Quantify Histology Fat Droplets & Edge Detect/Region Grow Image

Jan 17, 1-3pm; Due Jan 25th.

Overview

Please download the starter .m files and data files from the CLE.

Follow the steps below. It is fine to do steps in a different order or with different methods, as long as the final objective is the same and any major changes are explained.

Include images of figures and results and discussion as requested in the step-by-step guide by publishing your code + results in matlab and submitting on the CLE.

Parts:

I. Find Large and Small Fat Droplets
II. Segment SAT - Edge Detect, Dilate/Erode, Region Grow

Inputs:

Image files are:

histology_droplets.jpg

And MRIs in the format of volumes: - these are the same as in Lab 1.

<fileroot>.int2 = binary data, stored as short integers (2 bytes), top left of image, across, to bottom left of image, as a stack of images. Here inferior is listed first.

<fileroot>.idf is an image descriptor file = a text file w/ information such as the type of file and the # of pixels and FOV of the image volume

You can load these directly into matlab, or can use the read_idf_image_pc functions provided

Type help <command> to learn more

For this exercise, we will focus just on the umbilicus slice.

Pre = suc047_4_S10 files, use slice 15 if counting from the first slice, 30 if counting from the superior end (if using readidf functions)

STEP-BY-STEP GUIDE TO THE LAB

Part I – Histology – Quantify Large and Small Droplet Fat

Use the hist_starter.m file

The places you need to modify or add code are marked with:

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Steps
1. Load & display image.
2. Set a range of radii and sensitivity to detect large droplets.
3. `Use imfindcircles` to detect circles (see help)
4. Draw the circles on the slide, visually assessing the find.
5. Try a different range of radii and sensitivity – ensure you're finding the largest droplets. Just find a reasonable set.
6. Find the #circles and the histogram, mean, and median of the radii
7. Make a blank image and paint the circles you've found on the slide
8. Display this image.
9. Calculate the area the droplets cover in pixels and as a % of the total image area.
10. Repeat for the small droplets.
11. Display the histology slide w/ both sets of circles drawn, with a different color for each set.
12. Print the stats for the droplets: number, area, mean radii, median radii, and total fat %area (of slide %area) for the large droplets, small droplets, and totals (total median radius is extra credit)
Question H1 - Can you just calculate the area of the circles you just found to find the total area covered by these circles? Why or why not?
Question H2 – Visually assess the finding of circles – Is it perfect? If not, what are some examples of mistakes/errors? Please comment about why that error occurred and/or if it could be avoided. (briefly).
Question H3 – Comment on the selection of min and max radii and sensitivity you chose for large droplets and for small droplets. You don't need to try all options, just a couple.

Part II Segment SAT – Edge Detect, Dilate/Erode, Region Grow

Use slice 30 from suc047_4_S10 – calculate a fat fraction map based solely on the in and out of phase magnitude images – you will get a map with edges highlighted (This FF only ranges from 0-50%).

Generate the segmented SAT two ways: 1) based on the FF map (dilated and eroded, then region grow); and 2) based on an edge detected FF map (then dilate and erode the mask and region grow).

1. Follow the code in the IOP_edges_starter.m (OK to approach differently/ use other resources, etc).

Calculate a FF map ----------	----↓
↓	Edge Detect
1. Dilate FF map	Dilate Edge mask
2. Erode dilated FF map	Erode dilated edge mask
3. Region grow → segment SAT (FF)	Region grow → segment SAT (edge)

Steps
1. Load images.
2. Calculate a Fat Fraction (FF) Map, using the In and Out of phase maps, as shown in class slides. → FF map
3. Dilate the FF map → try more than one or two types or sizes
4. Erode the dilated FF map
5. Region grow this map
6. Make a figure of: the FF map, the edge detected map, the dilated map, the eroded map, and the region grown segmented mask.
7. Repeat but edge detect the FFmap first → you may want to try different thresholds for edge detection → and then dilate then erode this map.
8. S1.Question – Comment on the effects of different dilation parameters. What is the effect of too much dilation? Too little dilation?
9. S2.Question – how did you erode the dilated map/image?
10. S3.Question – Visually asses the segmentation – how accurate was each approach? If it failed, why?
11. S4.Question – Which approach was more accurate? Why?

I. Create Fat Fraction Map (FFmap (0-50% range))