2018-00356 - Doctoral/Advanced super-resolution techniques for high quality scanned images

**Contract type:** Public service fixed-term contract  
**Level of qualifications required:** Graduate degree or equivalent  
**Fonction:** PhD Position  
**Level of experience:** Recently graduated

**About the research centre or Inria department**

GeoStat projecting makes fundamental and applied research on new non linear methods for the analysis of complex signals and systems, using paradigms and tools coming from statistical physics.

**Research themes**

GeoStat's research thematics are centered on the following theoretical developments:
- Multiscale methods developed in Physics for the analysis of complex systems,
- Predictibility in complex systems,
- Multiresolution analysis,
- Analysis, classification, detection,

and the following applied objectives:
- Analysis of complex and turbulent signals in earth observation, astronomy and remote sensing,
- Digital implementation of adaptive optics in astronomy,
- Analysis of biomedical signals.

**International and industrial relations**

GeoStat is working in close collaboration with the following teams:
- Laboratoire d’Astrophysique de Bordeaux.
- ICM-CSIC, Department of physical oceanography, Barcelona, Spain.
- LEGOS Laboratory, UMR CNRS 5566, Toulouse, France.
- Laboratory of theoretical physics and condensed matter University Paris 6, CNRS UMR 7600, Paris, France.
- IRIT, UMR CNRS 5505, Toulouse, France.

**Context**

**Within the framework of a partnership**

- value-creation and technology transfer contracts with I2S (Innovative Imaging Solution) Company

**Assignment**

Geostat is an INRIA research team specialized in advanced signal and image processing. Geostat is associated with a world leader company in imaging devices, I2S (Innovative Imaging Solutions) in a InnovationLab starting in 2017. This PhD offer takes the form of a CIFRE funding where the applicant will work in close collaboration both with Geostat researchers and I2S engineers.

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**General Information**

- **Theme/Domain:** Optimization, machine learning and statistical methods
- **Town/city:** Talence
- **Inria Center:** CRI Bordeaux - Sud-Ouest
- **Starting date:** 9/3/18
- **Duration of contract:** 3 years
- **Deadline to apply:** 6/30/18

**Contacts**

- **Inria Team:** GEOSTAT  
- **Recruiter:** Yahia Hussein / hussein.yahia@inria.fr

**The keys to success**

In the framework of the acquisition chain and devices built by I2S, the objective of this PhD is to provide efficient algorithms able to merge different acquired images corresponding to slight spatial translational displacements in order to get a wider super-resolved image. Consequently, this PhD takes place within the general subject of super-resolution. At I2S, super-resolution is presently performed on monochrome images, and computed with the help of interpolation techniques performed on different acquisitions. Super-resolution is presently based on a priori knowledge of the sensor's displacement at subpixel level. The drawbacks of such an approach are clearly identified:
- limitation to monochrome images,  
- the technique necessitates a very high mechanical precision in the sensor's displacements (problems in calibration/displacement's measure)  
- the final gain in super-resolution is still limited

As a consequence, to overcome the a priori knowledge of the sensor's displacement would result in a great achievement in super-resolving images.

**Conditions for application**

Thank you to send:
- updated CV  
- cover letter  
- letters of recommendation  
- Master Degree Transcripts

**Defence Security :**

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.
INRIA provides an unique context for research, equal opportunity environment.

**Main activities**
In this thesis, the applicant will explore and develop different approaches for proposing efficient solutions to this problem of super-resolution, for instance and among others: optimization approaches (convex and non-convex), machine learning and deep learning approaches, etc.

**Skills**
Applied mathematics/Physics or Computer science student with a good applied maths background (image processing, Fourier transforms, optimization techniques). A good knowledge of a computer language is necessary.

**Benefits package**
- Subsidised catering service
- Partially-reimbursed public transport

**Remuneration**
1982€ / month (before taxes) during the first 2 years, 2085€ / month (before taxes) during the third year

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.

**Recruitment Policy:**
As part of its diversity policy, all Inria positions are accessible to people with disabilities.

**Warning:** you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.