E-Health

Lab 2: Software Tools

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1. Introduction

Segmentation is one of the prior steps for most of the Computer Aided Diagnosis (CAD) system and success of further analysis to some extend also depends on proper segmentation. In last decades numbers of literature has come out regarding manual, semi-automatic and automatic segmentation. Still for gold standard segmentation and testing the results of semi-automatic and automatic segmentation manual segmentation using some tools plays an important role. In this lab we get introduced with two publicly available tools called "**ITK-SNAP**" and "**3D-Slicer"** and performed segmentation task. The objectives of this lab shown below.

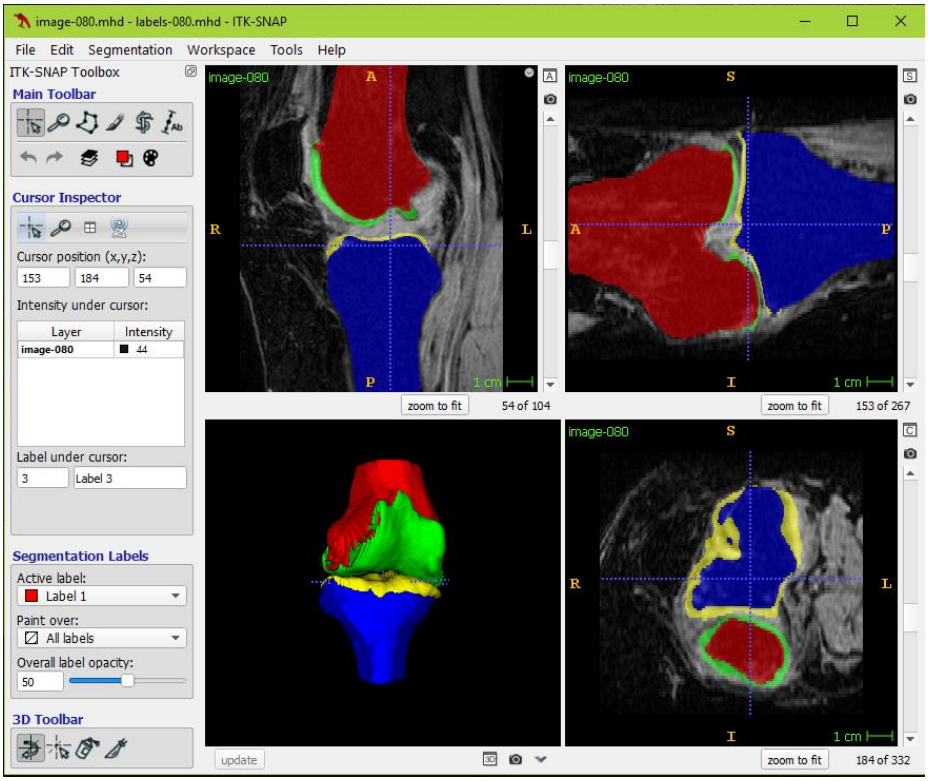


Figure.1: Visualization of the segmented knee image (Image-080) in ITK-SNAP.

Objectives:

I. To visualize the image and label of the image using ITK-SNAP
II. To perform segmentation using ITL-SNAP
III. To compute Dice Coefficient using 3D-Slicer.

2. Experimental Setup & Data

To perform the tasks of this lab two software were need. The experimental setup and the configuration of the device shown below.

I. **ITK-SNAP**: Version 3.6.0, http://www.itksnap.org.
II. **3D-Slicer**: Version 4.8.0 r26489, https://slicer.org
III. **Computer Device**: Windows10, Core-i5, RAM-8GB

For performing the Lab tasks a dataset was provided. Dataset consist Knee MRI and label for a corresponding image.

