

Brandon Shumin
12/10/2020
ECE 6310
Final Report

Basic Operation:

As described in the project specifications, this program loads either a PPG or PNM image and converts a colored PNM image into greyscale. This program also allows for the user to hold left click and draw an active contour curve around a desired object, these resulting contours can be shown in Figure 1-14. Using a right click, a bubble contour is initialized, an example of this bubble contour can be shown in Figure 17. After a contour is initialized, either Shift Key can be held down and a contour point can be clicked and dragged into a new position. This will reinitialize the contour from its previous state with the moved contour point, and the resulting new contours can be shown between Figure 15-16.

Extra Features:

If a new contour is drawn while a previous contour is running, the previous contour is stopped and cleared and the new contour is drawn. I built-in a button to stop and start contouring mid-run and continue from the same position when turned back on, contouring is enabled by default. A quick-clear button was added to very quickly stop a contour and clear a struct by pressing the “c” key. The contour also changes color from red to blue when contouring has finished to let the user know it is complete. During a shift click to move a point, the selected point is highlighted in cyan and moves with the cursor. Contour points are also stored in a struct to make for easy referencing within the threaded functions.

Failed Attempts:

I had originally attempted to create a system that would allow for multiple contours to run at the same time using a struct array of these contour points, but the process to synchronize these threads became too much of a hassle and ended up crashing my computer multiple times, so a normal struct pointer was kept instead and only one contour can run at a time.

The bubble contour only works well on objects with little gradient variation within them, this is due to my inability to find a good tuning of the algorithm to allow for the bubble to both expand through the object and to stop at outer gradient edges. I mixed the energies from a few different iterations of the bubble contour to arrive at energies that push the contours away from the center, space the points evenly, and allow the points to move perpendicularly along a gradient once it is found and a gradient energy.

I had initially been using a system for the active contour and bubble contour that “staged” the energy coefficients after half of the iterations had run. This idea was scrapped due to the staging often making performance very variable to the overall contours, with an improvement to one particular contour resulting in a loss of performance for another contour.

The amount of iterations was originally going to be determined dynamically based on the number of contour points being contoured, but it was found that this generally resulted in the run-time of this program to be needlessly lengthened with little-to-no improvement of the contour.

Future Considerations:

If I could do this project over again, I would likely take more time to make sure threaded processes were more carefully controlled. A lot of my time was spent making sure the threaded processes that contoured the points were correctly locked so that a new one could synchronously paint the image along with another running contour. Also, finding more efficient ways to evaluate useful energies would have been beneficial, I believe the energies that I used for the bubble contour in particular were especially in need of improvement. Fixing the gradient such that the bubble contour could perform well would have also been very helpful. Finally, finding a good way to more effectively space out contour points visually such that they do not appear to crowd the image would have been nice as well.

