



E-Health: Lab2

PACS & Visualization

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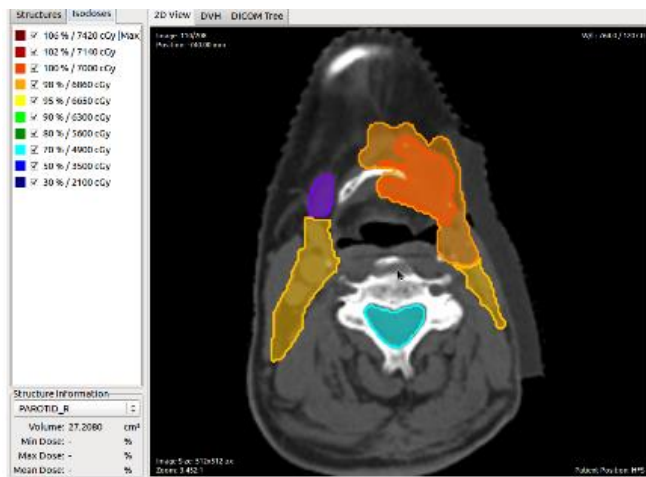


Aim

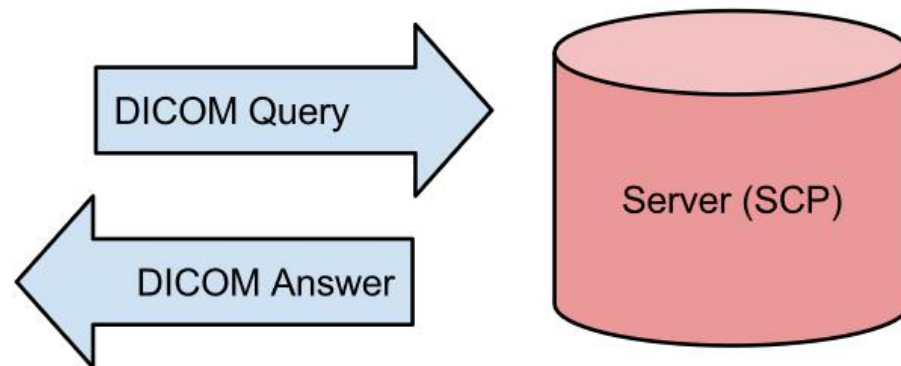
- Understand the PACS (DICOM network) main instructions
- Install and deploy a PACS system
- Test its main functionality
- Link a PACS with a visualization tool.
- Evaluate Visualization software: windowing and measuring.
- Software:
 - Orthanc: Free PACS server
 - Ginkgo CADx: Viewer (to be connected to the PACS).

PACS (DICOM network)

- **Basic actions in the DICOM network protocol**
 - **Test the connection** between two devices (C-Echo).
 - **Send images** from the local imaging device to a remote device (C-Store).
 - **Search the content** of a remote device (C-Find).
 - **Retrieve images** from a remote device (C-Move).
- SCU / SCP / Commands



Client (SCU)

