Numerical methods for off-the-grid imaging

Contract type: Public service fixed-term contract
Level of qualifications required: PhD or equivalent
Fonction: Post-Doctoral Research Visit

Context

The hired person will be supervised by Vincent Duval (INRIA) and will benefit from the scientific environment of the MOKAPLAN team. MOKAPLAN is a joint INRIA-CNRS-Université Paris-Dauphine team which develops numerical methods, algorithms and softwares to solve variational problems related to optimal transport and inverse problems in imaging sciences. The range of potential outputs is large and the focus is on a few selected applications in natural and social sciences.

See our web page: https://team.inria.fr/mokaplan/

Assignment

Whereas most numerical methods for solving inverse problems (such as deconvolution, super-resolution) try to reconstruct a signal or an image on a predefined grid, it has been recently proposed [CFG14, BP13, DC12, TBSR13] to tackle the super-resolution problem in a fully continuous domain. Removing the grid yields infinite-dimensional variational problems, but it brings theoretical and numerical improvements: a better understanding of earlier models such as the LASSO [DP16], and numerical methods which take advantage of the problem structure [BSR17].

Still, most existing works focus on the recovery of point sources in low dimension (usually 1, rarely 2 or 3), and the critical resolution above which those algorithms are guaranteed to succeed remains widely unexplored. The hired person should develop numerical methods for the off-the-grid recovery of more complex images (i.e. with some geometric structure), e.g. with the total gradient variation prior. The goal is to provide image processing methods which are fast, able to operate robustly at optimal resolution levels, and which do not suffer from the traditional grid discretization artifacts.

References:


Main activities

The main activity is the design and implementation of off-the-grid numerical methods. In that regard, the theoretical understanding of the underlying model is also an important objective.
Skills
PhD in Mathematics, Computer Science or Signal/Image Processing.

Some knowledge of convex optimization and variational problems.

Competence in inverse problems or compressed sensing.

Some familiarity with SDP formulations or Lasserre hierarchies would be a plus.

Benefits package
- Restaurant on site
- Financial participation for public transport

Remuneration
- Location: Paris 12ème
- Gross Salary per month: 2 653€ brut/mensuel

Security and defense procedure:
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).

Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.