Master Computer Vision

Medical Image Analysis

Management and Post-Processing if Prostate MRI
Lab Report

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1 Introduction

Prostate cancer is a form of cancer that develops in the prostate, a gland in the male reproductive system. Prostate Adenocarcinoma appears in older men mostly before an age of 50. Men over 60 years of age are 85 % more likely to get Prostrate cancer. In just first six month of 2014 prostrate cancer accounts for more than 29, 480 deaths in US alone. It is one of the most common type of cancer just after lung cancer. It is the third leading cause of cancer in men. Currently, there are four anatomically glandular areas within the prostate:

1. Peripherical zone (ZP)
2. Central zone (ZC)
3. Transition zone (ZT)
4. Anterior Fibromuscular Tissue (AFT)

Magnetic Resonance imaging provides high resolution images of prostrate in all plains of space, enabling better visualization of prostrate for cancer diagnosis. In this lab we are provided with dataset of 64 slices of Prostrate in different orientations. Our task was to create a GUI in Matlab which could enable us to read the dataset and perform useful operations on these slices such as manual segmentation. Our task are divided into three stages now we will explain each stage separately.

2 1st Stage:

In this stage of our lab work our task was to create a GUI interface in Matlab which could display the information our dataset in carrying and perform some basic operations on dataset. All the operation will be explained below.

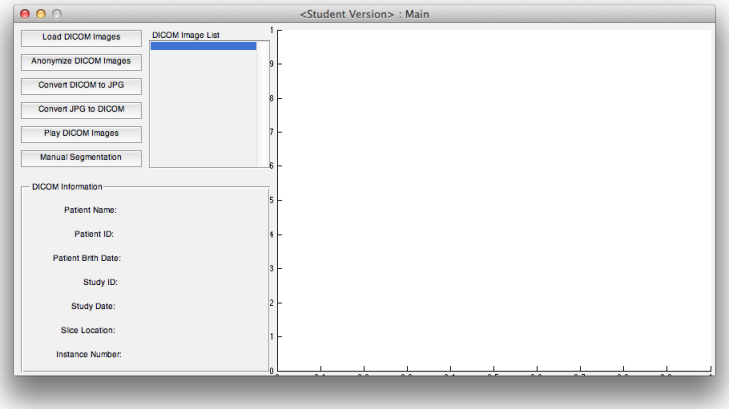

Figure 1: GUI

2.1 Displaying the information of DICOM:

First of all we created our GUI interface. We provided a button to load folder containing all images. After that we display all set of DICOM images which are available in user selected folder. User may select any DICOM image he want in Image List box and that image will be displayed as shown below.

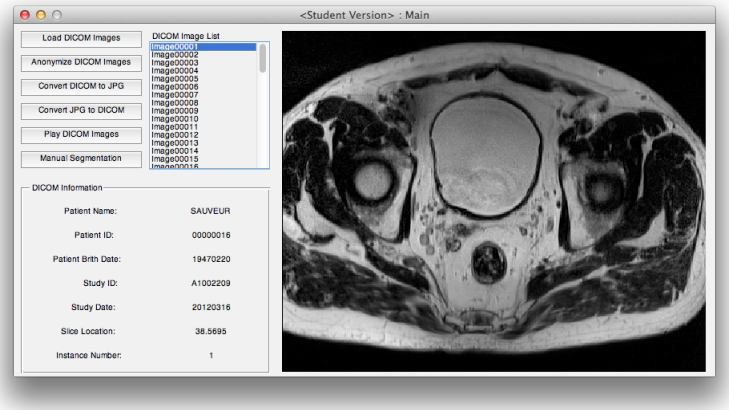

Figure 2: Displaying the information of DICOM

2.2 Anonymizing and Saving DICOM Images:

Sometimes user may require to remove specific patient information from DICOM images. We provide user this functional capability under this button "Anonymize DICOM Images". When user presses this button a browser window open which allow user to select the location where he want to save his DICOM data after Anonymizing. As shown below in figure user have to select the folder where he want to save the Anonymize DICOM data.

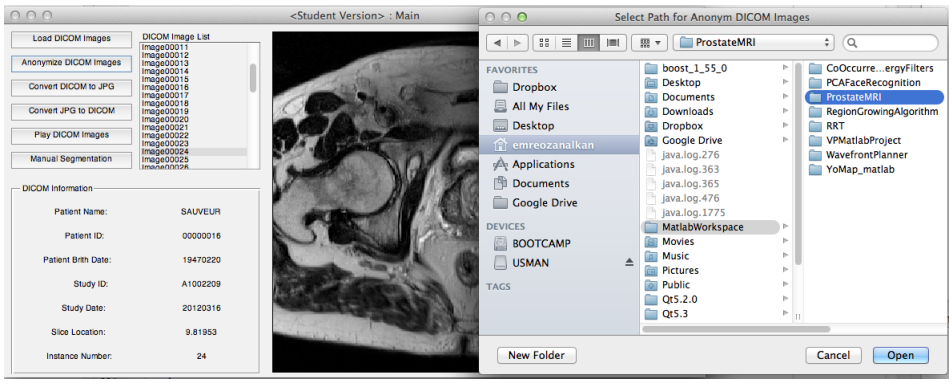

Figure 3: Anonymizing and Saving DICOM Images

2.3 Conversion from DICOM to Jpeg:

We also included this function with ability of converting the DICOM image to jpeg format image. Meanwhile we also save the DICOM information of respective DICOM image in mat file so that user may not lost any information as that information will be useful when he want to convert jpeg image to DICOM image.

