

Project proposal

In this project, students are asked to load, visualize and perform a coregistration of DICOM images. In particular, the following objectives are proposed:

1) DICOM loading and visualization

- a) Download the dataset HCC-TACE-Seg (click here). In the following, consider only the patient HCC_XYZ assigned to you (see Aula Digital),
- b) Visualize it with the help of a third party DICOM visualizer (3D-Slicer is recommended).
- c) Load the segmentation image, and the corresponding CT image with PyDicom. Rearrange the image and segmentation 'pixel_array' given by PyDicom based on the headers. Some relevant headers include:
 - 'Acquisition Number'.
 - 'Slice Index'.
 - 'Per-frame Functional Groups Sequence' → 'Image Position Patient'.
 - 'Segment Identification Sequence' → 'Referenced Segment Number'.
- d) Create an animation (e.g. gif file) with a rotating Maximum Intensity Projection on the coronal-sagittal planes.

2) 3D Rigid Coregistration

- a) Coregister the given images using either landmarks (that you should define) or a function similarity measure (that you should implement). Implement the image coregistration yourself (i.e. without libraries such as PyElastix).
 - Reference image: `icbm_avg_152_t1_tal_nlin_symmetric_VI`, of a T1 RM phantom in a normalized space.
 - Input image: `RM_Brain_3D-SPGR`, of an anonymized patient.
- b) Visualize the Thalamus region on the input image space.

Submission and grading

Students are asked to submit:

- **Intermediate submission**

- Brief document including current state of the project (max 1 page) and a list of questions on how to proceed/overcome difficulties found during the development (without page limit).

- **Final submission**

- Functional source code in a public github repository.
- A 4-page summary, which should focus on the technical part of the project: the algorithms, their implementation, and their performance. Figures, code, title page and index are excluded from the page limit.

- **Oral presentation** (10-minute presentation, which should include a demonstration of the software developed and the results obtained.)

- Slides and multimedia material used during the presentation.

To calculate the final course grade, the following weights will used:

Activity	Weight
Intermediate submission	–
Final submission	30 % (technical quality) 20 % (documentation)
Oral presentation	20 %
Project total	70 %

No questions about the project development/results will be answered to students that do not take part in the intermediate submission.