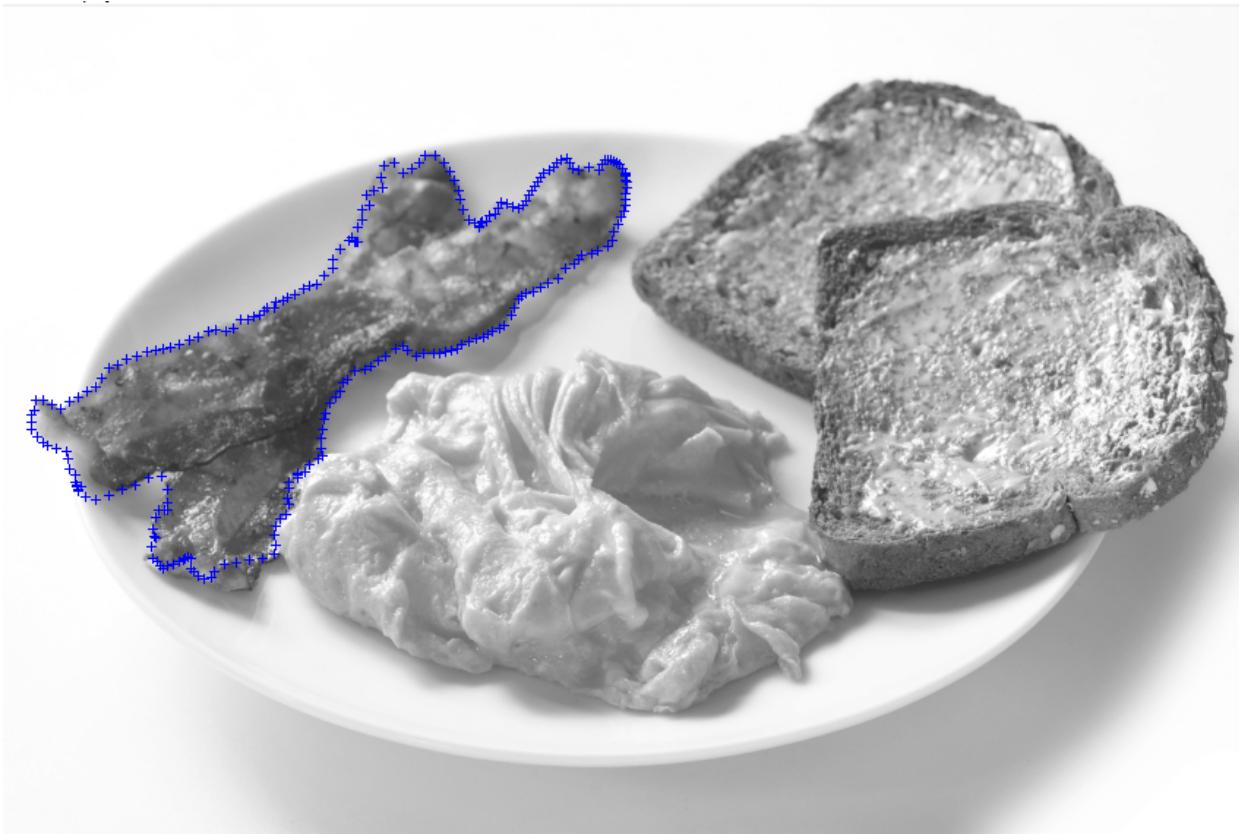


Figure 1: bacon-eggs-toast.pnm bacon contour

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Figure 2: bacon-eggs-toast.pnm toast contour

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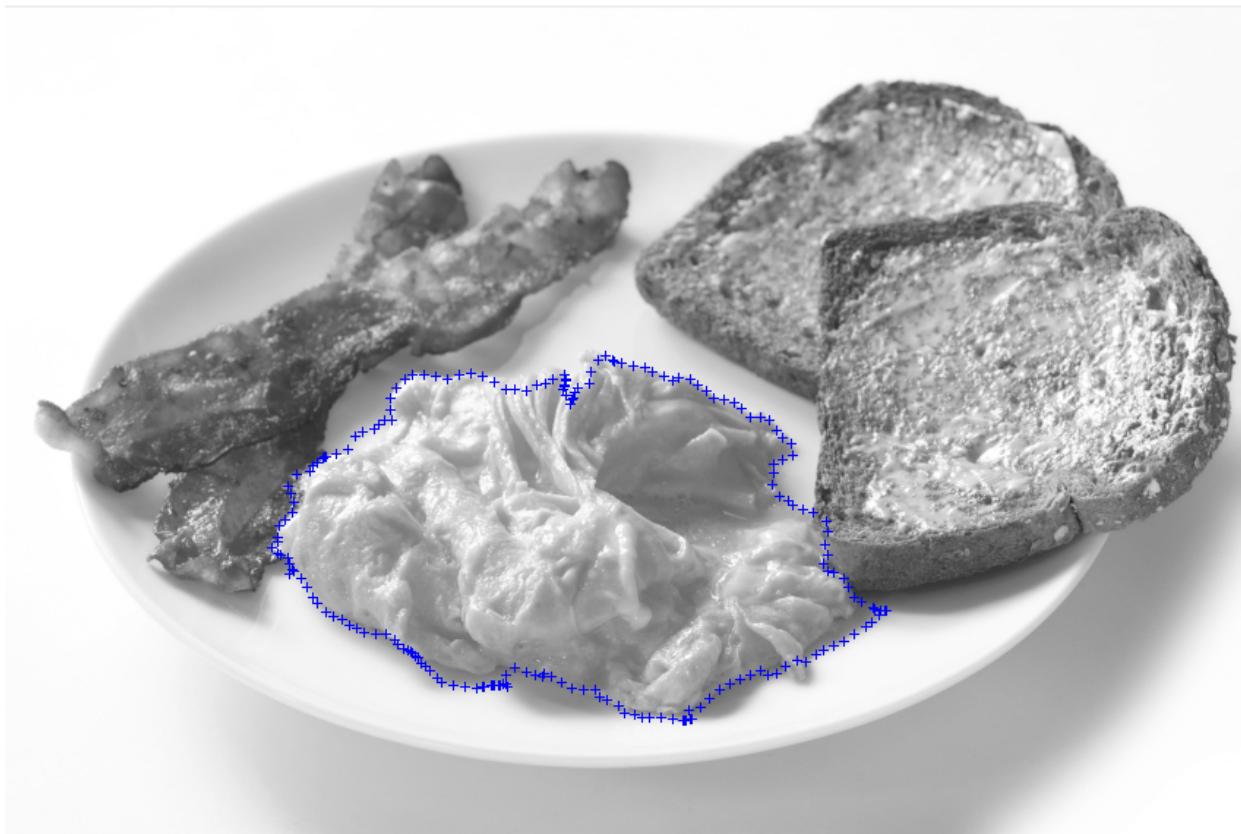


