ULTRASOUND LAB REPORT

I am from TEAM 2 : Positioning of the target.

INTRODUCTION

Brief Description on Ultrasound concepts: Its basically dependent upon computerised analysis of the waves which are reflected by the tissues present in our body. Eventually due to this property i.e. by the receiving of the reflected ultrasound signals , we plot fine images of the body structures. Its observers been observed that the resolution gets better with shorter wavelength and we know wavelength is inversely proportional to the frequency . It has been also observed with the usage of high frequency , comes greater attenuation and also depth in penetration. This is the reason why different range of frequency is being used for different parts of the body.

(1) 5–10 MHz for small and superficial parts and
(2) 10–30 MHz for the skin or the eyes.
(3) 3-5 MHz for abdominal areas.

Typically to produce the ultrasound images the ultrasound transducers are used. These are made up of thin disc of an artificial ceramic material for example it can be made up of lead zirconate titanate . The thickness is of the order 0.1 to 1 mili meter which in turn determines the ultrasound frequency . In the applications of ultrasound, the ultrasound beam is emitted by triggering the transducer by extremely short pulses which is comparable to a flashlight. When the reflected ultrasound is received , the piezoelectric crystal used in the transducer oscillates with the same frequency as that of the received signal .

The various Ultrasound techniques are :

(1) A-mode
(2) B-mode
(3) M-mode or TM-mode
(4) B-scan, two-dimensional
(5) B-flow

A MODE : A mode is the amplitude modulation and is used for one dimensional examination technique where the transducer is the single piezoelectric transducer . The echoes (reflected Ultrasound signal) can be plot as Amplitude on the ‘Y’ axis and depth on the ‘X axis.

B MODE : Its used for brightness modulation where the echoes are represented differently as compare to A mode .

M- MODE: The Time motion mode is employed for moving structures , such as heart valves which is moving structure . The transducer is kept at a stationary position and B mode is used to plot the signal which is reflected by the moving structures.

B- SCAN: B- Scan is used to plot many one dimensional lines which are acquired by the reflected ultrasound signals in one plane and builds the two-dimensional(2D) ultrasound image (2D B-Scan).

B-FLOW: Its a modified technique of the conventional B -scan which does not need the help of doppler effect. The reflected ultrasound waves coming from the moving blood cells and vessels are segregated from stationary tissues by the comparison of the successive incoming reflected echoes .

METHODS:

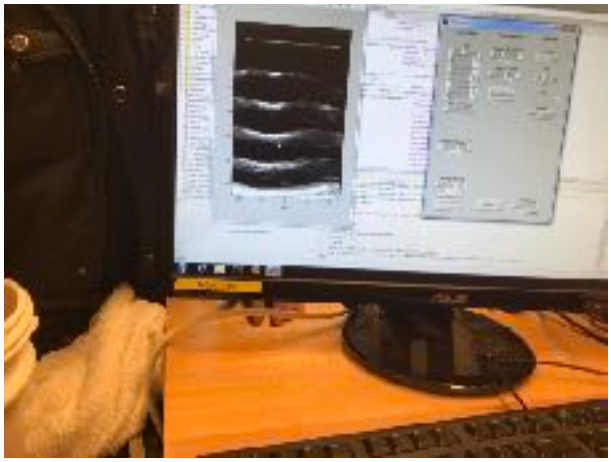
FOR PEOPLE: No preparation is needed for an ultrasound examination; however, for certain examinations of the abdomen, a period of 4-5 hours of fasting is useful or necessary. To avoid problems due to meteorism, dietary restrictions (no gas-producing foods), physical exercise (walking before the examination) and even premedication (antifoaming agents) are recommended.

A gel(water in our lab was used) is used between the ultrasound tissue and the skin of the person so that there is no air gap between the transducer and the skin. As we know if there would be any amount of the air , the air itself will reflect the majority part of the signal and it will be impossible to plot the image so the tissues. Further, artefacts are also removed by using coupling agents .The best coupling agents are water-soluble gels, which are commercially available. Water is suitable for very short examinations. Disinfectant fluids can also be used for short coupling of the transducer during guided punctures.

A coupling agent allow to remove any air cavities from our transducer to the subject that we are imaging.

The way we used the transducer to take the image from the tomato(subject) and the chicken are depicted in the images shown. Since we had a tomato and a chicken's leg piece as a sample, we aligned them in the manner illustrated in the figures to fetch the ultrasound images.

We changed the speed of the light by changing the acquisition parameters as shown in the image below -



Correct adjustment of an ultrasound scanner and the parameters is not difficult, as the instruments offer a wide range of possible settings. Most instruments have a standard setting for each transducer and each body region. This standard can be adapted to the needs of each operator

RESULTS:

The Github link to the jupyter notebook has been given along side this pdf document.

Discussion (responding to observations and issues during acquisition or running your notebook).

Thus, we obtained our ultrasound image for the subject(chicken's leg piece and a tomato). Normal water was used as a coupling agent. Different methods for acquiring the image has been shown above. There were not many issues while acquiring the images. Still we had to hold the transducer correctly and manoeuvre it in a specific direction looking at the anatomy of the subjects used to image. The speed of light was critical to set as it was directly effecting the contrast of the image by varying the reflection of the inner structure of our subject. Clicking on ' save RF data ' is also crucial to save the ultrasound data that might disappear . Sens. Cutoff, TGC all gain , range(mm) should be set precisely to capture a fine image so that it becomes easy for the doctor/physician to interpret the condition of the subject . We can even 'freeze ' the data acquired at a particular instant if its related to the field of interest.

REFERENCES :

[1] ‘Ultrasound in Medicine’ edited by Francis A. Duck, A.C Baker, H.C Starritt.
[2] Diagnostic ultrasound Book by K. Kirk Shung
[3]Ultrasound Teaching Manual: The Basics of Performing and Interpreting Ultrasound Scans Book by Matthias Hofer