BMI/CS 567 Medical Image Analysis
University of Wisconsin-Madison
Assignment #4

Instructor: Jeanette Mumford
Due April 10, 2018 *before* 2PM

For this assignment you should turn in a single pdf file containing your code and the specific output requested for problem 1 *only*. You'll turn in a separate m file for problem 2. I will be running your code for problem 2 to grade it.

(1) (5 points) For this problem you'll be building off of the region growing problem we worked on in class, based on Practical Lesson 6.8.3. Recall when we ran the algorithm in class we binarized the image and initialized where the growing began and so only the one region was identified. Please do work off the class code and not the author's since I wrote a more efficient version of the script that should grow the region much faster and I simplified the algorithm to work with binary images. The goal here is to skip the initialization step (selecting a pixel in the segment of interest) and then use this flexibility to allow us to find all connected segments in our binary image. Your result should produce an image where each connected region of pixels is indicated by an integer and should look like Figure 1, where each color represents a different segment for a total of 5 segments (your colors may differ). To achieve this you will need to embed the while loop from class into a for loop that will loop through the pixels and if a pixel in the image has an intensity of 1 and hasn't yet be assigned to a segment, that pixel serves as the initial pixel of a new segment. Tip: If you want your loop to go really fast, have it skip rows of pixels where the original image is all 0s or where the nonzero pixels have already been assigned to a segment. My version took fewer than 4s to run and I'm sure that time could be beat!

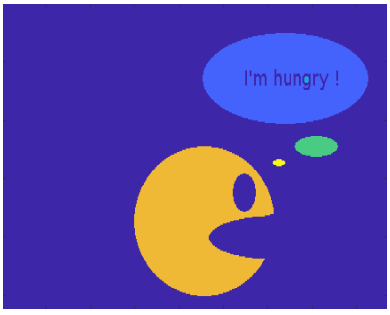

Figure 1: The solution you are working toward for problem 1. Each color represents a different segment (dark blue is background).

(2) (10 points) This goal of this problem is to check that you're making progress on the final project and that you're able to write code that I (and the TA) can easily execute. Generate code that extracts 1 feature from each of the distributed retina images. Recall, this is a single, numeric, value

that summarizes something about each image. Write this code so it will estimate these features from the left out data set as well as the distributed data set. Please see the Final Project instructions for more details. In short, I should be able to change 2 paths in your code to the 2 sets of data (one I distributed and held out data). I will then run your code directly from the command line (akin to using the `run` command). Some of you may have written extra functions, so it is fine if I also need to change an `addpath` command. Just zip up all your MATLAB functions. This portion of the homework will *not* use the mlx/pdf option. You will submit MATLAB script(s) only. You will be graded on:

- Whether your code executes without errors.
- Whether your code is efficient. It should be able to compute the features on all images within a minute or two, tops.
- I will *not* grade you on the quality of your features, but I will give you feedback if I think you are not on the right track. The only output from the code should be any notes you include to verify the code is running (I often like it to print out the image it is currently working on so I can notice if it gets stuck) and a scatter plot of the feature magnitude on the y-axis and the image number on the x-axis (one for the distributed data and the held out data). For the distributed data I ordered all of the healthy retinas first, so this will be an easy check to see if your feature has any potential. You should be able to see a noticeable difference in the feature magnitude for the first 18 vs second 18 values.