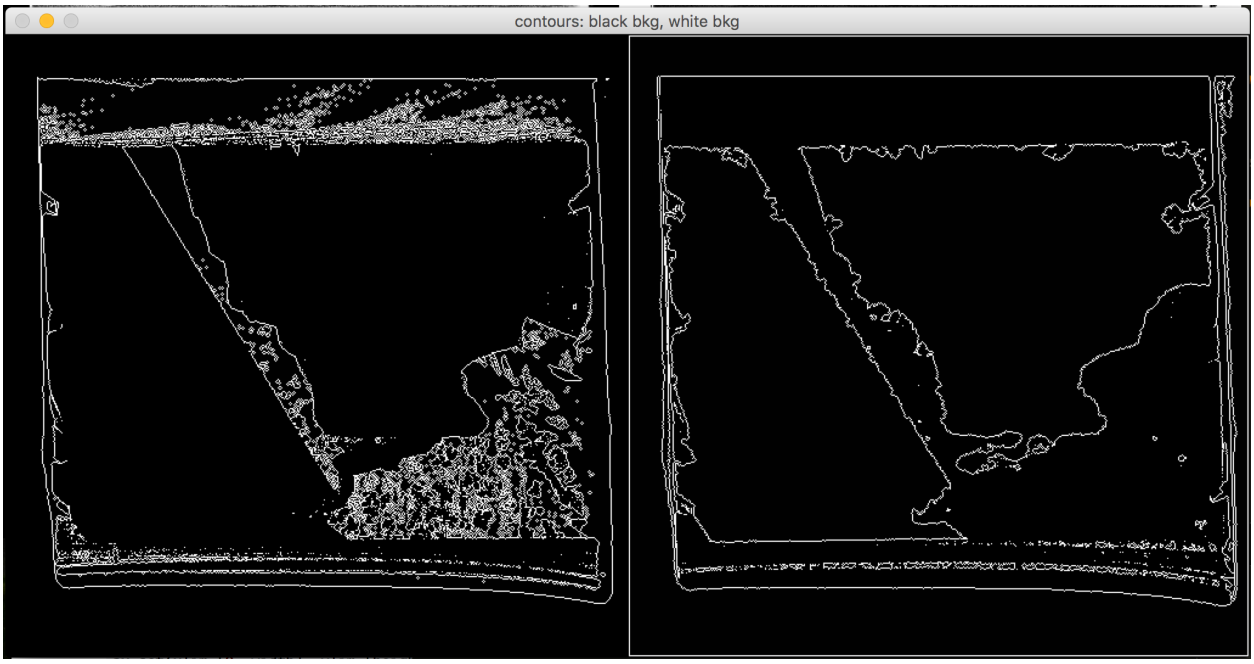
Regions of Interests have a even lower contrast in the right image, which would lead to noisier results.

- Contour results comparison:
Conclusion: converting unselected regions to white does not fix the problem; black background (original) has too much noise, and white background does not show the microstructure.

Part 3: find contours of the hand-traced image, and compare it to the calculated one.



problem: findContour function ignores the boundary lines that are less than one pixel wide, and thus clustered a lot of

Solution: Morphological Transformation has a function called Gradient. Not the best solution, but decent enough.

- Newly calculated value: **39% difference** between my segmentation and ground truth

