

Master Internship – 6 months

## Age and Sex Estimation from CT Images with Machine Learning



Figure 1: Example of a sagittal section of a CT image

The internship is part of the ANR TOPACS project that proposes to investigate full-body computational anatomy, through the analysis of a large set of 3D CT and MRI scans (more than 10000 individuals). First applications will focus on Forensic Science, such as the determination of age and sex. Another application is to predict different anatomic characteristics from a partial 3D body image in anthropology and taphonomy studies. This project could also contribute to the emerging field of virtual autopsy, which consists in analysing a deceased individual in a non-destructive manner via 3D imagery.

The first data processing step (addressed by our partners in the TOPACS project) is to register the 3D CT and MRI in the data set, in order to bring into correspondence the corresponding anatomical points. The distribution of the positions of the corresponding points (landmarks) is then analysed by a machine learning algorithm in order to infer the sex and age of an individual. Determining sex is a two-class classification problem, estimating the age is a regression problem.

In a first step, standard machine learning methods will be used to solve the aforementioned regression and classification problems. Sparse regression or classification methods will be investigated to obtain a map of the relevance of each voxel in the image, as well as an estimation of the desired variable (sex or age). Linear or non-linear data reduction approaches combined with regression/classification methods will also be tested. Finally, a large part of the internship will be devoted to deep learning approaches and to test cases where only a part of the tested image is available (which is the case in anthropology).

The internship could open to a PhD thesis on the same subject (for which a financial support is already available).

**Working environment** The student will be a member of the IMAGeS team (<http://images.icube.unistra.fr/>) in the ICube laboratory in Illkirch. The internship will begin between January and May 2019, for a period of 6 months.

Supervisors: Sylvain Faisan ([faisan@unistra.fr](mailto:faisan@unistra.fr)) and Fabrice Heitz ([fabrice.heiz@unistra.fr](mailto:fabrice.heiz@unistra.fr)).

### **Profile of the candidate**

- Last year of Master studies in the following fields: computer science, applied mathematics and machine learning.
- Good programming skills (the coding language will be Python).
- Interest for image processing and medical applications.

### **Application**

Send a CV and a short description of your motivation, as well as the transcript of marks for the past 2 years to Sylvain Faisan ([faisan@unistra.fr](mailto:faisan@unistra.fr)) and Fabrice Heitz: [fabrice.heiz@unistra.fr](mailto:fabrice.heiz@unistra.fr).