Offer #2025-08683

Post-Doctoral Research Visit F/M Vision language models towards interpretable deep learning for Earth observation

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Level of experience : From 3 to 5 years

About the research centre or Inria department

The Inria centre at Université Côte d'Azur includes 42 research teams and 9 support services. The centre's staff (about 500 people) is made up of scientists of di?erent nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regiona economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Context

We are seeking a highly motivated postdoctoral researcher to work on the interpretability and explainability of Vision-Language Models (VLMs) for remote sensing applications, with a specific focus on Sentinel-2 data. This research aims to enhance our understanding of how VLMs process satellite imagery and textual descriptions to improve geospatial analysis and decision-making.

It will build on recent work (https://arxiv.org/pdf/2412.08536) developed in the EVERGREEN team on aligning remote sensing and textual representations.

Assignment

Cross-Modal Alignment of Ground-Level and Satellite Imagery:

- Develop or leverage existing remote sensing-based VLMs that align ground-level images with satellite imagery, integrating time-series and multi-spectral data for a more comprehensive geospatial understanding.
- Improve the model's capacity to interpret textual prompts by incorporating ground-level perspectives, strengthening the connection between aerial and terrestrial observations.

Interpretability and Explainability of VLMs:

- Employ interpretability and explainability techniques to analyze the textual component of the model, identifying how prompts influence predictions and determining the most influential features.
- Examine how different textual descriptions of locations impact the model's decision-making process when comparing ground-level image alignments VLMs with other remote sensing VLMs trained on captioned satellite imagery and text pairs.
- Develop visualization and analytical methods to explore the interaction between textual and visual data within the model.
- Investigate attention mechanisms, activation maps, and latent space representations to enhance model transparency.
- Implement feature attribution techniques, such as SHAP and Grad-CAM, to provide insights into model decision-making.
- Design explainability-driven refinements to improve model interpretability and trustworthiness for geospatial applications.

Evaluation and Application to Earth Observation Tasks:

- Assess model performance on key remote sensing applications, including land cover-land use classification and map generation based on textual prompts with reasoning .
- Develop strategies to mitigate biases and improve the robustness of VLMs for Earth observation.
- Collaborate with interdisciplinary teams to apply findings to real-world geospatial challenges.

Main activities

The main objective of this postdoctoral research is to develop methodologies for improving the transparency and interpretability of VLMs applied to remote sensing. This includes:

- Investigating the latent representations of Sentinel-2 imagery within VLM architectures.
- Identifying biases and limitations in how VLMs process textual and visual geospatial data.
- Evaluating model trustworthiness for Earth observation tasks through user studies.
- Writing a journal publication sharing the findings from the project.

Skills

- Python programming.
- Deep Learning with Python (preferably with Pytorch).
- Experience with GIS.
- Experience with NLP would be a plus.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Social, cultural and sports events and activities
- Contribution to mutual insurance (subject to conditions)

Remuneration

2788 € per month

General Information

- **Theme/Domain :** Vision, perception and multimedia interpretation
  Information system (BAP E)
- **Town/city :** Montpellier
- **Inria Center :** Centre Inria d'Université Côte d'Azur
- **Starting date :** 2025-06-01
- **Duration of contract :** 12 months
- **Deadline to apply :** 2025-04-13

Contacts

- **Inria Team :** EVERGREEN
- **Recruiter :**
  Marcos Gonzalez Diego / diego.marcos@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

We are looking for someone with strong competences in Python programming and Deep Learning, ideally with experience with geospatial data and NLP. A strong motivation towards using these skills for tackling problems related to environmental monitoring is appreciated.

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.

Instruction to apply

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 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.