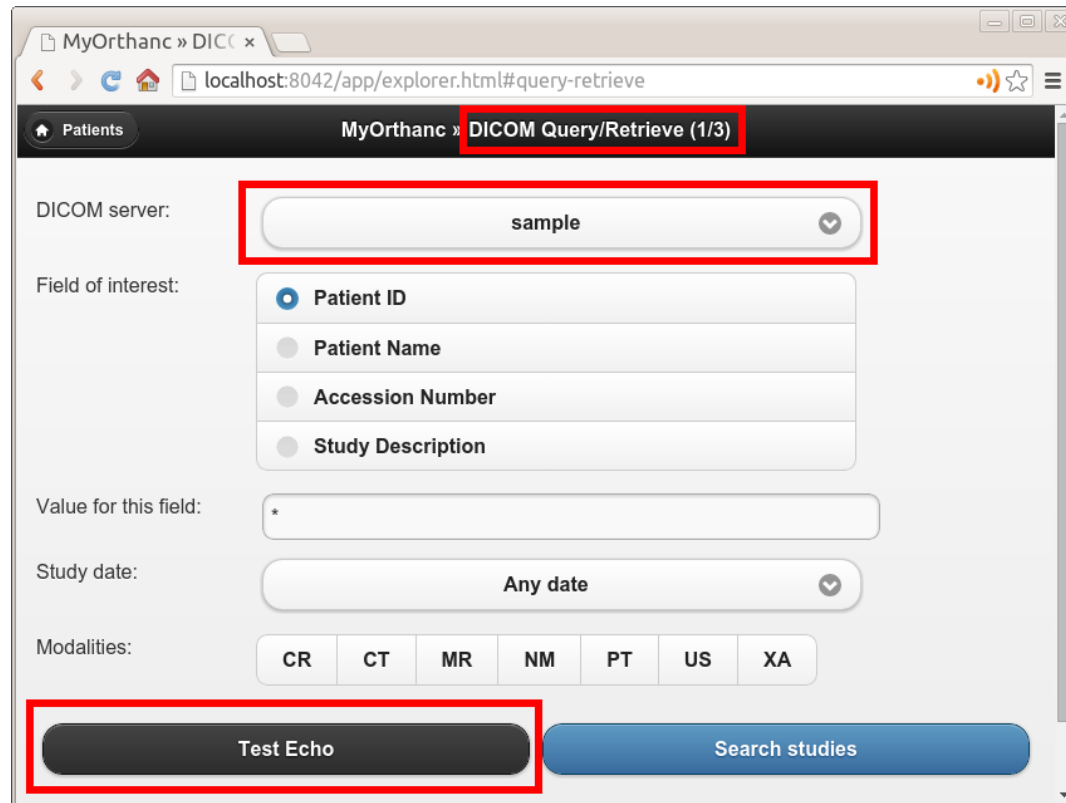


PACS (DICOM network)

- **Parameters of the DICOM server**
 - IP address
 - TCP port (DICOM is 104 but Orthanc uses 4242).
 - Application Entity Title (AET). Unique identifier inside the intranet (alphanumeric and less than 16 chars).
- DICOM server configuration
 - *DicomServerEnabled* must be set to true. (default)
 - *DicomAet* must be set to the AET (default: ORTHANC) .
 - *DicomPort* specifies the TCP port of the DICOM server (4242).
- Each Client/server will have a different IP and AET.
 - See C:\Orthanc\Configuration\orthanc.json
- In Orthanc each server/client should be indicated in the *Modalities* section of the configuration file.

Orthanc

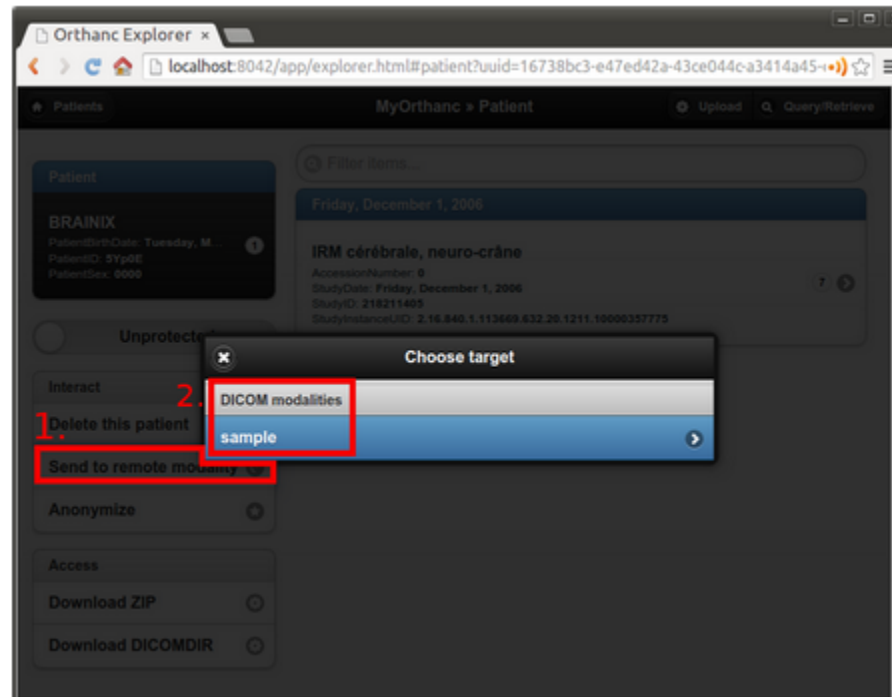
- **C-Echo (test connectivity)**
 - Ping the ip address to check TCP connectivity
 - Use the C-Echo from the client to the server to test DICOM connectivity.



