UNIVERSITAT DE GIRONA

MEDICAL IMAGE ANALYSIS

LABORATORY REPORT

Image Modalities Ultrasound, MRI and X-ray

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1 Introduction

Medical Image Analysis is a interdisciplinary field involving fields of computer science, mathematics, vision related technology, medicine for sure and many others. This field is developed to solve the medical imaging problems faced usually in biomedical research and clinical care.

In this lab we were given task to understand more about the $DICOM$ standard and its particularities. Various modalities used in this lab are $X-Ray$, $Ultrasound$, MRI in $MATLab$ environment.

2 Learning's

We have learned in this lab about the $DICOM$ image standard widely used as a format of medical images. Here, we tried opening the image, reading its content, visualizing its content, histogram and finally to transform a raw image to a more realistic ones.

3 Results

Dimensionality of data for each modalities:

MRI

$$Modality = MR$$

$$Numberof Pixels = Rows \times Columns = 512 \times 512$$

$$PixelSpacing = [0.3125, 0.3125]$$

$Ultrasound$

$$Modality = US$$

$$Numberof Pixels = Rows \times Columns = 452 \times 564$$

$X-Ray$

$$Modality = MG$$

$$Numberof Pixels = Rows \times Columns = 4096 \times 3328$$

$$PixelSpacing = [0.07, 0.07]$$

On checking the information about the patient we found that the annonymization has been done in terms of parameters like $PatientName$, $Patient-ID$ whereas information like DOB, Sex, $Year$ etc have been made public in

the given *DICOM* image dataset provided. Things not included in the *DICOM* information: *Referring physician Name*, *Performing Physician Name*, *Patient ID*.

Third part of the task requires us to compute the histogram of MRI volume which can be seen from the figure shown below.

Next we have to see the three axial views from the data-set of MRI image which is as shown below.

In the visualization related to the raw image and processed image there is subtle difference. Raw image is not very much clear and understandable like we see after processing it. So to make the information more visible, various techniques have been proposed to obtain the more clearer view which has also been implemented in coming section.

Though I have used many techniques for obtaining the best viewable raw image but none were of the standard to obtain the one provided in the lab sheet. So I have included the result after inverting the image and applying some equalization techniques whose results are shown in Section. [5]. On this equalized images *Gaussian* filters have been applied to obtain a smoother version of the image. *MATLab* file also has the output of *gamma* corrected image which I do not find worth mentioning because of insignificant contribution.

4 Difficulties faced

Even after spending lot of time in trying to obtain the image similar to the ones provided, I couldn't succeed. This might have been possible to finish it had this been for a long term project but not for a lab. Still I have tried ways to get closer to the solution.

Firstly I was aiming to segregate two regions, one which has the breast and the second part contains the remaining of it. I applied dilation operation to fill the part within the image so that all the information could be saved. After this, using an arbitrary but logical threshold (50) another image was formed having intensities greater than that of threshold. Once this image is formed, I used closure operation to cover the gap in between. Till this part I have included in the *MATLab* file. For obtaining the contour of the segmented part I tried various functions including contour which were unsuccessful and I was not able to form the boundary of the region. So assuming once I have the boundary, this could be imposed on my resultant image which was a almost similar to the one provided for comparison purpose.