Figure 3: bacon-eggs-toast.pnm egg contour

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Figure 4: eggs-pancakes-milk.pnm pancake contour

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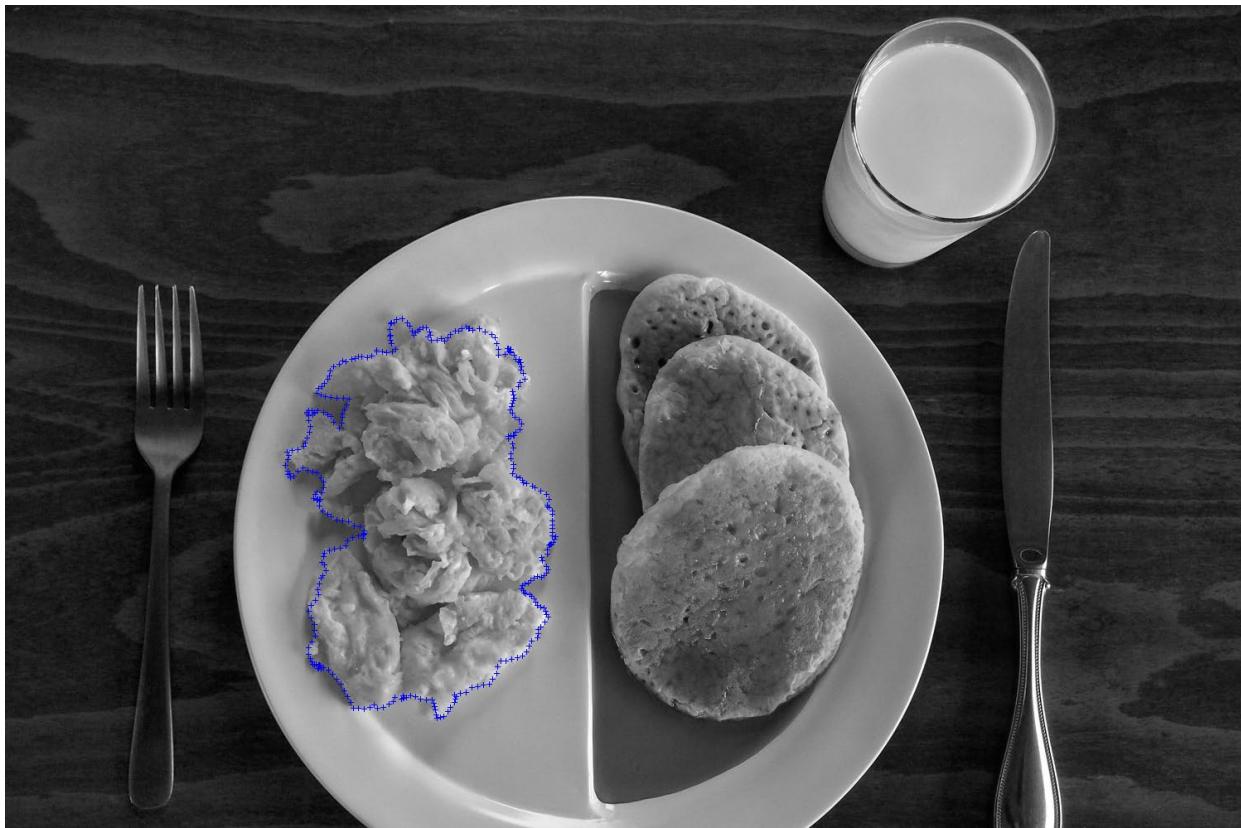