The screenshot shows the 'MyOrthanc » DICOM » DICOM Query/Retrieve (1/3)' interface in a web browser. The interface includes several input fields and buttons. A red box highlights the 'DICOM server:' dropdown menu, which currently shows 'sample'. Another red box highlights the 'Test Echo' button at the bottom left. The 'Field of interest:' section has radio buttons for 'Patient ID' (selected), 'Patient Name', 'Accession Number', and 'Study Description'. The 'Value for this field:' is a text input with an asterisk. The 'Study date:' is a dropdown menu showing 'Any date'. The 'Modalities:' section has buttons for 'CR', 'CT', 'MR', 'NM', 'PT', 'US', and 'XA'. A 'Search studies' button is located at the bottom right.

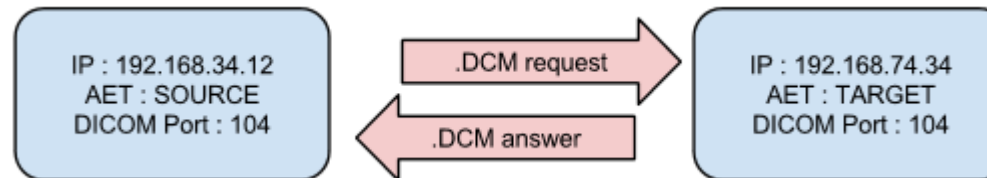
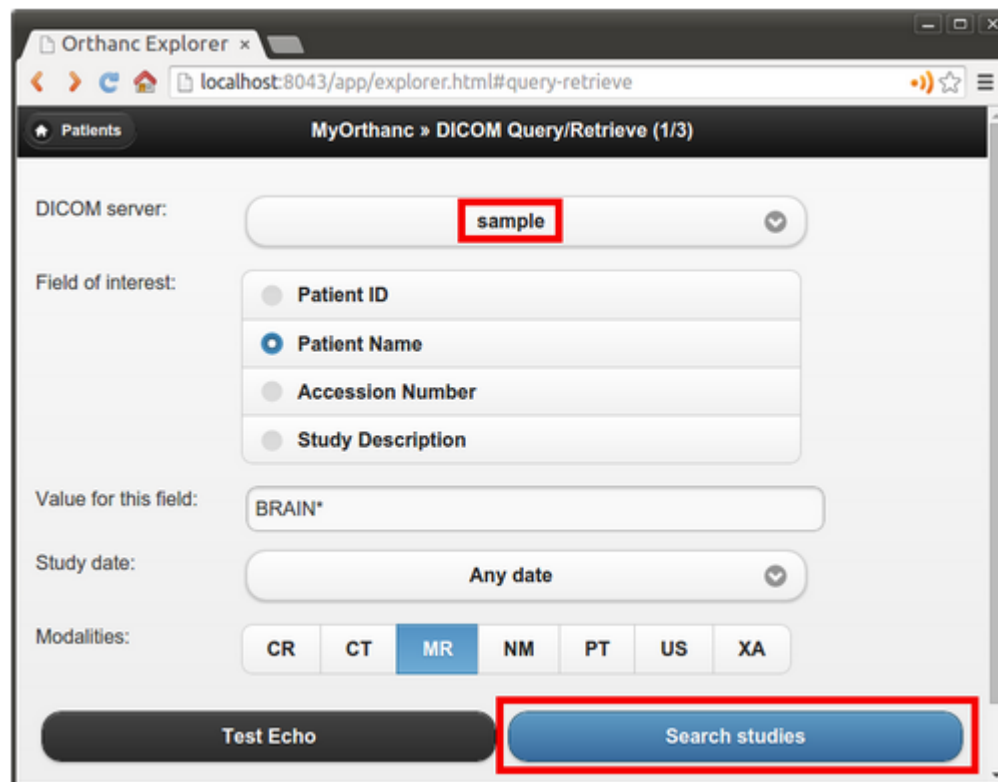
Orthanc

- **C-Store:** Send images to a server
 - Use orthanc explorer to send files at any level patient, studies or series.



