

GUSTAVO CAO CANCIO

Scientific Data Analyst & Systems Modeller



SUMMARY

Multidisciplinary technical analyst and modeller with deep experience in building end-to-end data solutions across environmental, geospatial, and engineering domains.

My recent career more often spanned remote sensing, environmental monitoring, and spatial data integration.

Skilled at developing bespoke methods and pipelines for underdefined problems, integrating diverse data sources, and applying advanced classic machine learning, artificial intelligence and physical simulation approaches.

Recognized for rigorous methodological design, cross-domain synthesis, and practical implementation in real-world contexts.

I am a complex problem-solver, technical generalist of unusual range, capable of building systems and methods from scratch, even in domains outside my formal specialty.

SELECTED RELEVANT PROJECTS

- Developed a neural network-based data fusion algorithm that provides a 10 m resolution (49-fold increase) Land Surface Temperature product with less-than-a-week revisiting time and a static downscaling stack that fuses ERA5-Land (11.1 km) to 500 m ^a.
- Developed a custom pipeline for analysis and attribution of local meteorological phenomena based on historical data. Built parsers and interfaces for Spain's AEMET data repositories and implemented spectral, wavelet, and entropy-based tools to identify and characterize precipitation events. While experimental, it was used to estimate probabilistic rainfall events relevant to infrastructure resilience under climate variability (in support of ongoing doctoral research).
- Carried out quality control and validation of daytime and nighttime airborne thermography for the [Metropolitan Adelaide Urban Heat Mapping 2022 project](#) ^b along with development of custom processing pipelines and algorithms mostly related to coregistration under degraded satnav conditions, leading to extensive experience with ECOSTRESS, the Specim AISA range and thermal data from FLIR imagers based on microbolometer arrays.
- Developed a micrometeorological simulation (typical resolution smaller than 1 m) aimed at, but not limited to, evaluating the influence of the three-dimensional structure and energy release component distribution of the forest in the propagation of bushfires and its coupling with long-term ecological aspects ^c.
- Developed proxy-based biodiversity and population ecology-related methods for the aforementioned Green Infrastructure Strategy of Galicia and Northern Portugal ^d.
- Developed and implemented methods for vegetation, crops and land cover classification in multiple projects across multiple continents and regions in a variety of different settings. Instrumental in monitoring the populations of *Posidonia australis* of the Spencer Gulf.

^aSeveral commissioned derived products were included in the Green Infrastructure Strategy of Galicia and Northern Portugal. Available (per council) at [GreenGap Results](#)

^bTechnical report (data capture both parts A and B) and data available at the [South Australian Government's Open Data Portal](#)

^cStarted as my unsubmitted Degree Thesis in architecture -originally intended to model urban comfort- that coupled a lattice-Boltzmann CFD simulation with heat transfer models and parameterization schemes. While incomplete, I showed some aspects in the [poster for the Atlantic from Space Workshop 2019](#)

^dAlso for the aforementioned Green Infrastructure Strategy of Galicia and Northern Portugal.

EDUCATION

Degree in Architectural Studies.

University of A Coruña.

Incomplete; 48 credits pending.

Thesis (unsubmitted): "Climatic Variations in the Promenade of A Coruña: Implications for Design and User Comfort". Urban micrometeorological modeling and comfort indices simulation. With substantial research and work showcased at ESA Atlantic from Space Workshop 2019 (see [c](#)).

TECHNOLOGIES AND TECHNICAL SKILLS (NON-EXHAUSTIVE)

- Strong systemic thinking and abstraction skills. Tool-agnostic algorithm design and rapid cross-domain synthesis.
- Programming languages: Julia, Python, MATLAB/Octave, assembler.
- Machine learning and artificial intelligence: Keras, TensorFlow, Orfeo Toolbox, Flux, scikit-learn.
- Geospatial data: QGIS, GDAL, PDAL, SAGA, Orfeo Toolbox, Pandas, DSP, Agisoft Metashape, Global Mapper and in-house developed software.
- CAD: Freecad, OpenSCAD, Rhino 3D, Revit, SolidWorks, Luxology Modo, KiCad.
- Knowledge of mechanical design, machining, additive manufacturing.
- Experience in 3D printing and custom mechanical parts manufacture.
- Interest in hardware design, PCB manufacturing, and FPGA synthesis.
- High generalist technical range and deep computing skills, with autonomous system-level learning across physics, engineering, data science, and environmental modeling.

WORK EXPERIENCE

CNRS / ENSA Toulouse — Laboratoire de Recherche en Architecture 2024-2025.

Ingénieur d'étude.

Developed a number of products for the [CRoCuS_2 project](#). CRoCuS_2 aims to evaluate the network of galician public libraries from the point of view of its use as climate shelters. Designed and implemented the entire operational structure currently in use, mostly putting together a comprehensive database of the characteristics of these buildings, developing surveys to evaluate their accessibility in a broad sense and substantially expanding the scope and depth of the project:

- Carried out the conceptual design and development of a comprehensive data lake integrating remote sensing, cadastral, land use, and demographic data.
- Engineered pipelines extracting environmental, microclimate, morphological, sociodemographic and accessibility metrics from different sources (contractual clearance is being sought to release the software repository as open source).
- Developed a comprehensive online survey instrument for integral characterization of library infrastructure.
- Visualization and reporting of key metrics to support climate adaptation strategies.
- Delivered reproducible analyses with strict data attribution and licensing compliance.

University of A Coruna (Civil Engineering Department — Cartographic Engineering Lab) 2024.

Consultant scientist.

