

## MASTER: Image reconstruction from experimental spectral CT data

CREATIS opens a Master internship of 5-6 months to address new questions in the emerging field of X-ray spectral imaging.

**Context** CREATIS is a research unit of CNRS/INSERM/INSA Lyon/University of Lyon devoted to medical imaging. Its different teams target various modalities (X-rays, Ultrasounds, MRI, PET and optics) and carry research from signal processing to medical applications. The candidate will join the *Tomographic Imaging and Radiotherapy* team, which has internationally recognized expertise in X-ray imaging and inverse problems.

**Project** X-ray "color" or "spectral" computed tomography (CT) is a new imaging modality that is raising increasing interest in radiology. Thanks to the emergence of new detectors that can discriminate X-ray photons depending on their energy [1], it is possible to reconstruct the constituents of the human body such as bone, water, fat or concentration in contrast agents [2]. Although recent works have shown the feasibility of spectral CT systems, there are still many open questions such as the best way to decompose and reconstruct images of the object into a material basis. We recently proposed a new material decomposition method that was validated on simulated data for one projection view. However, image reconstruction from experimental data is very challenging as it requires decomposing multiple views and addressing the tomographic problem.

**Keywords** X-Ray Imaging, material decomposition, inverse problem, regularization.

**Work Plan** The goal of the internship is to perform reconstructions from experimental data. In particular, a new method to estimate model parameters (source and detector response function) is needed so as to apply our material decomposition method to experimental data. The successful candidate will address the following points:

- Method to estimate model parameters
- Extension of material decomposition to multiple views and tomographic reconstruction
- Collaboration with CPPM (Marseille) who will provide the data

**Salary** 550€ net monthly

**Skills** The student must have a strong background in medical imaging and image processing. Knowledge in radiation physics would be appreciated but is not required. Programming skills: Matlab, C, C++.

### How to apply?

Send your CV and academic records to

Juan FPJ Abascal [juan.abascal@creatis.insa-lyon.fr](mailto:juan.abascal@creatis.insa-lyon.fr)  
Nicolas Ducros [nicolas.ducros@creatis.insa-lyon.fr](mailto:nicolas.ducros@creatis.insa-lyon.fr)

**Reference** [1] K. Taguchi *et al*, "Vision 20/20: Single photon counting x-ray detectors in medical imaging," *Medical Physics*, 40, 100901, 2013.

[2] H. Gao *et al*, "Multi-energy CT based on a prior rank, intensity and sparsity model (PRISM)", *Inverse Problems*, 27, 115012, 2011.

#### Site Université Lyon 1 – ESCPE :

Campus LyonTech la Doua – Université Lyon1, ESCPE  
3, rue Victor Grignard  
69616 Villeurbanne Cedex, France  
Tél. : +33 (0)4 72 44 80 84 / +33 (0)4 72 44 80 15  
Fax : +33 (0)4 72 44 81 99

#### Site INSA : CREATIS - Direction

Campus LyonTech la Doua – INSA de Lyon  
Bât. Blaise Pascal - 7 avenue Jean Capelle  
69621 Villeurbanne Cedex, France  
Tél. : +33 (0)4 72 43 82 27  
Fax : +33 (0)4 72 43 85 96

#### Site Hospitalier :

Hôpital Louis Pradel  
28 avenue du Doyen Lépine  
69677 Bron Cedex, France  
Tél. : +33 (0)4 72 68 49 09  
Fax : +33 (0)4 72 68 49 16



UMR 5220



U 1044

