

Two Year ANR Post Doctoral Fellowship; Mathematics and Algorithms for Dynamic Cone-Beam CT and ROI Reconstruction

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1 The ANR DROITE research project

The laboratories TIMC-IMAG, LHC and CREATIS (located in the Rhône-Alps Region, respectively in Grenoble, St-Étienne and Lyon) open a two years post-doc fellowship on the mathematics and algorithms for Dynamic Region-Of-Interest (ROI) Cone Beam (CB) Computed Tomography (CT). The "DROITE" project, as it is called, has already received funding for this post-doc position from the Agence Nationale de la Recherche (ANR), the primary research-funding agency in France.

The goal of the DROITE project is to make theoretical contributions to the field of dynamic CT (reconstruction of objects moving during the projection acquisition) and ROI reconstruction. Open questions remain that restrict the use of such systems in certain circumstances:

- In case of internal patient movement during the data acquisition, solving the inverse problem (even when the movement is known exactly) is an open problem, except for some very particular motion classes.
- The use of a relatively small detector compared to the patient size, and the need to minimize the X-ray dose to the patient, lead to the problem of reconstruction from truncated projections. The largest region-of-interest (ROI) that can be stably reconstructed from a given set of truncated projections is still not known for many scanning geometries. This challenging open problem is also under investigation in the project.
- Finally, the third open question which we will attack is the combination of patient motion with truncated projections, for which virtually no theoretical results exist today.

Our objectives are to solve mathematical problems arising from the open questions presented above, i.e. to obtain results on existence, uniqueness, and stability for dynamic ROI reconstruction, to develop the associated reconstruction algorithms, and to experimentally validate the results using simulated and real data.

Laurent Desbat and Rolf Clackdoyle will be the post-doc advisors. The post-doc project will additionally benefit from Simon Rit (CREATIS-CLB, Grenoble and Lyon), another key player on the ANR DROITE team.

2 Candidate qualifications ; contact information

The candidate must hold a PhD in applied mathematics or a closely-related field, with a minimum background that is equivalent to an honors bachelor's degree in mathematics. Her/his scientific interest should be in mathematics (inverse problems, tomography) with real applications (In the DROITE project, medical imaging is used for radiotherapy treatment or computer-assisted medical interventions). Good programming skills(C++ or matlab or scilab or python or IDL, etc.) are required for the computer simulations and tests of the proposed methods on simulated or real data. English language proficiency is necessary, french is optional.

The research will take place in Grenoble at TIMC-IMAG within the ANR DROITE project. For more technical information about the fellowship, see http://droite.imag.fr/doku.php?id=news_postdocposition

Send **before 20 December 2014** an email to both Rolf Clackdoyle and Laurent Desbat: rolf.clackdoyle@univ-st-etienne.fr,laurent.desbat@imag.fr (“subject: DROITE post-doc application”) containing:

- a CV with a publication list
- a brief statement of interest
- a link to your PhD report and PhD reviews (if available)
- the name (+email/tel) of two persons (we will contact them for recommendation if your application is selected)
- a list of courses and marks of your MSc should be included.

If your application is selected, you will be contacted for an interview before January 2015.