Orthanc

- **C-Find:** Search a list of DICOM resources (wildcards)
 - Use orthanc explorer to send

Orthanc Explorer x

localhost:8043/app/explorer.html#query-retrieve

Patients MyOrthanc » DICOM Query/Retrieve (1/3)

DICOM server:

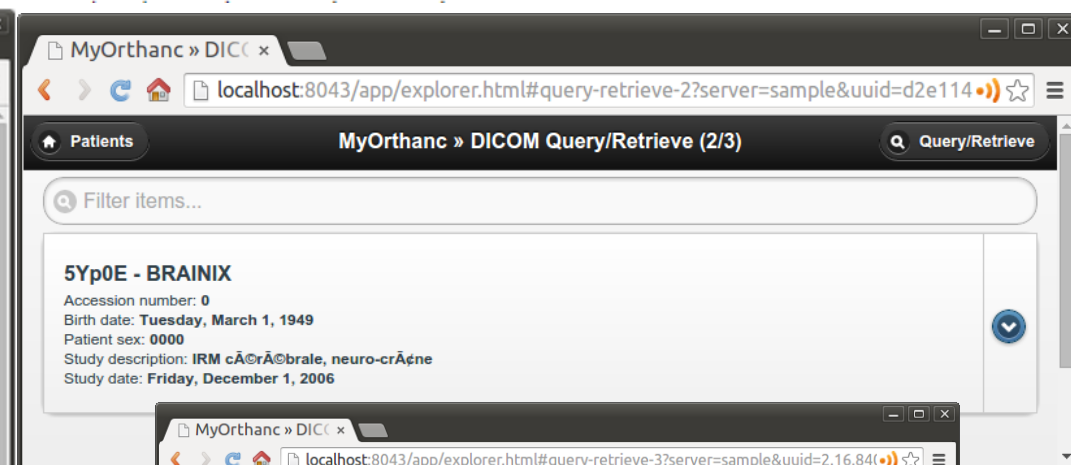
Field of interest:

- ☐ Patient ID
- ☒ Patient Name
- ☐ Accession Number
- ☐ Study Description

Value for this field:

Study date:

Modalities: ☐ CR ☐ CT ☒ MR ☐ NM ☐ PT ☐ US ☐ XA



MyOrthanc » DICOM x

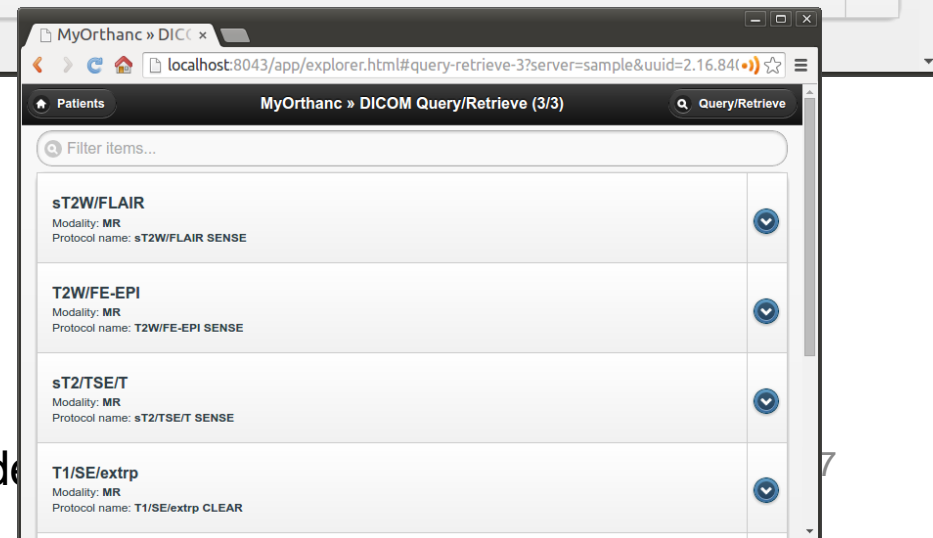
localhost:8043/app/explorer.html#query-retrieve-2?server=sample&uid=d2e114

Patients MyOrthanc » DICOM Query/Retrieve (2/3)

Filter items...

