CIS 537 Segmentation Grand Challenge – Part 2

Due Monday 3pm April 27, 2015

1. Introduction

In the second part of this assignment, you are asked to create a solution that will segment a tumor and any edema (swelling) around the tumor given that a small set of pixels are already labeled with the correct label.

As in the first part of this challenge ,you are to investigate and compare three different segmentation algorithms that all have a Markov Random Field (MRF) formulation: Iterative Conditional Mode, Graph Cut, and the Random Walker segmentation.

2. Data

Like the first dataset, the second datasets is divided into training and testing subsets. For the images in the training set, manual segmentations are provided, which allows you to test your algorithms. The segmentations for the testing set, which are not provided, will be used to test your algorithm on unseen data.

2.1 Data set 2

This data set consists of co-registered MRI slices from brain tumor patients. The MRI slices were obtained using several MRI modalities: T1- weighted without a contrast agent, T1-weighted with a contrast agent, T2-weighted and FLAIR.

There are 3 tissue classes of interest for segmentation in the images:

1 Tumor
2 Edema (fluid surrounding a tumor)
3 all other tissues

3. What you need to do

3.1. Challenge 2

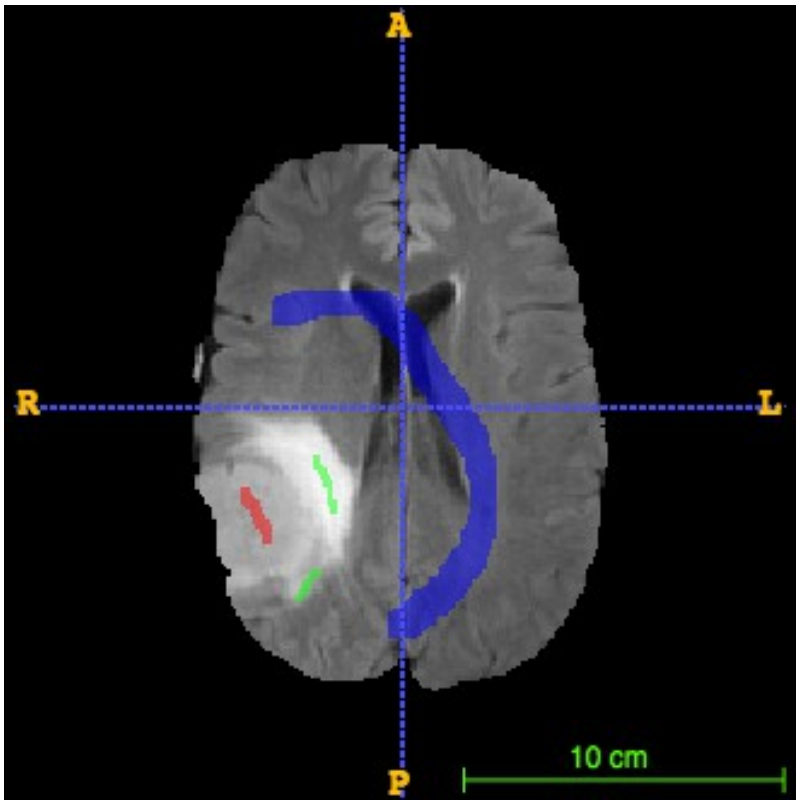
The image **subXXX_seed.nii.gz** contains hand-drawn samples of each tissue class (see in the figure below). In ITK-Snap these can be loaded as "segmentations". The goal of the assignment is to use these samples to segment the rest of the image using each of the three algorithms. Remember that the "image" is really 5 different images that are aligned. The subXXX_seed.nii.gz images have 3 labels

1 Tumor (red in ITK-Snap)
2 Edema (green in ITK-Snap)
3 other tissue (blue in ITK-Snap).

But most of the image is unlabeled.
The final segmentation from you algorithm will be a single image pixels in the tumor and edema have one of 2 labels:

1 Tumor
2 Edema (fluid surrounding a tumor)
or no label for all other tissues and the background

In your report, explain the details of how you applied each of the 3 algorithms to this specific problem. You should explain how you applied the Graph Cut algorithm which produces a binary segmentation to this problem of segmenting 3 classes. You should explain how you used information from the 5 different MRI image types and the seed image to create the n-link and t-links for the Graph Cut algorithm and the Random Walker algorithm.



3.2 Evaluating the segmentation results

You should report Dice overlap, Average distance, and Maximum distance error measures for each algorithm and data set. However, the Grand Challenge results will be determined base on the best Dice overlap measure only.

3.3 Submitting Your Data to the Competition

This is the most important part! Pick the method/parameters that yielded best cross-validation accuracy in your experiments and apply it to the segmentation of the training dataset. Save the results as NIFTI files, named subxxx_ourseg.nii. These files should have the same structure as the segmentation files in the training directory, pixels in the tumor and edema regions should each have a single label. The rest of the image does not need a label. Make a zip file with these images and submit as part of your assignment.

4. What to submit

1. The **.zip** file with your segmentations.
2. All your MATLAB source code. Make sure that it is documented, so a reader can follow what you did.

3. A short report explaining what you did and a table of the results for each challenge and each segmentation algorithm.

5. Grading

The top ranked team for each of the two parts of the Segmentation Challenge will receive an extra 7 points towards the overall assignment grade.