Figure 5: eggs-pancakes-milk.pnm egg contour

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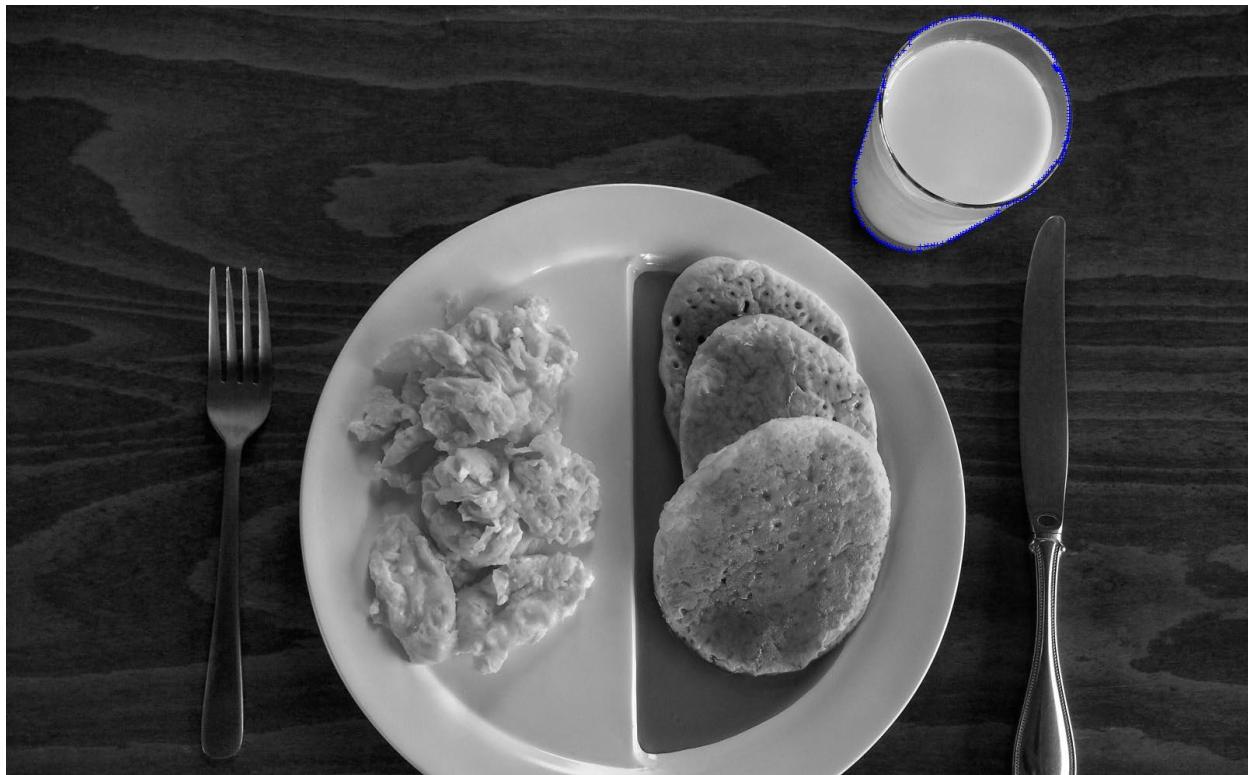


Figure 6: eggs-pancakes-milk.pnm milk contour

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Figure 7: hushpuppies-biscuits.pnm hushpuppies contour

