



Beatriz Peres

Geospatial Engineer & Earth Observation Scientist — Remote Sensing, LiDAR, Machine Learning

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Profile

Geospatial engineer and Earth observation scientist working across the full stack of a geospatial problem — from field acquisition and sensor characteristics, through processing chains and data infrastructure, to machine learning models and an honest evaluation of what they actually show.

Professional background in aerial photogrammetry, LiDAR and laser scanning across all three acquisition families (TLS, MLS, ALS), with a long-standing specialism in quality control and statistical validation of geospatial data. Years of producing survey deliverables that had to be checked, defended and signed off shape how any result is read — with attention to what the data physically is, how it was acquired, and what a headline accuracy figure conceals.

Current research applies deep learning to Earth observation, with satellite image time series (SAR, optical, multispectral) as the central object of study and geospatial foundation models as the method — specifically how learned representations transfer across regions, seasons and sensing conditions.

Three complete retrains (fine arts and conservation, geospatial engineering, AI for Earth observation) and study or work in four countries make becoming productive in an unfamiliar environment an evidenced pattern rather than a claim. Equally comfortable in commercial delivery, where throughput and tolerances decide, and in research, where baselines and ablations do.

Experience

IRISA — Obelix team (UMR CNRS 6074), Researcher, MSc Thesis

Vannes, France

Research on the transferability of geospatial foundation models for crop-type mapping, held within a remote sensing and machine learning group whose work centres on satellite image time series, domain adaptation and land cover mapping.

Mar 2026 – present

6 months

- Designed, implemented and evaluated the full seven-month programme end to end, from research question to reported results, supervised by Charlotte Pelletier (Associate Professor, Université Bretagne Sud, IUF chair holder and co-leader of the CDE Geodata Science track) and Karima Hadj-Rabah.
- Worked inside an active research laboratory rather than on an isolated student project, with results held to publication standard.
- Member of the organising team for the AI4EO Spring School 2026 (Université Bretagne Sud, Campus Tohannic, Vannes, 8–10 April 2026) — an international three-day school on AI for Earth observation co-organised by IRISA/Obelix, the Copernicus Master in Digital Earth, Cluster Sequoia (PANORAMIX chair) and ESA Phi-lab, covering foundation models for EO, MLOps, responsible AI and generative models, with invited speakers from HZDR, TUM, CNES, IGN and Observatoire de Paris and a competitively selected, ECTS-bearing cohort.

Development Seed, Intern

Cloud-native Earth observation data infrastructure, within an international, distributed open-source engineering team.

- Investigated data formats for large EO archives — Cloud-Optimized GeoTIFF and, principally, the Zarr specification — assessing its potential for storing and serving satellite data at scale and what it changes about how such archives are accessed.
- Contributed to ESA's EOPF Toolkit, the project modernising and harmonising the data products of the Copernicus Sentinel missions, and produced a final study on flood mapping in Valencia from cloud-native Sentinel data.
- Worked in the working practices of a distributed open-source team — public repositories, review and documentation as part of the deliverable.

Remote / international
July 2025 – Sept 2025
3 months

Geotrilho, Geospatial Engineer

Full commercial survey engineering role covering acquisition through to delivered product.

- Acquisition and processing of aerial LiDAR, mobile mapping and terrestrial laser scanning, and UAV photogrammetry — including piloting the aircraft for survey missions.
- Creation and modelling of Digital Terrain Models and extraction of features from them; structure monitoring for deformation and change; stockpile volume measurement for quantity reporting.
- Inspection and quality control of geodata, verifying that deliverables met specification and tolerance before release — the origin of a specialism in statistical validation of geospatial data.
- Delivery to client deadlines using the full proprietary survey chain (RIEGL, POSPac MMS, Cyclone3DR, TopoDOT, Metashape).

Barreiro, Portugal
Sept 2022 – July 2024
1 year 11 months

Geotrilho, Geospatial Engineering Intern

- Introduction to the professional topographic survey process — feature extraction from acquired data, and the comparative use cases and limitations of the three laser scanning families. Converted directly into the engineer role above.

Barreiro, Portugal
Apr 2022 – Aug 2022
5 months

Copenhagen Coffee Lab, Barista

- Held alongside full-time study, self-supporting the Geospatial Engineering degree.

Lisbon, Portugal
Oct 2020 – Mar 2022
1 year 6 months

Areas of Expertise

Remote sensing: Multi-modal work across SAR (including interferometric processing), optical and multispectral, hyperspectral, VHR imagery and LiDAR — with a working sense of what each modality can and cannot resolve, and of the physical acquisition constraints behind it

Survey & geomatics: Aerial LiDAR, mobile mapping, terrestrial laser scanning, UAV photogrammetry, digital terrain modelling and feature extraction, structure monitoring, volumetric measurement, GNSS and navigation, total station and bathymetric survey, GIS and cartography — performed commercially, to client tolerances

Quality control & validation: Error budgets and uncertainty, fair baselines, evaluation splits that do not leak, and treating an unexplained improvement as a bug until proven otherwise