5Yp0E - BRAINIX

Accession number: 0
 Birth date: Tuesday, March 1, 1949
 Patient sex: 0000
 Study description: IRM cÃ©rÃ©brale, neuro-crÃ©ne
 Study date: Friday, December 1, 2006



MyOrthanc » DICOM x

localhost:8043/app/explorer.html#query-retrieve-3?server=sample&uid=2.16.84

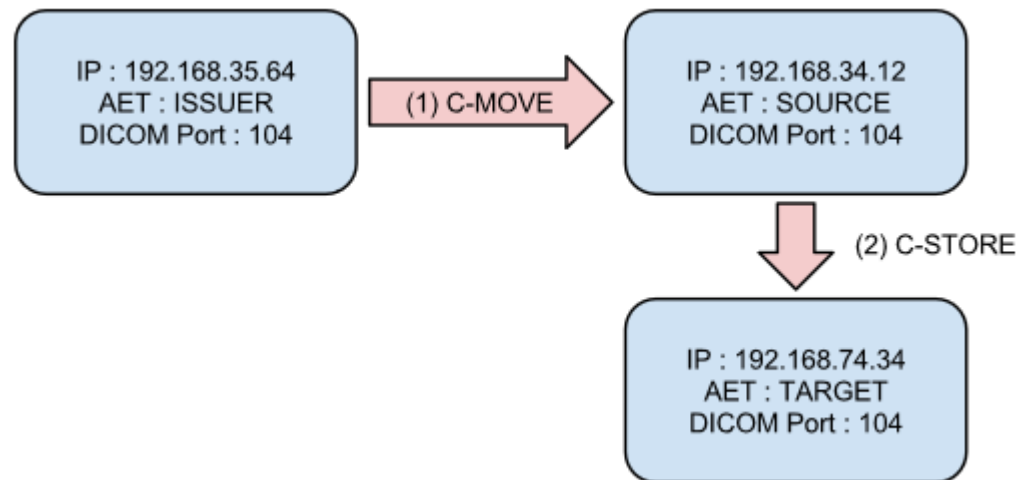
Patients MyOrthanc » DICOM Query/Retrieve (3/3)

Filter items...

sT2W/FLAIR	Modality: MR Protocol name: sT2W/FLAIR SENSE
T2W/FE-EPI	Modality: MR Protocol name: T2W/FE-EPI SENSE
sT2/TSE/T	Modality: MR Protocol name: sT2/TSE/T SENSE
T1/SE/extrp	Modality: MR Protocol name: T1/SE/extrp CLEAR

- **C-Move: Query/Retrieve**

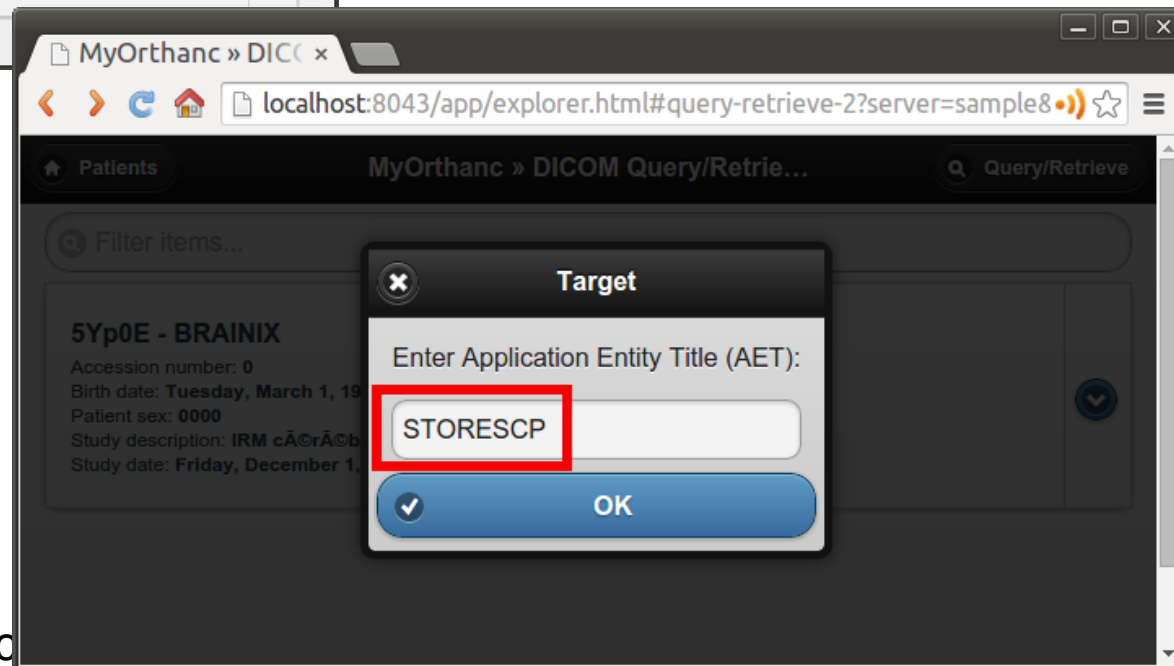
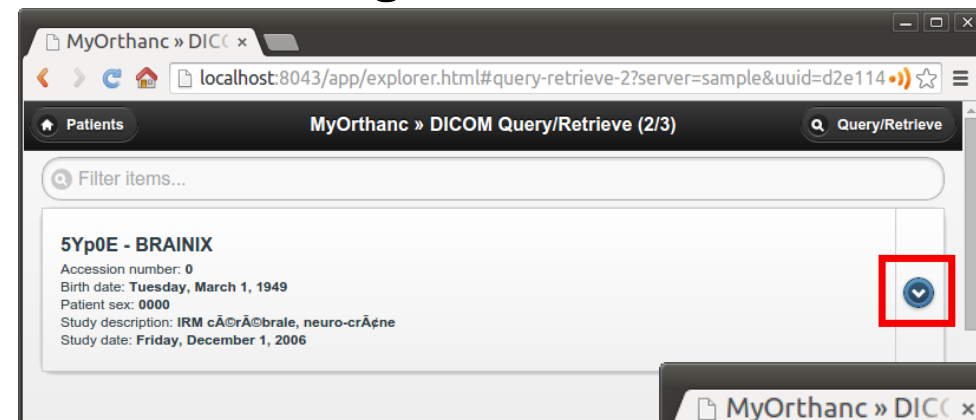
- C-move can involve 3 imaging devices.