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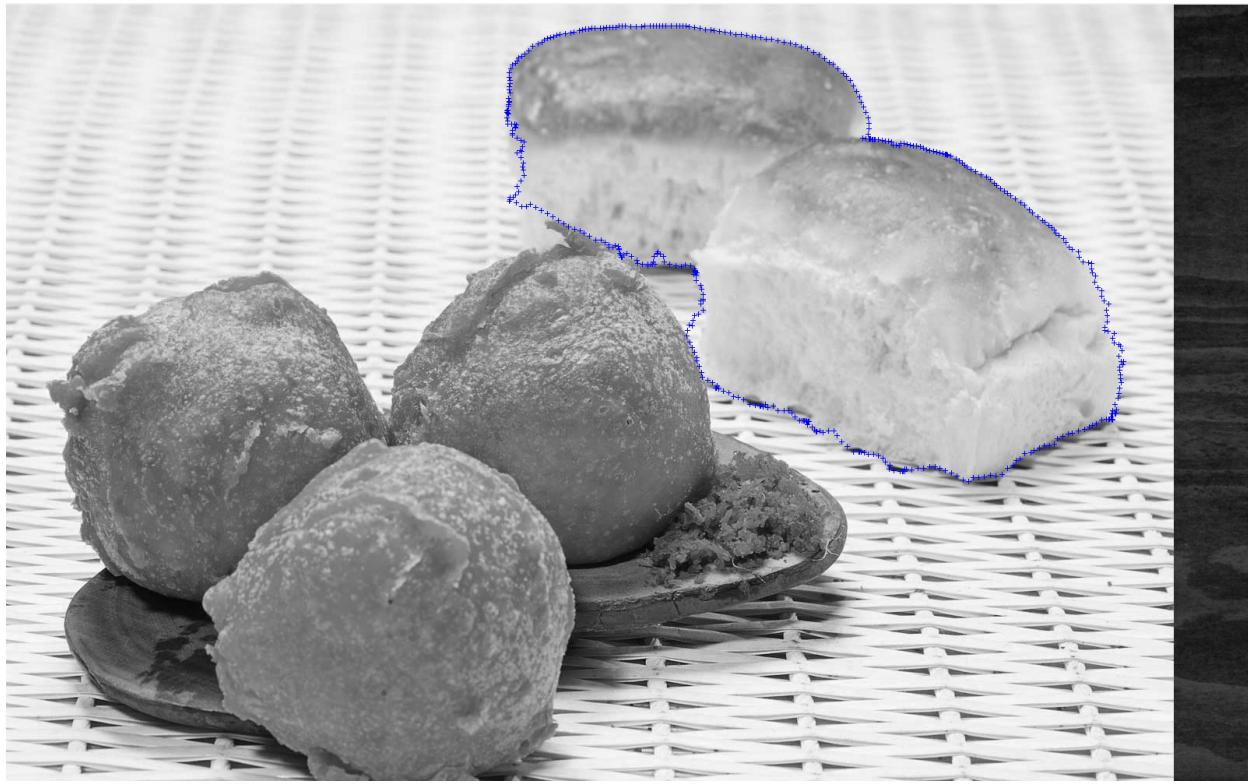


Figure 8: hushpuppies-biscuits.pnm biscuits contour

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Figure 9: fish-lemon-rice-greens.pnm fish contour

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Figure 10: fish-lemon-rice-greens.pnm lemon contour

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Figure 11: fish-lemon-rice-greens.pnm greens contour

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Figure 12: fish-lemon-rice-greens.pnm greens contour

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Figure 13: macaroni-kale.pnm macaroni contour