Serving as ecological consultant, remote sensing data product developer, and data scientist for the development of guidelines for a municipal-level Green Infrastructure strategy for Galicia and Northern Portugal. Projects include:

- High resolution, high availability land surface temperature and urban heat islands mapping, related to the development of a 10 m LST product as a personal project (listed below) (Python language, Keras, TensorFlow, GDAL, convolutional neural networks).
- Proxy-based biodiversity and population ecology research and related metrics (Python language, QGIS, convolutional neural networks, geographically weighted regression, Shannon's entropy-derived indices).
- Automated land-cover classification and cartographic harmonization (Python language, Keras, TensorFlow, GDAL, convolutional neural networks).
- Processing, propagation and reanalysis of historic meteorological data (Python language, GDAL, 2D universal kriging with external drift, wavelet transform, mutual entropy, basic regression and statistics).
- Satellite-based change detection and its relationship with the aforementioned metrics (In progress).

Airborne Research Australia 2016 - 2023.**Remote sensing and data scientist (telecommuting contractor).**

Accessed ARA computers and servers remotely from Spain in order to complete a range of projects, many of which involved production of datasets and reports forming formal deliverables for ARA research contracts with Australian government and industry. Notably, this built a solid familiarity with ARA's in-house developed software systems and processes. Projects include:

- Processed LiDAR point cloud data of Nullarbor cliffs along with large areas (Julia language, CloudCompare).
- Worked on processing airborne sensor images for specular reflection removal, bidirectional reflectance function correction, and tonal harmonization over water surfaces in the "South Australia Water Seagrass Mapping Data Collection" project and recent False Bay data collection (Whyalla) (Julia language, C++, GDAL, Orfeo Toolbox).
- Processed data from multiple sources over a range of different habitats and settings, seafloor, mangrove and coastal ecosystems and land carrying out automated corrections, classifications and fusion from LiDAR, bathymetric LiDAR, microbolometer arrays, hyperspectral imagers, etc
- Develop data processing pipelines for new airborne instrumentation, writing new software where appropriate (Julia/C++/Python).
- Performed data processing tasks for the Urban Heat Islands 2022 project, primarily focusing on cross-validation of airborne sensor data with satellite platform data and generating final products (Julia language, GDAL, co-registration by means of finely tuned 2D Fast Fourier Transform coupled with phase shifting detection).
- Developed processing pipelines for faulty satnav data post hoc coregistration.
- Designed and manufactured 3D-printed models (Rhinoceros 3D, Cura).

University of A Coruna (Civil Engineering Department — Cartographic Engineering Lab) 2017 - 2020. Remote sensing and data scientist.

Involved in a wide range of data analysis and field work. Notable projects include:

- Participated in the SIXHIARA project, focusing on the development and implementation of a decision support system for water management.
 - Developed a demonstrative model for the southern Mozambique region to classify crop surfaces for irrigation flow estimation (Julia language, GDAL, random forest classification algorithm fed with textural, biophysical and secondary metabolites-related radiometric indices).
 - Organized field campaigns and developed methodological aspects, including planning fieldwork using satellite image data (Julia language, Principal Component Analysis).
- Involved in the PIMA Adapta Costas project, working on coastal modeling and risk assessment in the context of climate change adaptation.
 - Acted as a consultant and expert in remote sensing for obtaining bathymetry from satellite images (Julia language, Lyzenga method, convolutional neural networks).
- Contributed to the development of green infrastructure plans for Galicia.
 - Focused on ecological corridor design, canopy classification, and fragmentation metrics. (Python, GDAL, QGIS).
 - Worked on the normalization and integration of various databases (Mostly GNU Octave language).
- Worked on the development of preprocessing pipelines of mobile mapping LiDAR data for autonomous road condition monitoring projects. (Julia language, B-spline interpolation, coordinate transforms).

Independent Research and Experimental Work (Ongoing, mostly personal)

- Neural network data fusion of Sentinel-2 and ECOSTRESS data delivering high availability 10m resolution Land Surface Temperature.
- Indirect measurement of Rn concentrations in buildings using partial readings from self-developed low-cost Geiger counters arrays.
- Detection and characterization of oceanic internal waves.
- Super-resolution and spectral analysis of spatial data and time series (mainly climatic variables); detection and attribution of climatic events.
- Monitoring coastal dynamics using satellite platforms.
- Evaluating minimum metabolic cost paths for bipeds on digital terrain models.
- Natural language processing and co-authorship network analysis applied to academic fraud detection and strategic foresight.
- Instrumentation of biological reactors.
- Experience in ship stability and interest in parametric and autoparametric resonance phenomena across multiple fields.
- Limited experience in processing synthetic aperture radar data.
- Experience in ground-based total station and LiDAR, artificial vision and photogrammetry-related methods.
- Final Degree Project, pending presentation: *Climatic Variations in the Promenade of A Coruña: Implications for Design and User Comfort*. Development of micrometeorological and microclimatic models based on explicit simulations running on an abstraction layer that takes the form of a cellular automaton, including a lattice-Boltzmann model in CFD, energy transfer, atmospheric optics, and various parameterization schemes. Validation through the construction of a small portable meteorological station in a 3d printed enclosure that includes a global positioning module, barometric, radiometric, and temperature probes, and a hot-wire anemometer (Mostly written in Matlab/Octave back in the day, requiring an extensive rewriting).

MAIN INTERESTS

- Complex systems theory.
- Numerical modelling of ocean and atmospheric dynamics and processes and ecological systems.
- Planetary plasma physics and magnetohydrodynamic models.
- Airborne platforms, instrumentation and avionics.
- Additive manufacturing.
- Numerical modelling of momentum and mass-shifting control methods.
- Image and signal processing.
- Neural networks and classic machine learning.
- **Virtually anything about science**, history of space exploration and aviation.
- Rowing, track and field athletics and alpinism.