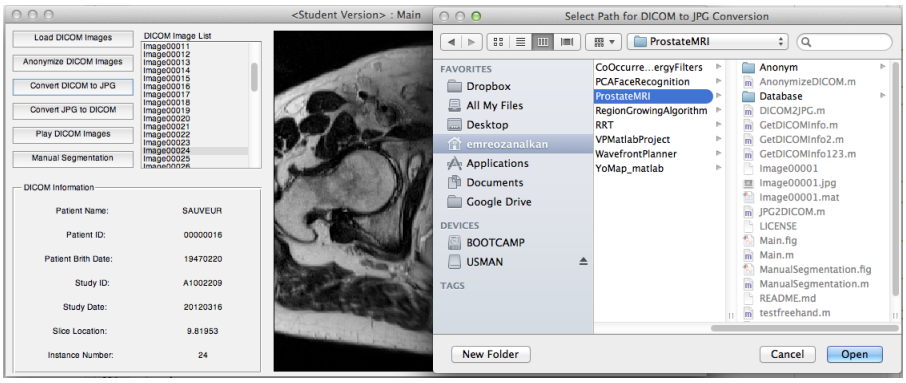

Figure 4: Conversion from DICOM to Jpeg

2.4 Conversion from Jpeg to DICOM:

In this section we allow user to convert his jpeg images to DICOM format. User also need to provide the require info and we already saved that while converting from DICOM to jpeg.

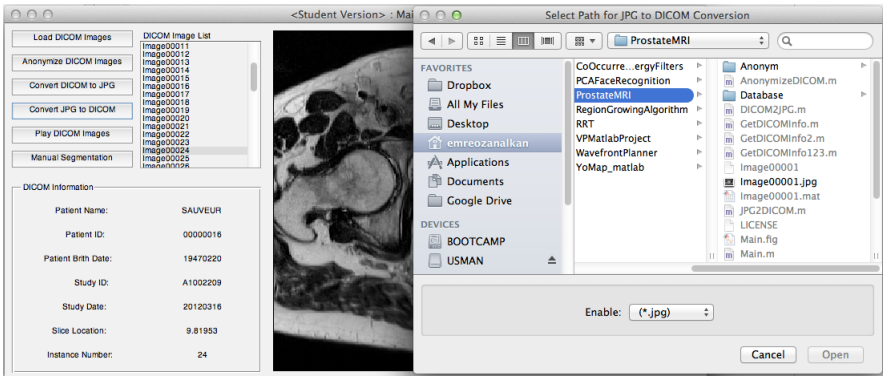

Figure 5: Conversion from Jpeg to DICOM

2nd Stage:

In this stage we were required to build such functionality in our GUI which enable user to manually segment the different regions of images. We provided this functionality in Manual segment button, when user presses it another window opens as shown below. This window is purely dedicated to manual segmentation part.

