Medical Imaging Analysis : Image Modalities 3D Ultrasound and MRI

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VIBOT MSc

Contents

1 Introduction

The aim of this lab is to understand the particularities of medical image modalities along with the DICOM standard. For this lab we will use MRI and 3D ultrasound volumes as an example within the Matlab environment. In this lab you will learn

- How to open DICOM images and view its contents (both the image and headers)
- Visualize the contents and histograms of a 3D volume and its information (dimensionality and pixel spacing).
- Propose an image transformation to provide a more realistic image.

The 3D Ultrasound scanner (Siemens Antares) generates a 3D volume from an array of US transducers, as shown in figure 1.

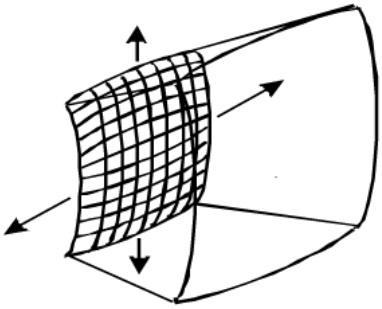


Figure 1: Convex array of transducers for 3D ultrasound.

The response of each of the transducers is captured and saved in a DICOM file generating a volume as shown in the figure 2.

2 Image information

In this section you should be able to open the DICOM files (MRI and 3D Ultrasound, US) provided and observe its contents. Use `dicomread` in Matlab for the image contents and `dicominfo` for its header contents (DICOM tags). The MRI contains a prostate image and the 3D Ultrasound contains a scan of a prostate phantom (Model 035 CIRS inc) as shown in figure 2.
Questions (to be included in the report)

2.1. What is the dimensionality of the data for each modality, number of pixels and pixel size?

2.2. Check the DICOM info concerning the patient information and verify the files are anonymized.

2.3. Visualize the histogram of the 2 volumes using Matlab.

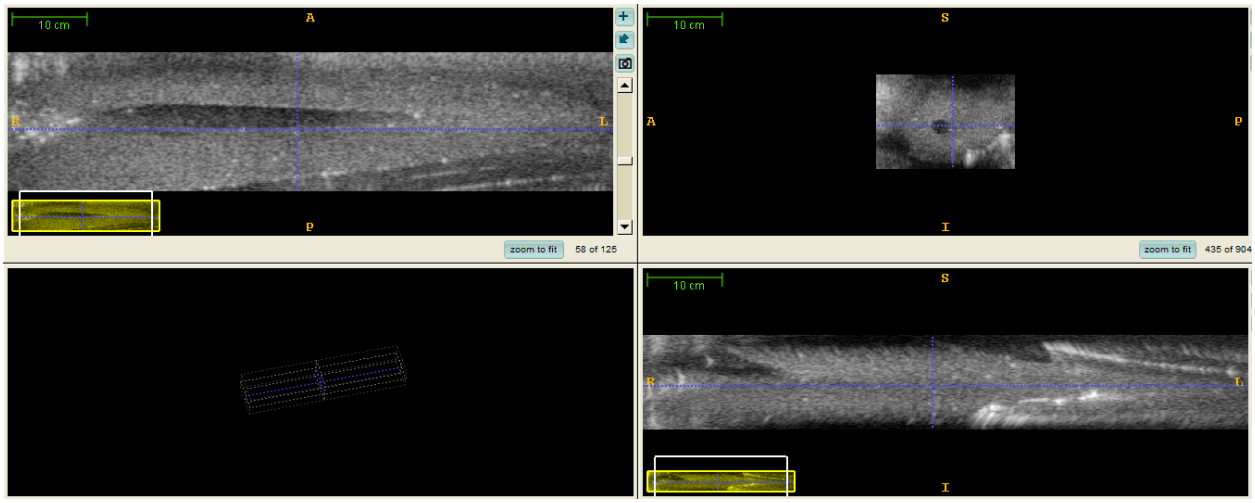


Figure 2: Volume of the 3D Ultrasound.

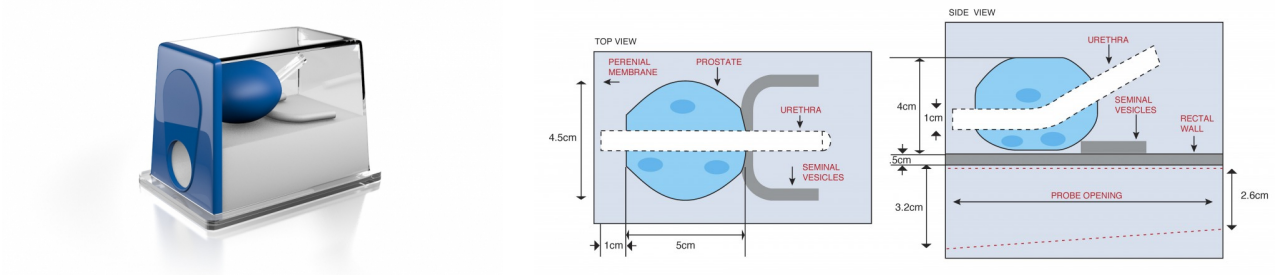


Figure 3: Prostate phantom.

2.4. Visualize some slices in Matlab for the MRI and 3D US, does it make sense what do you see?

2.5. Provide the Matlab code for the questions above.

3 US Image transformation

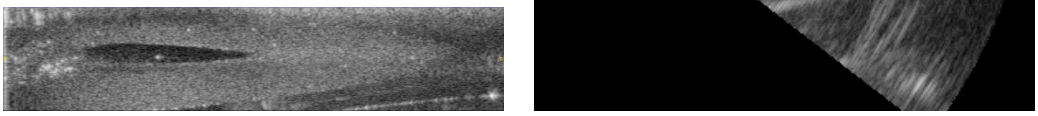
As you have probably noticed, the original volume shown does not show the real appearance of the prostate phantom but a distorted one. Figure 4 shows original and a transformed version of an slice of the phantom (not exactly the same one). Notice that in the transformed version the phantom looks more realistic (and could be used for diagnostic purposes).
Questions (to be included in the report)

3.1. Why this distortion appears?

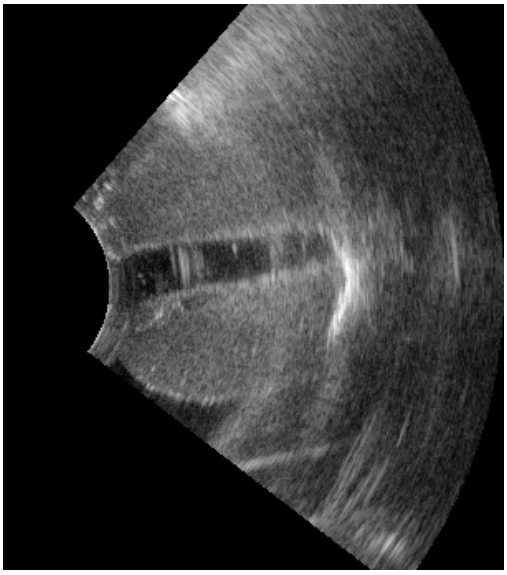
3.2. What would you propose to transform the slice in figure 4 (a) to the one in (b)?

3.3. Can you think of any problems for the above transformation

3.4. [BONUS POINT] Provide the Matlab code / pseudo code for this transformation.



(a) Original slice



(b) transformed slice

Figure 4: Original and transformed slices of the volume.