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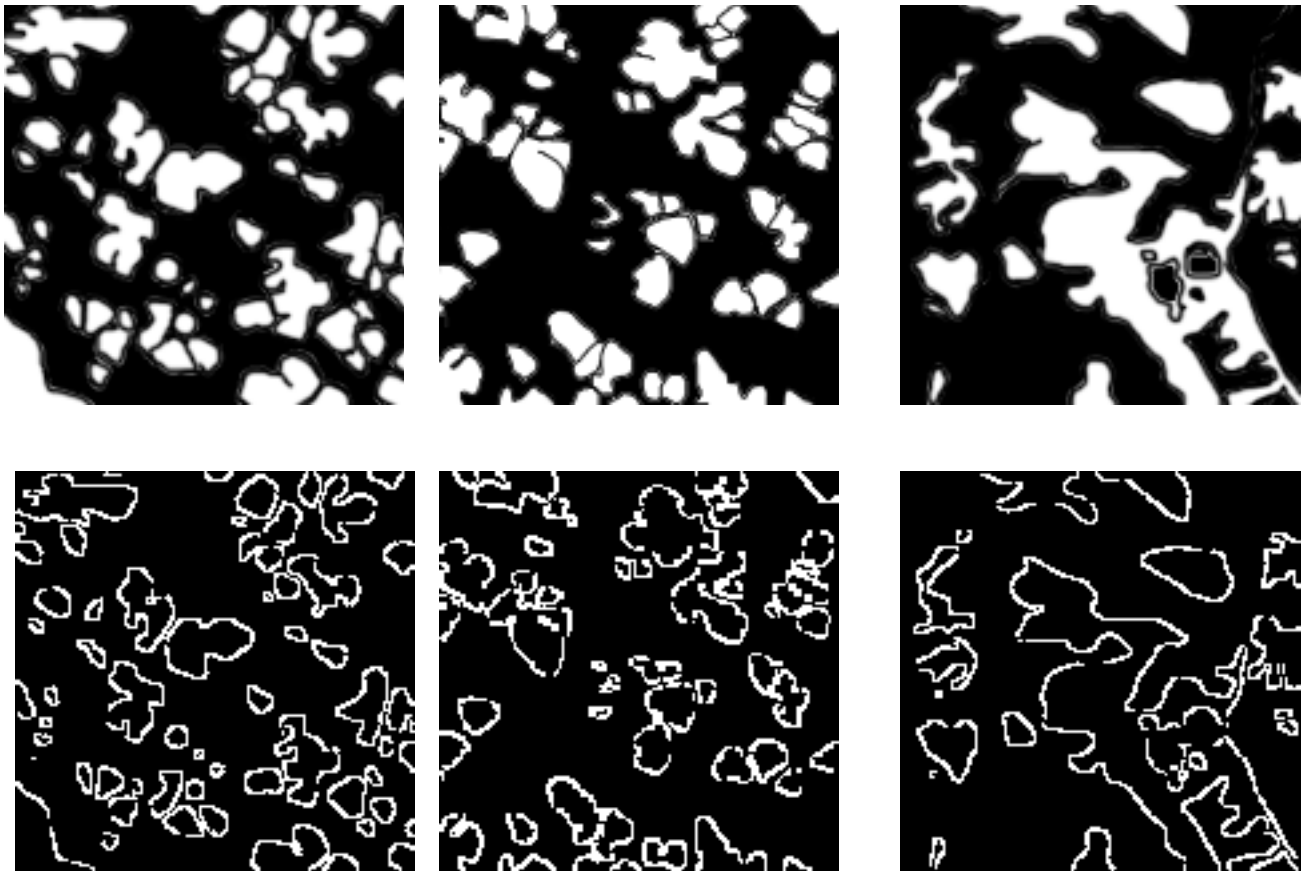
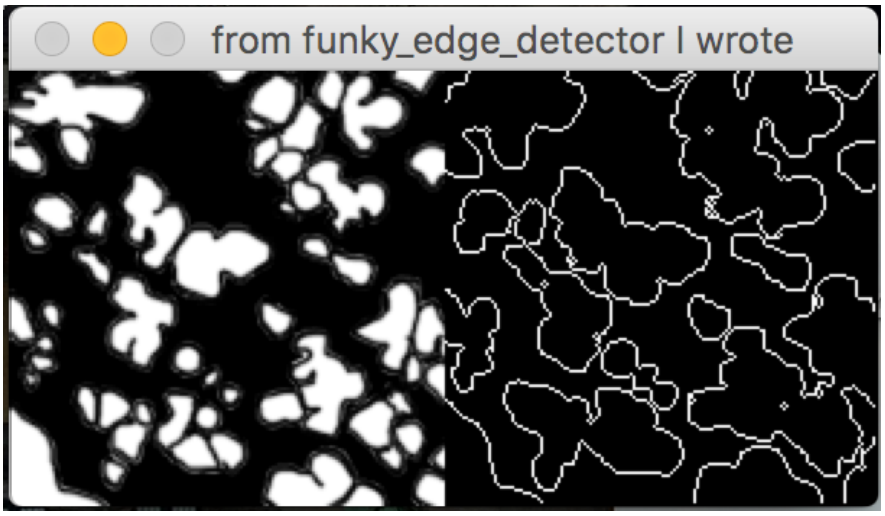