I. **Data for visualization**: image-080.mhd and labels-080.mhd.
II. **Data for Segmentation**: image-081.mhd

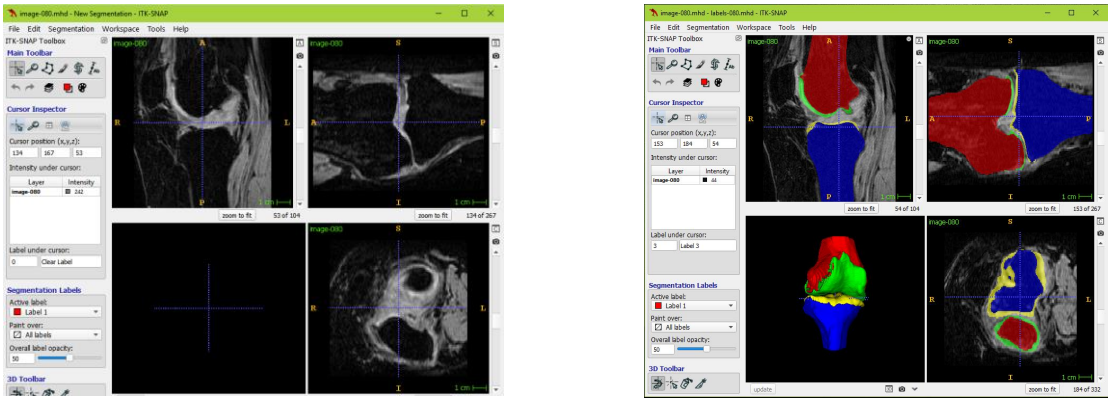
3. Experimental procedure

3.1 Visualization Using ITK-SNAP

In this step we need to visualize "**image-080.mhd**" and "**labels-080.mhd**" using the "**ITK-SNAP**".

To perform that we had to go through following steps.

I. **ITK-SNAP** was installed and opened. The "**image-080.mhd**" Knee MRI was dragged on **ITK-SNAP** window and the MRI view was shown in figure. 2(a).



(a) MRI knee data image-080.mhd. (b) MRI knee data with label.

Figure.2: Visualization of the knee MRI and Label (Image-080) in ITK-SNAP.

II. Moving the cursor in one window, corresponding positions in other different windows was observed.
III. Afterward the label was visualized. The "labels-080.mhd" was dragged to the **ITK-SNAP** where the "**image-080.mhd**" is already opened. Then a window pop-up where the new MRI is selected as "**Load as Segmentation**". The loaded label was shown in figure. 2 (b).

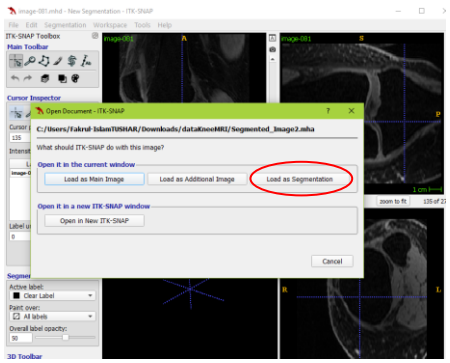
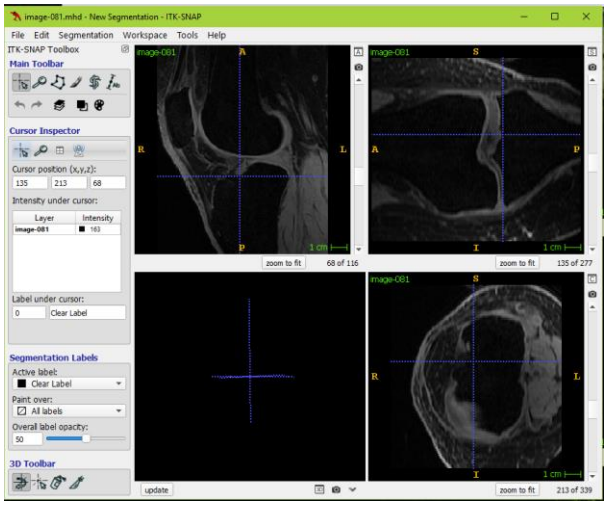


Figure.3: Loading the Label MRI as Segmentation in ITK-SNAP.