Machine learning for EO: Deep learning and computer vision applied to imagery, time series and point clouds — semantic segmentation, object detection, classification, embedding analysis — with train/test protocols designed for spatial and temporal autocorrelation

Satellite image time series: Building, harmonising and modelling multi-date Sentinel-1 and Sentinel-2 series, handling irregular acquisition, applied to crop-type classification, land cover and environmental monitoring

Foundation models & representation learning: Frozen-embedding workflows over pre-trained geospatial foundation models, and interrogation of what those representations encode — probing, domain shift quantification, adversarial adaptation, label-efficiency ablations

Cloud-native geospatial & scale: Cloud-Optimized GeoTIFF, Zarr, STAC catalogues and EO data cubes; distributed computation with Spark and Dask; columnar Parquet storage for large point-cloud and imagery workloads; open-source engineering practice

Hazard & vulnerability assessment: Impact chain modelling and multi-hazard risk assessment — tracing a hazard through exposure, physical and social vulnerability to its human consequences; the step that connects an Earth observation measurement to why the measurement is being made

Education

MSc	Copernicus Master in Digital Earth (Erasmus Mundus Joint Master) , Earth Observation and Geodata Science Two-year European joint programme combining Earth observation science with data science, delivered across two universities and requiring relocation between countries between the two years. • Year 1 — Paris Lodron University of Salzburg (PLUS), Austria, Remote Sensing: hyperspectral, SAR, optical, multispectral, VHR and LiDAR; EO data cubes; Copernicus programme and Sentinel mission architecture; big data concepts; spatial databases; scientific programming for EO workflows. Courses included Advanced Remote Sensing, Methods in Spatial Analysis, Systems Thinking in Spatial Representations (Spatial Simulations), Spatial Databases and Digital Earth: Big Earth Data Concepts. • Year 2 — Université Bretagne Sud (UBS), Vannes, France, Geodata Science: machine learning, deep learning and computer vision; foundation models and large geospatial AI models; foundations of remote sensing analysis; efficient remote sensing image processing; big data, parallel and cloud computing. • Thesis: <i>Spatial and Temporal Transferability of Geospatial Foundation Models — A Case Study on Crop-Type Identification from Satellite Image Time Series</i> (IRISA, Obelix team). To be published as a scientific article.	Salzburg, AT / Vannes, FR Sept 2024 – Oct 2026
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| <p>BSc Faculdade de Ciências, Universidade de Lisboa, Geospatial Engineering</p> <p>Full engineering degree spanning both ends of the methodological range, from classical instrument survey to modern digital acquisition.</p> <ul style="list-style-type: none"> • Remote sensing, geomatics, programming, satellite systems, GNSS and navigation, GIS, cartography and mapping. • Practical training from total station and levelling survey through to bathymetric survey and UAV-based mapping. • Completed while working part-time. | <p>Lisbon, Portugal
Sept 2019 – June 2022</p> |
| <p>Accademia di Belle Arti di Roma, Conservation and Restoration of Cultural Property (Erasmus exchange)</p> <p>A semester specialising in conservation and restoration of cultural property, taught and assessed in Italian within a different pedagogical tradition.</p> <ul style="list-style-type: none"> • Theory and studio practice of conservation and restoration applied to cultural property; material and condition assessment, documentation of intervention, and the ethics of reversible treatment. • First of four countries of study and work, and the first full change of working language. | <p>Rome, Italy
Sept 2018 – Mar 2019</p> |
| <p>BSc Faculdade de Belas Artes, Universidade de Lisboa, Art and Heritage Sciences</p> <ul style="list-style-type: none"> • Art history, and the theory and practice of conservation and restoration of fine arts — close visual analysis, material and condition assessment, documentation and intervention ethics. | <p>Lisbon, Portugal
Sept 2016 – June 2019</p> |

Selected Projects

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| <p>Geospatial foundation model embedding transferability for crop-type mapping</p> <p>Does a pre-trained geospatial representation separate crop identity from the geography it was observed in — or does a model trained in one country quietly inherit that country's conditions?</p> <ul style="list-style-type: none"> • Evaluated TESSERA embeddings against raw Sentinel-1/2 time series baselines on 13 harmonised EuroCrops classes, training lightweight classifiers on one country or year and testing on others — spatial transfer across 10 European countries (2018), temporal transfer and out-of-distribution years across Austria (2016–2023). • Cross-country transfer retained 66% of in-distribution accuracy for embeddings vs 59% for raw series; cross-year transfer retained 92–94% vs 88%. Embedding-based models matched or exceeded the baselines using only one quarter of the labels. • Probing experiments recovered country, coordinates and acquisition year from the embeddings; domain-adversarial adaptation (DANN) improved mean target accuracy by 2.8 percentage points but most of the transfer loss remained — pre-training reduces spatial domain shift without removing it, leaving crop identity entangled with geographic and environmental context. • <i>PyTorch, TESSERA, EuroCrops, Sentinel-1/2, scikit-learn, linear and non-linear probing, DANN.</i> | <p>MSc thesis, IRISA / UBS
Mar 2026 – Sept 2026</p> |
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Impact chain model for seismic risk, Valea Lupului

BIP, University of Bucharest

Mar 2025 – Apr 2025

Assessed output of the Blended Intensive Programme *Quantifying Vulnerability to Natural Hazards in Changing Climate Patterns* — a team-built causal model linking an earthquake hazard in a Romanian village to exposure, structural and social vulnerability, and the downstream impacts.