ROI 1 ROI 2 ROI

- **Previous Trial 1 [Failed]:** Write a boundary-finding algorithm myself, and hope I don't need to retrace the image;



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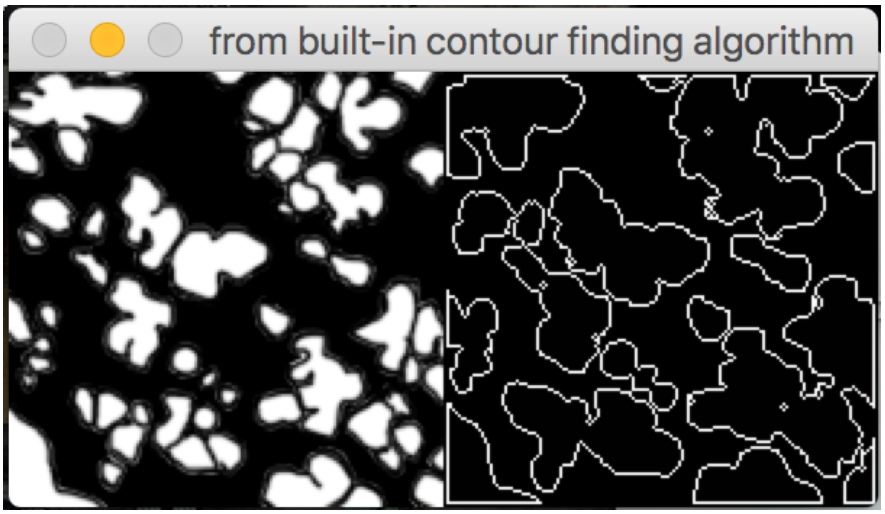
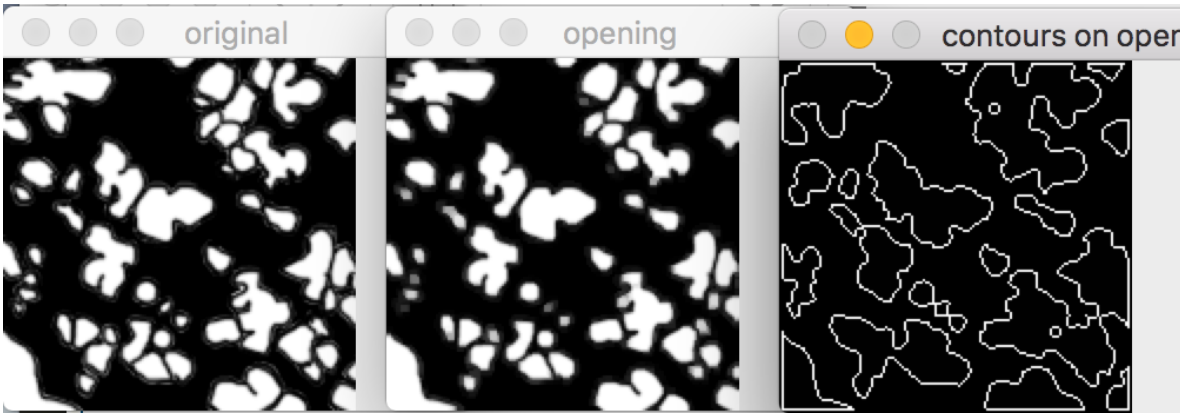
Didn't work very well, but at least slightly more accurate than the library find_contour function



- **Previous Trial 2 [slightly Failed]:** Use opening (eroding and dilating) to remove of thin lines of white color, that were created by accident. But result was similar to trials before.



- **Previous Trial 3 thoughts [too time consuming]:** Retrace the ground truth picture again, make sure there's no grey regions between white regions and black background.