

Vacancy announcement
Two years post-doctoral position in
text/satellite cross-modal self-supervised learning
Full-time contract

*International Centre for Advanced Mediterranean Agronomic Studies
Mediterranean Agronomic Institute of Montpellier (CIHEAM-IAMM)*

The Mediterranean Agronomic Institute of Montpellier (CIHEAM Montpellier), one of the four institutes of the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), is an intergovernmental organization whose mission is the development of higher education and lifelong learning, research and cooperation in the Mediterranean area. Within the scope of the GRANULAR project, CIHEAM Montpellier is looking for a postdoctoral researcher to develop cross-modal (text/satellite imagery) deep learning frameworks to extract useful information in order to characterise rural areas.

CONTEXT

GRANULAR (Giving Rural Actors Novel data and re-Useable tools to Lead public Action in Rural areas) is a newly awarded project under the Horizon Europe programme gathering 23 European partners (academic institutes, international organisations, NGOs, rural networks, and local authorities) and coordinated by CIHEAM Montpellier.

This four-year project will generate new insights for characterising rural diversity based on a multi-actor and interdisciplinary approach. Insights from Multi-Actor Labs (MALs) will help modellers to generate novel datasets using a wide range of methods and data, such as remote sensing, crowd-sourced data, mobile phone data and web scraping. This will then be combined with a variety of existing institutional data to derive indicators to measure resilience, well-being, quality of life and attractiveness in rural areas.

GRANULAR will directly support concrete policies, by informing rural action with the opportunities and requirements in terms of data-collection methods and indicator development to enhance and support the co-creation and co-learning with multiple actors in rural areas. After ensuring the scalability of the results, datasets, data visualisation and other tools will be made available on a dedicated platform designed by, and for, rural actors and rural policy-makers.

ROLE

The postdoctoral researcher will contribute to the design and development of new Deep Learning (DL) algorithms to detect and map landscape features and their changes based on earth observations (EO) data.

The aim is to develop a cross-modal deep learning framework capable to connect different modalities (geo-localized photos, text prompts and satellite images) in order to produce probability maps that capture the spatial distribution of a particular concept of interest (i.e. rural structures, rural functionalities, forest typology, agricultural systems morphology, anthropic activities, ...) expressed in natural language. To this end, we will leverage recent literature and models for cross-modal image/text analysis [6] with the objective to extend them with Earth observation data and get a spatial representation of the concept of interest. Geo-localized photos will be obtained via social media platforms (i.e. Flickr) while multi-temporal satellite data will be obtained via the Copernicus programme, more precisely time series of radar (Sentinel-1) and optical (Sentinel-2) satellite imagery.

The main tasks of the research will be:

- Create a large dataset of at least 10M geo-located image / satellite time series pairs over the whole of Europe.
- Obtain CLIP [6] embeddings of the photos and use them to train a feature extractor for the satellite time series, using - contrastive learning (i.e. method proposed in [6])
- Evaluate the resulting method in the zero-shot setting on a suite of land-use and land-cover (LULC) benchmarks using different types of text prompts.
- Analyse the results of creating maps for several concepts that are relevant for rural areas (at the local level with Living-Labs, and at EU level with JRC/DG-AGRI/DG-REGIO).

The work will be held within the Joint Research Unit TETIS. You will be working mainly with Diego Marcos (Inria), Dino Ienco (INRAE), Tristan Berchoux (IAMM) and Ian McCallum (IIASA), with other potential international collaborations (Joint Research Centre, University of Southampton).

ACTIVITIES AND TASKS

- Lead EO component within the GRANULAR project;
- Design and develop novel algorithms for the use of EO in rural areas (experimentation on downscaling/upscaling across different territories across EU);
- Possibility to calibrate and validate generated data with data collected in-situ by Living Labs through citizen science (led by IIASA);
- Contribution to the writing of reports and scientific papers;
- Presentation of results within the project and towards the larger scientific community.

REQUIREMENTS

The postdoctoral researcher must meet the following requirements:

- Background: PhD in remote sensing/computer science.
- Skills: good knowledge in scientific programming in Python, image analysis using deep learning and statistical analysis.
- Dynamic and collaborative team player, autonomous, proactive and rigorous.
- Excellent English oral and written communication.

JOB SPECIFICATIONS

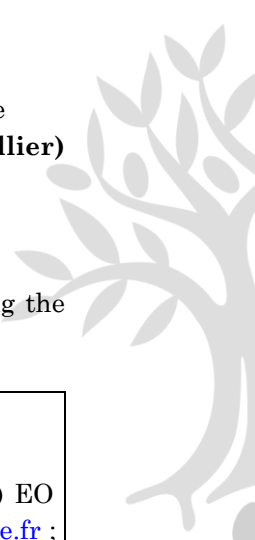
- Starting date: **from April 2023**
- Contract duration: fixed term contract of 12 months once renewable
- Full-time (37,5h per week)
- 8 weeks annual leave
- Salary: gross monthly salary ranging between 2 000€ and 2 400€ based on experience
- Location: **Joint Research Unit TETIS (Maison de la Télédétection, Montpellier)** with occasional travels in different EU member states

SELECTION PROCESS

The application must be written in English and include a CV and a cover letter concerning the scientific activities defined in the job description.

Closing date of the call for applications: **15 March 2023**

The application file must be sent by email with the following object "[GRANULAR] (WP3) EO Post-doctoral Vacancy" to the following 4 addresses: diego.marcos@inria.fr ; dino.ienco@inrae.fr ; tristan.berchoux@iamm.fr and emploi@iamm.fr



- [1] J. Xie, C. Ren, X. Li, L. Chi Hay Chung: “Investigate the urban growth and urban-rural gradients based on local climate zones (1999–2019) in the Greater Bay Area, China”, *Remote Sensing Applications: Society and Environment*. Volume 25, January 2022
- [2] C. Qiu, X. Tong, M. Schmitt, B. Bechtel, X. X. Zhu: Multilevel Feature Fusion-Based CNN for Local Climate Zone Classification From Sentinel-2 Images: Benchmark Results on the So2Sat LCZ42 Dataset. *IEEE J. Sel. Top. Appl. Earth Obs. Remote. Sens.* 13: 2793-2806 (2020)
- [3] C. Lee, W. Timo de Vries: Bridging the Semantic Gap between Land Tenure and EO Data: Conceptual and Methodological Underpinnings for a Geospatially Informed Analysis. *Remote Sens.* 2020, 12(2), 255
- [4] Q. Levering, D. Marcos, D. Tuia: On the relation between landscape beauty and land cover: A case study in the U.K. at Sentinel-2 resolution with interpretable AI. *ISPRS Journal of Photogrammetry and Remote Sensing*. Volume 177, July 2021, Pages 194-203
- [5] S. Zou, L. Wang: Mapping individual abandoned houses across cities by integrating VHR remote sensing and street view imagery. *Int. J. Appl. Earth Obs. Geoinformation* 113: 103018 (2022)
- [6] Radford, A., Kim, J.W., Hallacy, C., Ramesh, A., Goh, G., Agarwal, S., Sastry, G., Aspell, A., Mishkin, P., Clark, J. and Krueger, G., 2021, July. Learning transferable visual models from natural language supervision. In *International Conference on Machine Learning* (pp. 8748-8763). PMLR.