- Developed from field observation in a mixed team of geomorphologists, engineers, climate scientists and social scientists, and presented to programme lecturers on the final day. *Impact chain methodology, multi-hazard risk assessment.*
- Five weeks of cross-disciplinary virtual sessions (vulnerability in the Anthropocene, geo-hazard dynamics in fragile landscapes, sea level change and adaptation, landscape and community resilience, social vulnerability in coastal environments, tectonic and climatic forcing of geohazards) followed by five days of fieldwork in Bucharest and the Vrancea seismic region.
- Fieldwork covered structural retrofitting after the 1977 earthquake, shallow landslides in Subcarpathian molasse, construction-induced slope instability, earthquake-triggered landslides as hazard cascades, mudflow-reshaped terrain, a village survey comparing housing vulnerability, and disaster risk reduction inside protected areas around active mud volcanoes.

SAR processing — SNAP chain as a Python API, and interferometry

PLUS Salzburg

Jan 2025

A tool reproducing the processing steps and operators of ESA SNAP programmatically, converting an interactive desktop workflow into scripted, reproducible code.

- Accompanied by SAR processing through to interferogram generation, covering coregistration and phase handling. *Python, SNAP.*

Distributed classification of point clouds and BigEarthNet imagery

UBS

Jan 2026

Parallel classification of datasets too large for single-machine processing — point clouds stored columnar in Parquet, and the BigEarthNet Sentinel-2 benchmark at scale.

- Combined point-cloud domain knowledge from industry with distributed computing. *Spark, Parquet, PyTorch, Python.*

Applied machine learning and segmentation coursework

PLUS Salzburg / UBS

2025 – 2026

- Swimming pool detection from aerial and satellite imagery — a small-object, high-imbalance segmentation problem. *PyTorch, U-Net, OpenCV.*
- Drought prediction from environmental time series, with feature construction from temporal signals and model selection. *pandas, scikit-learn.*
- Supervised classification and segmentation of EO imagery, and semantic classification of LiDAR point clouds. *Python, scikit-learn, Open3D.*

Skills

Programming: Python (primary), Bash, SQL including spatial databases

Deep learning & ML: PyTorch, TorchGeo, Keras/TensorFlow, scikit-learn, UMAP; vision transformers, U-Net, CNNs, foundation models and frozen-embedding workflows, semantic segmentation, object detection, time series classification, domain adaptation and adversarial training, dimensionality reduction, probing

Geospatial Python: rasterio, rioxarray, xarray, geopandas, shapely, fiona, pyproj, affine, pystac / pystac-client, stackstac, planetary-computer, earthengine-api, geotessera, OpenCV, Open3D

Data engineering & scale: NumPy, pandas, SciPy, PyArrow/Parquet, Dask and dask.distributed, joblib, Apache Spark, HDF5 (h5py, PyTables), Zarr, COG, STAC and EO data cubes, cloud computing environments

Visualisation: matplotlib, seaborn, plotly, bokeh

Tooling: Git and GitHub, Docker, uv, Hugging Face, Jupyter, requests; HTML and CSS for building and maintaining a project ePortfolio

Survey & geomatics software: Cyclone3DR, POSpac MMS, RIEGL RiACQUIRE and RiPROCESS, Agisoft Metashape, TopoDOT, ESA SNAP, QGIS, ArcGIS

Sensors & data: Sentinel-1 SAR, Sentinel-2 multispectral, hyperspectral, VHR optical, airborne / mobile / terrestrial LiDAR, UAV imagery, GNSS, bathymetric and total station survey

Applied risk methods: Impact chain modelling; hazard, exposure and vulnerability assessment; multi-hazard cascade analysis

Languages

Portuguese: Native

English: C2 listening and reading, C1 writing and speaking

French: B2 listening, reading and speaking, A2 writing

Italian: B1 listening and reading, A2 speaking, A1 writing

Spanish: B1 listening and reading, A1 speaking and writing

In use: Study and work carried out in Portuguese, English and partly Italian, with two academic years spent in French- and German-speaking countries

Certifications and Distinctions

- Erasmus Mundus scholarship — Copernicus Master in Digital Earth, competitive European funding for a two-university joint master (2024).
- Organising team, AI4EO Spring School 2026 — IRISA/Obelix and ESA Phi-lab, Vannes, April 2026.
- Blended Intensive Programme certificate — Quantifying Vulnerability to Natural Hazards in Changing Climate Patterns, University of Bucharest, 2025.
- MSc thesis to be published as a scientific article (IRISA, Obelix team; date to be announced).
- EASA A1–A3 Open Subcategory remote pilot certificate — European drone licence, held and used professionally for UAV survey missions.
- VHF Global Safety Passport — site safety certification for industrial and survey environments.
- Portuguese driving licence, category B.
- Study or work in four countries (Portugal, Italy, Austria, France); mobile across Europe.