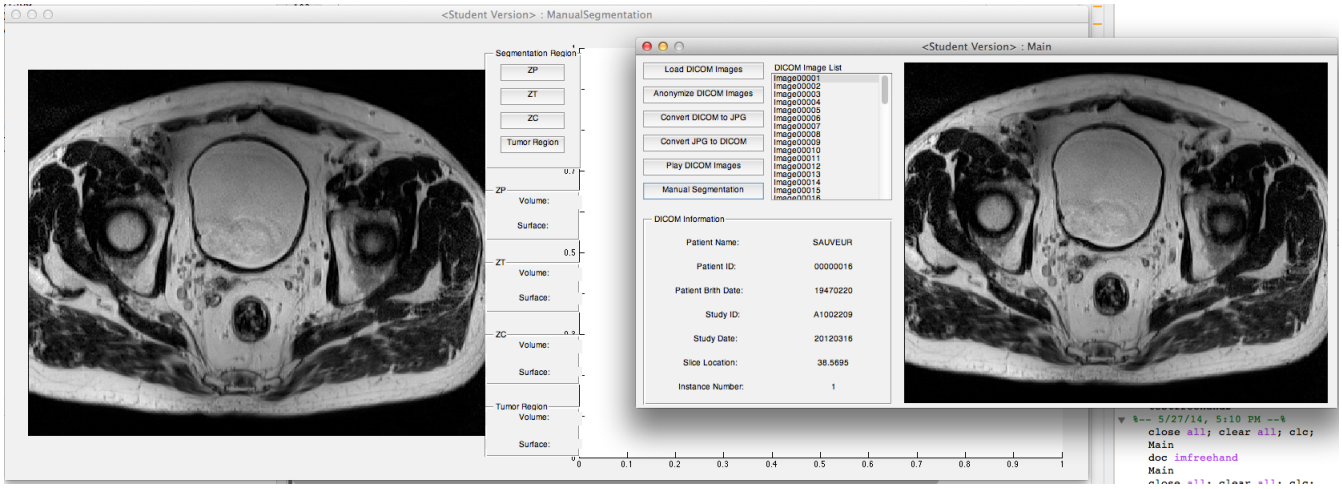

Figure 6: Conversion from Jpeg to DICOM

Now user have to select the type of region he want to segment. Given regions are Peripheral zone(ZP), central zone(ZC), Transition zone (ZT) and Tumour region. When user presses respective buttons then user have to manually segment the image by clicking and holding cursor on image shown on left side of GUI. When user is done with this manual selection he has to double right click on that region and 3d representation of that segmented slice will be displayed in right window. After segmenting one region user may select another region and repeat the process as shown below. We also show the type of region label on 3d representation.

2.5 Manual Segmentation and 3d Representation:

Now we take one image we will try to manually segment all the sections which we want to segment. We selected this image from data set as it was having best possible Visualization of sections we want to segment. In this image We segmented tumour region, which is very large relative to normal size. It is coloured in Red in 3d. We also segmented Peripheral zone of prostrate, which is sub-capsular portion of the posterior aspect of the prostate gland that surrounds the distal urethra. It is coloured in blue. It is from this portion of the gland that 70–80% of prostatic cancers originate. We have central zone in this image and after segmented we displayed it in yellow colour as it can be seen in image below. We segment transition zone too with green colour. The transition zone surrounds the proximal urethra and is the region of the prostate gland that grows throughout life. All these regions can be seen in 3d representation to ease the visualization. There area and volume is also given with them.

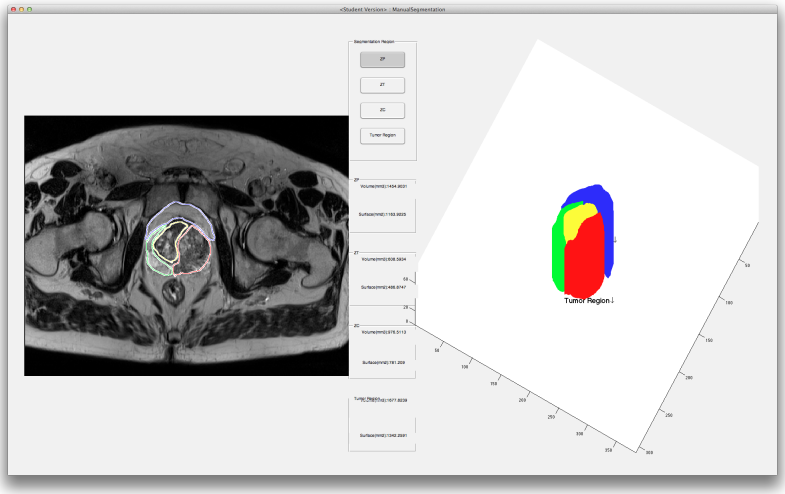

Figure 7: Manual Segmentation GUI

3 3rd Stage:

In this stage we were required to proved surface area and volume for respective manually segmented regions. We have show the calculated area and volume and show them inside our manual segmentation window. As soon as user finishes the manual segmentation area and volume of segmented regions are displayed. We used Matlab function "Regionprops" to measure area of segmented regions in pixels then we obtain area in mm^2 by multiplying it with Pixel spacing which we obtained from DICOM images info. Similarly for volume we multiply area by slice thickness and an arbitrary number which here we assume 12.

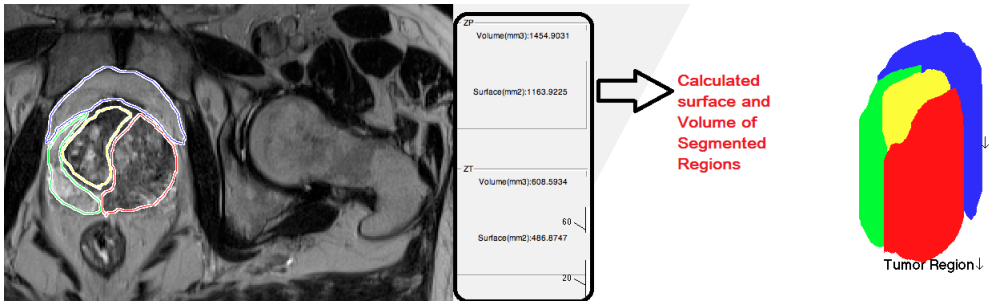

Figure 8: Calculation of Area and Volume of Segmented Regions

4 Conclusion:

This lab exercise was very helpful for us being our first practical interaction with DICOM format. We learn how to embed and extract information about medical image in DICOM format. We also learn very informative knowledge about severity of prostrate cancer as it accounts for so many deaths each year. In this lab course we also learn how important is to segment medical images for the benefit of doctors so that they can detect the tumour at initial stages with ease and speed, so that they can take appropriate actions.

5 References:

1. Lecture Notes, ALTauthor = Christian MATA
2. http://en.wikipedia.org/wiki/Prostate