- The **issuer** asks the **source** to send some images to another DICOM server (**target**)
- In other words, is a C-Store between two remote DICOM servers
- Query/Retrieve: issuer and target are the same.
- Alternative command in DICOM: C-Get (not implemented yet).

Orthanc

- **C-Move (2): Query/Retrieve**
 - After a C-find, click on the down arrow and enter the AET of the target.



Exercises: PACs

1. Download and install orthanc. Check that it is working.

<https://www.orthanc-server.com/resources/2015-02-09-emsy-tutorial/index.html>

2. Configure Orthanc (IP, and AET and Modalities) and test the 3 commands: C-Store, C-Find and C-Move. You will need one machine to work as server and another one as client.

1. Check C-Echo works fine with client-server
2. C-Store: from a client send the data to the server.
3. C-Find: retrieve list of patients from a server
4. C-Move: similar to C-Store but specifying the AET.

Excercises: Viewer

3. Download a viewer and link it with the DICOM server.

1. Use Ginko CADx (<http://ginkgo-cadx.com/en/>)

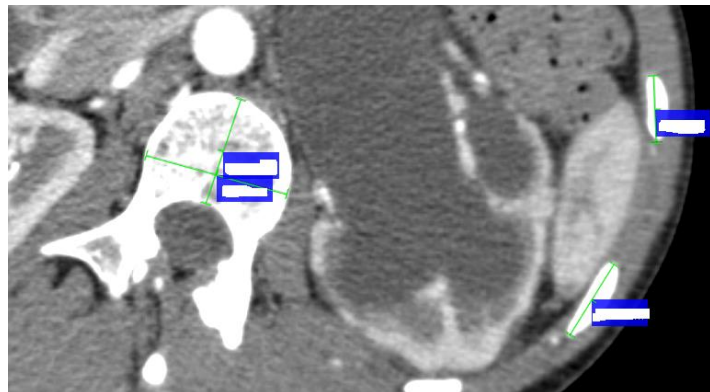
2. Configure to work with Orthan

<http://book.orthanc-server.com/faq/query-retrieve.html#query-retrieve>

Use any Orthan server or try visor.udg.edu (AET: VISOR)

3. With the CT data provided visualize at a maximum contrast the bones and soft tissue.

4. Measure the major axes of the vertebrae, and ribs. Relate this measurement to pixel size and number of pixels.



What to submit

- Write down a short summary of your work, including:
 - Problems encountered and snapshots of the correct execution of all exercises (except 1).
 - Modifications in the default configuration of Orthan.

