Postdoctoral fellow in medical physics
MRI-driven PET quantification for hybrid PET-MR imaging

Two-year postdoctoral position offered by the Frédéric Joliot Hospital Facility (SHFJ) at CEA in Orsay City, France, starting between August and October 2014

This postdoctoral fellowship is granted by the *Physics and Engineering for Medicine* project (PIM, in French) of the new Paris-Saclay Campus University (PSC, http://www.campus-paris-saclay.fr/en). The PIM project aims at making significant advances in the field of Medicine built on the outstanding research resources in physics and engineering at PSC. Its initial goal is to establish a unique cooperative research and educational environment to meet the challenges brought by the advent of integrated Positron Emission Tomography/Magnetic Resonance Imaging (PET-MRI), a highly innovative technology allowing for simultaneous multi-molecular and functional imaging. The project is motivated by the installation, in Spring 2015, of a simultaneous time-of-flight PET-MRI system at the SHFJ facility in Orsay. The technology is not mature yet and many methodological developments are still needed to fully exploit its huge potential. Nine laboratories of PSC are gathering expertise within different subprojects in the fields of physics, instrumentation, radiation dosimetry, medical imaging, medical information processing, and medical research.

In the present subproject, the postdoctoral fellow will develop new MRI-driven PET quantification methods, in particular for attenuation correction and respiratory motion correction. The methods will be implemented on the new PET-MRI system and their performance will be evaluated for selected biomedical research protocols.

Unlike X-ray CT, MRI does not provide electron density information about tissue as needed for attenuation correction in PET. Nevertheless, a combination of several techniques is likely to provide the best estimate for attenuation coefficients, including segmenting MR images with specific sequences, use of statistical atlases (M. Hofmann *et al*., J. Nucl. Med. 49, 634-641), use of ultra-short Echo-Time MR sequences to image bone, and exploiting the consistency conditions that must be satisfied by the time-of-flight PET data (M. Defrise *et al*., Phys. Med. Biol. 57, 885-899). The methodology for adequate merging of such estimates remains to be developed. Simultaneous PET-MRI is also very appealing for motion compensation, since techniques such as multiple navigator echoes or MR tagging can be used to measure 3-dimensional motion fields. Motion-sensitized MRI data will be incorporated into an iterative 4D PET reconstruction to obtain motion-corrected PET images.

The biomedical physics team at SHFJ owns expertise in PET imaging. The activity will also involve the Laboratory of Modelling, Simulation and Systems (LM2S) at CEA, with expertise in signal and image processing statistical methods, and the Medical Magnetic Resonance and Multi-Modality Imaging research unit (IR4M) at CNRS and Paris-Sud University, with expertise in MR imaging.

Required skills

- PhD in physics, medical physics or image processing, not older than 3 years.
- In-depth experience with MR or PET imaging.
- Advanced computer skills including programming.
- Excellent communication skills.
- Willing to work in a multi-disciplinary environment (physics, medical imaging, and statistics).

Contacts

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Applicants must combine all application materials (personal letter of interest with accompanying curriculum vitae and a list of references) into one PDF file and send it by email to Claude Comtat, claude.comtat@cea.fr