Figure 14: macaroni-kale.pnm kale contour

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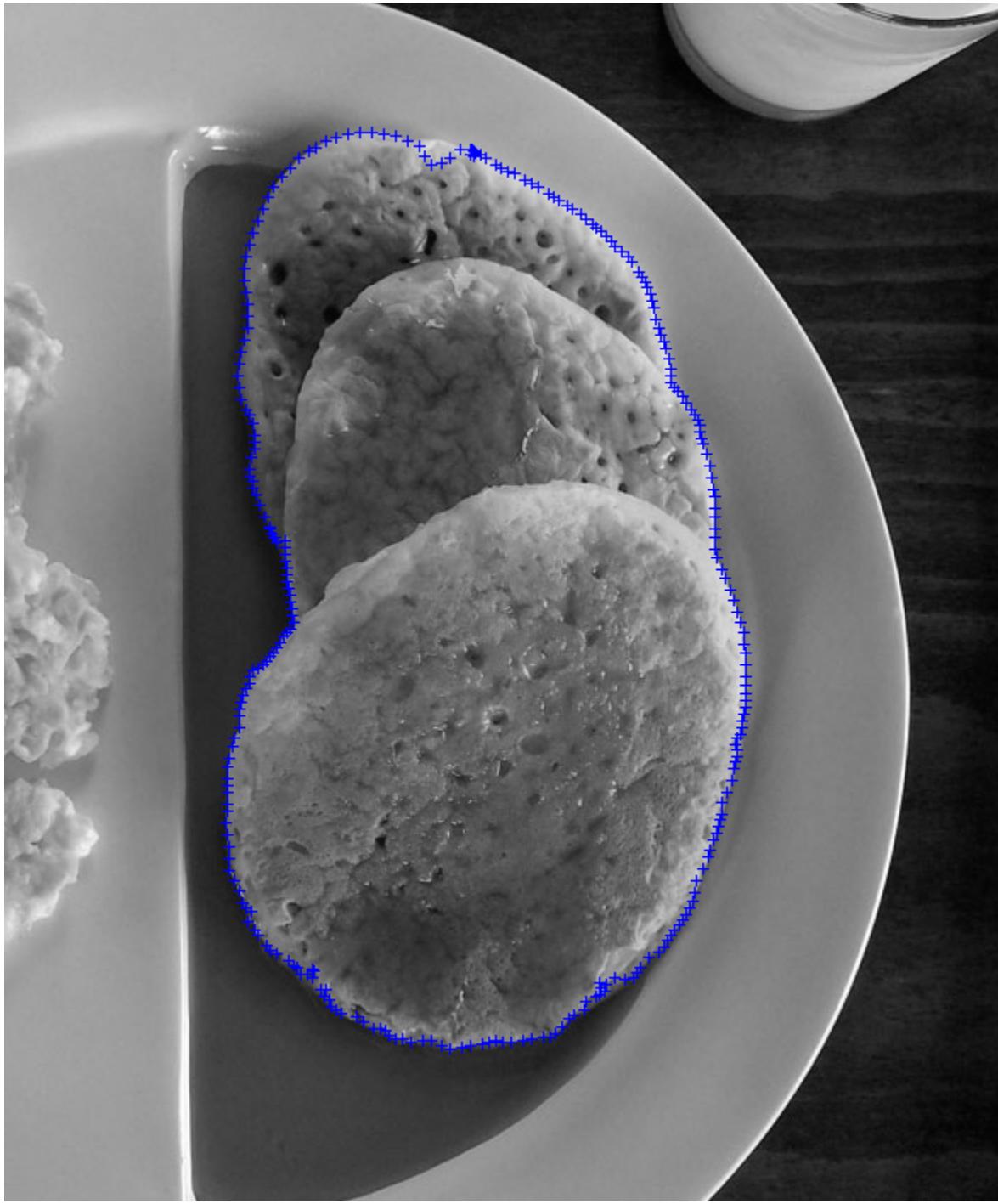