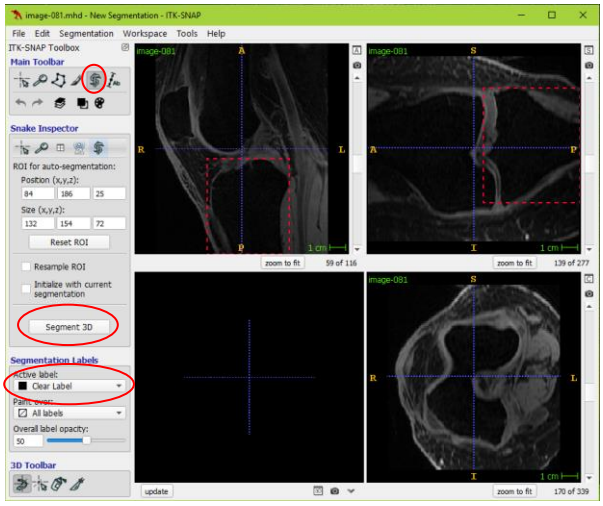
3.2 Segmentation using ITL-SNAP:

In this step the segmentation was performed on “image-081.mhd” MRI knee data using active contours for tibia segmentation. Following procedures was performed to accomplish this task. Over all process was shown in figure 4.

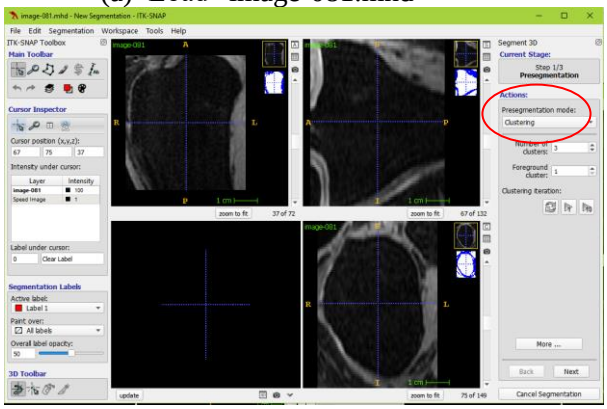
I. The Image “**image-081.mhd**” loaded to **ITK-SNAP**.



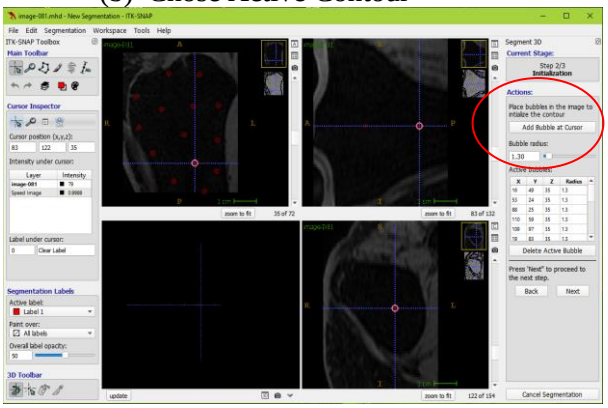
(a) Load “image-081.mhd”



