## Project proposal

In this project, students are asked to perform **two of the three objectives** proposed:

1) DICOM loading and visualization

   a) Download the sample `RadCTTACEomics_DDDD` (click here), where `DDDD` is the sample associated to you (see assignment in Aula Digital).

   b) Visualize it with the help of a third party DICOM visualizer (3D-Slicer is recommended).

   c) Load the reference CT image (pydicom) and the associated segmentations (highdicom). 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, visualizing the tumoral mask.

2) 3D Image Segmentation

   a) Consider the `Tumor` mask associated to the reference image, and extract its bounding box and centroid.

   b) Create a semi-automatic tumor segmentation algorithm that only uses the CT image, and either the bounding box or the centroid of the tumor.

   c) Visualize both the provided `Tumor` mask and the segmented `Tumor` mask on the image. Assess the correctness of the algorithm, numerically and visually.

3) 3D Rigid Coregistration

   a) Coregister the input to the reference image, implementing all steps of the image coregistration yourself (i.e. without libraries such as PyElastix).

   b) Visualize the Liver region on the input image space. Assess the correctness of the algorithm, numerically and visually.

**Submission and grading**

Students are asked to submit:

- **Intermediate submission**
  - The self-evaluation form, completed according to the progress made.
  - A brief document showing the progress made (max 2 pages, including a github link to your repository) and a list of questions on how to proceed/overcome difficulties found during the development (without page limit).
- **Final submission**
  - 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. Please include a github link to your repository.
  - Slides and multimedia material to be used during the 10-minute oral presentation, which should include a demonstration of the software developed and the results obtained.

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

| Activity | Weight |
|---|---|
| Intermediate submission | – |
| Final submission | 30 % (technical quality)<br>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.