Figure 15: contour before shift-click

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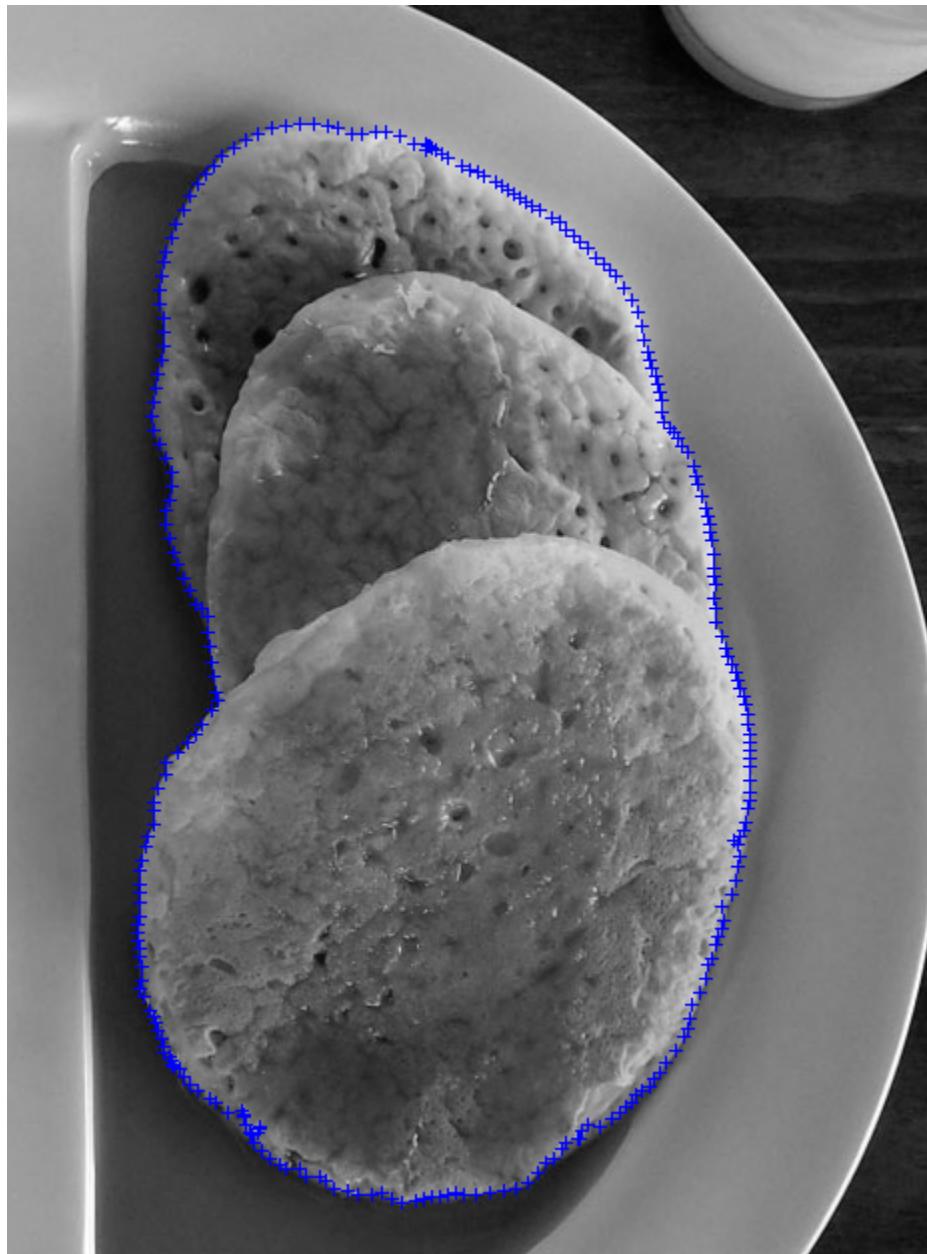


Figure 16: contour after shift-click (notice the notch at the top is gone)

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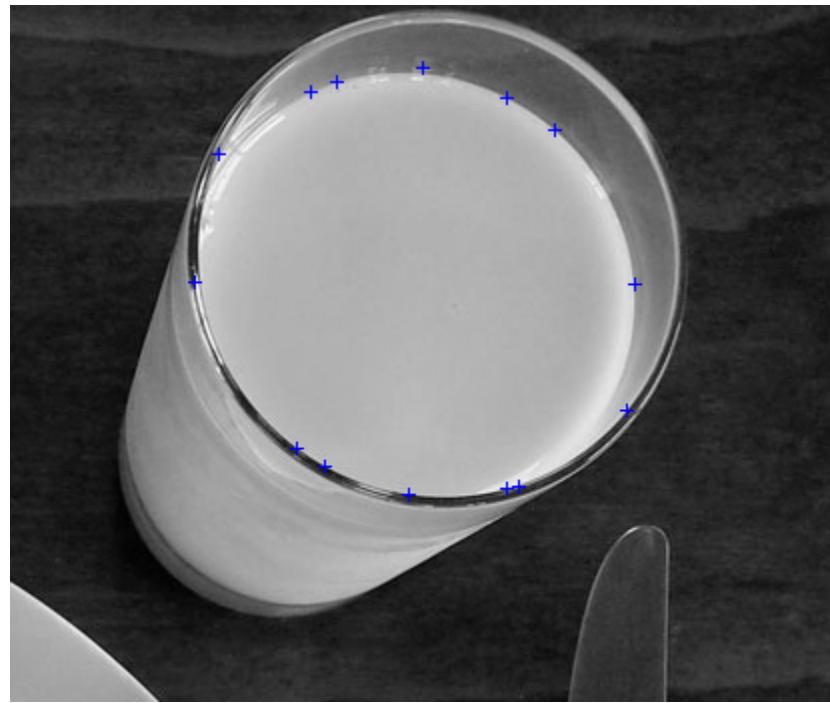


Figure 17: bubble contour on milk image