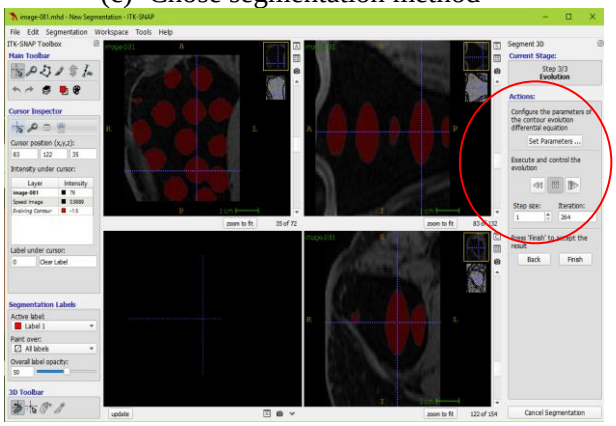
(b) Chose Active Contour



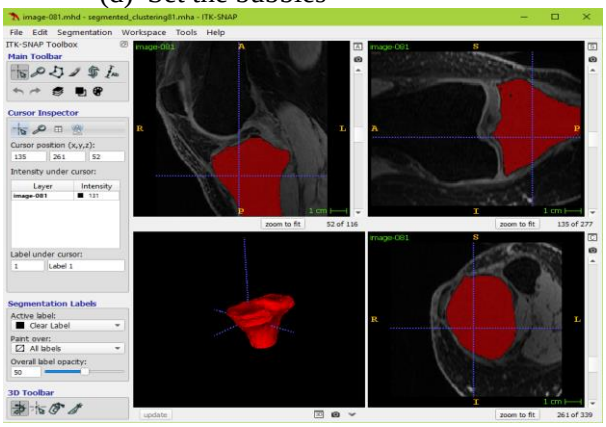
(c) Chose segmentation method



(d) Set the bubbles



(e) Execute the control evaluation



(f) Save the Segmented Image.

Figure. 4: Segmentation procedure step by step.

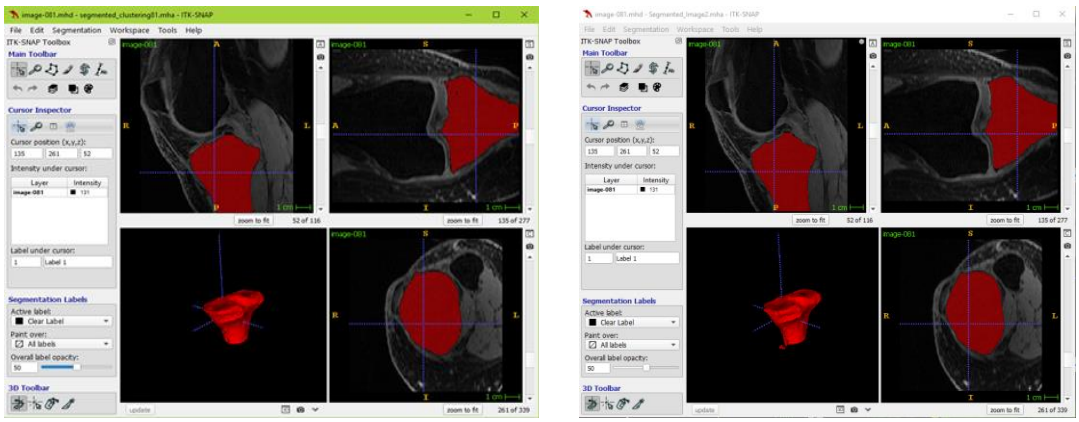
II. From "**Main Toolbar**" of the ITK-SNAP "**Active Contour**" option was chosen. Then the desired windows were set for the region of interest (ROI) shown in figure.4(b). After that "**Segment 3D**" was selected.

III. Then the RIO is loaded. Next step was to select the semi-automatic method that we want to apply for the segmentation from the "**Actions**" shown in figure.4(c). For our lab tasks we have applied two methods called **Clustering** and **Edge Attraction**.

IV. Afterward the bubble was added in different position using the cursor and "**Add Bubble at Cursor**" shown in figure.4(d).

V. Then the execution was performed and after getting the desired segmentation the segmentations were saved.

VI. Figure. 5(a) and 5(b) shown the Segmentation performed using Clustering and Edge Attraction methods gradually.



(a) Segmentation using Clustering (b) Segmentation using Edge Attraction

Figure.5: Performed Segmentations.

3.3 Compute Dice Similarity Coefficient:

To measure the performance of segmentation computing the Dice Similarity Coefficient is a well-known matric that compares the similarity between two samples. In this lab instead of calculating dice using programming languages like **Python**, **MATLAB** we used **3D-Slicer's** module called "**DiceComputation**" and compute dice between two segmented images what we saved earlier in section 3.2.

I. From the "**Extension Manager**" of **3D-Slicer** the "**DiceComputation**" module was download and installed.

II. From the "**Modules**" the "**DiceComputation**" was selected.

III. Then the two Segmented images were loaded as **"Volume>LabelMap"** shown in figure.6.

IV. In "**Parameters**" **Dice** was selected. And in "**Label Maps" Segmented_Clustering81** (Segmented using Clustering method) **and segmented_edgeAttraction** (segmented using Edge Attraction method) selected in Item 1 and Item 2. Shown in figure 7.