5 Output

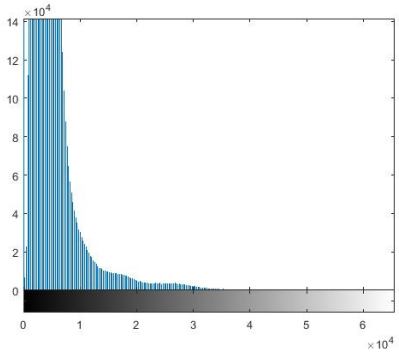


Figure 1: Histogram Output of all the slices of MRI data set

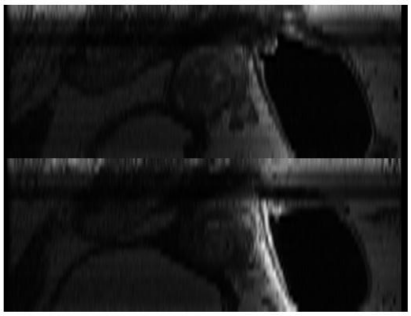


Figure 2: Coronal View of MRI slice

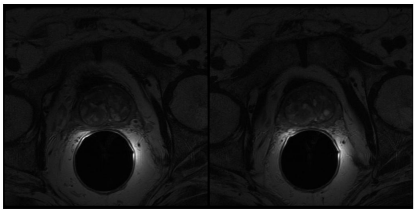


Figure 3: Axial View of MRI slices

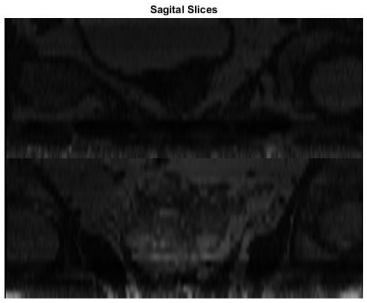


Figure 4: Sagital View of MRI slices

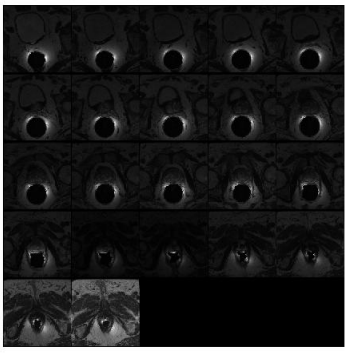
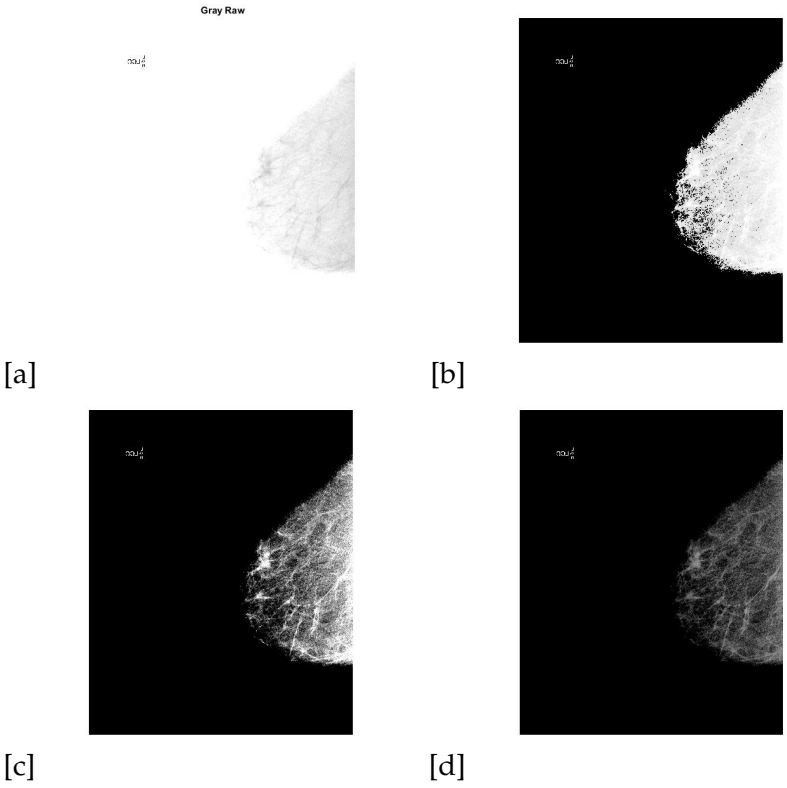


Figure 5: Joined View of MRI slices



[a] [b]

[c] [d]

Figure 6: A set of four subfigures: **??** Gray Raw Image; **??** After applying Histogram Equalization; **??** After applying Imadjust; and, **??** After applying adaptive histogram equalization.

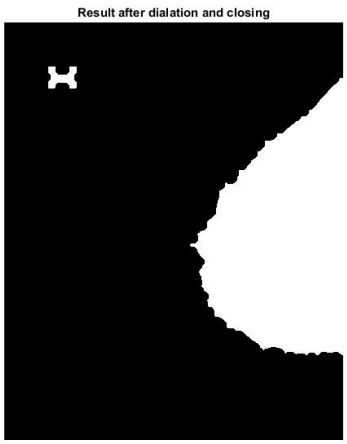


Figure 7: Morphological Operation Output

Figure 8: Final Output