

Position description

1. Position identification

Title of post : Self-supervised learning and class discovery in image analysis at very high spatial resolution (Pléiade).

Type of contract : CDD Post-doctorat

Category (A,B or C) : A

Contract/project period : 12 months **Expected date of employment :** 01/03/2025

Proportion of work : 100%

Workplace : ICube – Equipe SDC – Pôle API

Desired level of education : PhD

Experience required : 0-36 months

Contact(s) for information on the position (identity, position, e-mail address, telephone) :

Baptiste Lafabre - lafabre@unistra.fr

Antoine Cornuejols - antoine.cornuejols@agroparistech.fr

Date of publication : 20/12/2024

Closing date for the receipt of applications : 31/01/2025

2. Research project or operation

In many fields, the almost continuous generation of increasingly massive amounts of data makes it impossible to carry out the labeling phase of supervised learning, particularly in remote sensing at very high spatial resolution. This task can no longer be carried out by experts, as it is too tedious and time-consuming. What's more, it assumes that the experts already have an a priori definition of the classes (nomenclature, ontology...) of interest to them.

However, this is not always available, or is only partial. This post-doc proposal is part of an ICube-CNES R&T project. The aim of this project is to respond to this need by proposing an interactive method for building learning games and discovering classes of interest in a Pleiades-type image.

3. Activities

➤ Description of the research activities :

The proposed process consists of 4 main steps:

1. Initial segmentation and selection of a restricted set of quality segments

2. Initial expert annotation of a small sample of these segments for known classes.
3. Proposal and iteration: Classification of segments and potential identification of new classes
4. Evaluation by the expert and enrichment of a learning base with annotated segments that can be integrated into AutoLabel.

The person recruited will initially (≈ 2 months) test recent segmentation methods in order to implement step no. 1.

In a second phase (≈ 8 months), he/she will have to propose a representation learning mechanism. This should, on the one hand, enable the production of quality classifications for the selected sample and, on the other hand, serve as a basis for class discovery methods (Generalized Category Discovery). At the end of this work, stage 2 should be operational.

Finally, the concrete implementation of the overall process (≈ 2 months) should demonstrate (proof of concept) its feasibility and effectiveness for the creation of interactive learning and class discovery example sets applied to Very High Spatial Resolution (VHSR) data.

➤ **Related activities :**

As this is a research and development project, the person recruited will be interested in implementing the proposed methods in the CNES and ICube work and development environment (FoDoMuST platform developed by the SDC team).

As far as possible, he/she will also study the potential contribution of these methods to the Samarah collaborative classification method proposed by ICube.

4. Skills

➤ **Qualifications/knowledge :**

PhD in computer science, specializing in machine learning/data mining.

Knowledge of remote sensing or experience in this field would be appreciated.

➤ **Operational skills/expertise :**

Solid knowledge of Data Science, particularly Deep Learning methods. Initial experience of using foundation models in image analysis would be appreciated.

➤ **Personal qualities :**

- Good verbal (English or French) and written (English) communication skills.
- Interpersonal skills and the ability to work individually or as part of a project team.

5. Environment and context of work

➤ **Presentation of the laboratory/unity :**

The SDC (Science des Données et Connaissances) team within the ICube laboratory specializes in machine learning, which lies at the heart of knowledge extraction, data science and artificial intelligence. It comprises 11 permanent staff working, among other things, on the classification (of time series) of remote sensing images. To validate its work, it is developing the existing FODOMUST platform, currently accessible on a server hosted at the Unistra DataCenter via the MULTICUBE interface dedicated to incremental image classification.

➤ **Hierarchical relationship :**

The new employee will report to Baptiste Lafabrègue and Antoine Cornuéjols, in collaboration with Anne Jeannin-Girardon.

➤ **Special conditions of practice (notice attached):**

Depending on the level of expertise of the person recruited, it will be between €2,100 and €2,300 net (before income tax).

To apply, please send your CV, cover letter, diploma and recommendation letter or recommendation contact to :

- **Baptiste Lafabrègue - lafabregue@unistra.fr**
- **Antoine Cornuéjols - antoine.cornuejols@agroparistech.fr**