V. Then the Dice was computed. Using the "Export to CSV" computed Dice can be saved in CSV format.

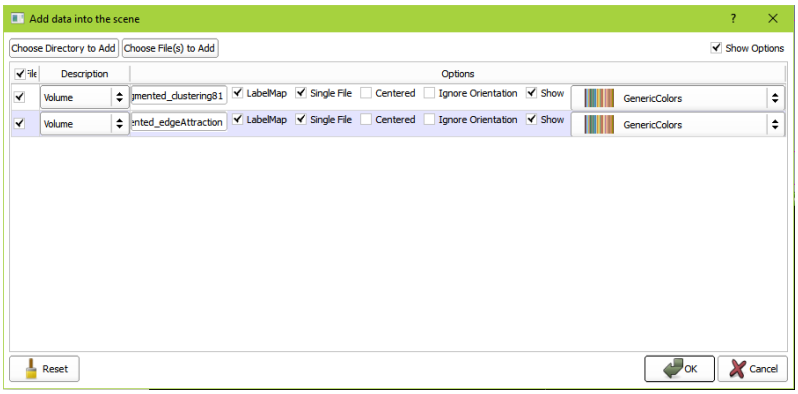


Figure.6: Loading the Segmentations for Dice Computation in 3D-Slicer

VI. The computed Dice is 0.989. it indicated both the segmentation methods perform almost same.

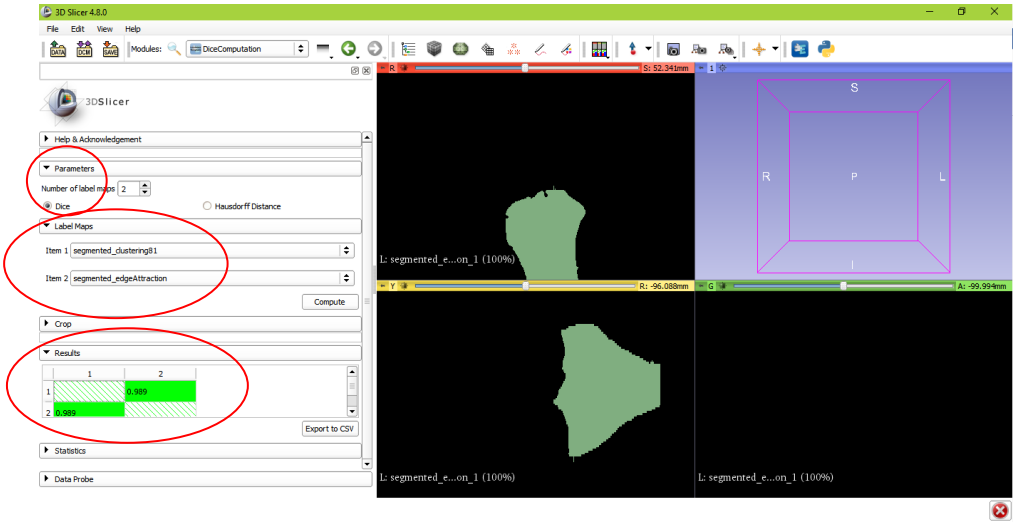


Figure.7: Dice Computation

4. Conclusion and Discussion:

This lab was very interesting because that was the first time we performed the segmentation using imaging tool. Visualization of 3D MRI imaging data in ITK-SNAP was very used to understand the data and explore the 3D orientation of data. The Segmentation task was straight forward and can be useful for annotation of desired test-set in future works. The computed dice indicate the performance of the two method namely clustering and edge attraction that used in this lab tasks perform almost identical.

Segmented Data:
https://github.com/fitushar/Ehealth_Course_work/tree/master/LAB_2_Software_Tools/Segmented_MRI_DATA

Reference

[1] Robert, Marti. 2018. E-Health: Lab2 Software Tools [lab manual]. Girona (Spain): University of Girona.