

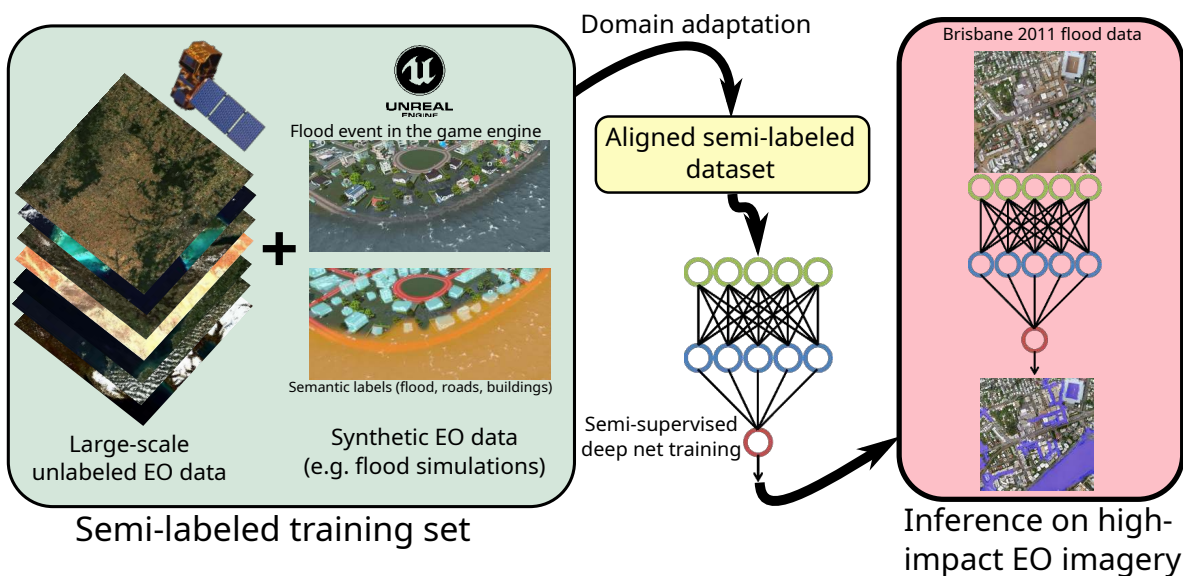
# Research engineer position in procedural generation of urban environments

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Application deadline: September 30, 2022

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| <b>Location</b>      | Cnam (Paris, France)                        |
| <b>Salary</b>        | ≈2100€ to 2500€ net/month                   |
| <b>Contract</b>      | 1 year fixed-term contract (renewable)      |
| <b>Remote work</b>   | Partial                                     |
| <b>Starting date</b> | February 1 <sup>st</sup> 2023 at the latest |

**Keywords:** 3D modeling, game engines, geodata, procedural generation.



## 1 The research project

The MAGE project (*Mapping Aerial images using Game Engine data*) investigates the use of synthetic data to train very large-scale deep models for land cover and land use mapping from aerial and satellite imagery. Huge amounts of Earth Observation (EO) data are available thanks to european satellites Sentinel-2 and to French observations programs SPOT and BDORTHO. However, these big data are unlabeled and therefore contain no useful semantic information that could be used to train downstream machine learning models.

However, the Copernicus disaster management program, that delivers rapid mapping of sinistered areas, could strongly benefit from the faster response time that AI is able to bring. Interpretation of remote sensing data after a disaster (flood, earthquake...) is currently done by hand by experts. Since these events are exceptional, there are few labeled datasets that can be used to train supervised models. Meanwhile, the autonomous driving community has dealt with this problem by using video games to simulate events that are rarely observed in real life. Simulation of EO data is now possible thanks to softwares such as CityEngine that can procedurally generate entire cities.

This project aims to bring together both those tools and using simulations to train deep networks for rapid post-disaster mapping. We will leverage modern video game engines to simulate aerial views of cities before and after a disaster (flood, earthquake, fire). These images will constitute the labeled dataset that will complement the large amount of existing unlabeled data. We will improve the realism of the simulation using adaptation domain techniques based on generative models, and we will develop semi-supervised learning algorithms based on self-supervision for semantic segmentation. This will allow us to train deep models able to generalize for large-scale mapping of damaged structures, to identify the most affected areas and improve how emergency services navigate the city after a disaster.

## 2 Scientific missions

One of the objectives of the MACE project is the creation of tools to synthesize realistic aerial views of cities, before and after a natural disaster. To achieve this goal, we will produce digital twins of existing cities based on a combination of open data and procedural generation, for example using the CityEngine software (ArcGIS). This 3D model will then be integrated into a versatile game engine such as Unreal Engine to produce aerial views of the city in various architectural styles, weathers and illumination configurations, etc. The person hired on this project will work on the following topics:

1. Developing a tool to automatically produce a 3D model of an average French city based on a mix of open geodata (OpenStreetMap, official mapping agencies) and procedural generation, based on CityEngine or an open source equivalent,
2. Generating synthetic acquisitions from an airborne point of view in diverse meteorological conditions using Unreal Engine, for example by leveraging the Vitruvio plugin from CityEngine,
3. Simulating flooding events and its impact on the city using the physics of Unreal Engine.

## 3 Candidate profile

The ideal applicant holds either a master of science or engineering degree with a major in either computer graphics, video games or remote sensing/photogrammetry. They have a demonstrable experience with the Python and C++ programming languages. An inclination for team work and good communications skills (written and oral) is required. While being able to speak French is not a requirement, it can help with the day to day life. A first experience with Unreal Engine or an equivalent game engine is an advantage for this position, however it is not mandatory to apply. Some interest for Earth Observation, disaster management and for scientific research is a plus.

## 4 Where you will work

The *Center for research and studies in computer science and communications* (Cédric) is the computer science laboratory of the Conservatoire national des arts et métiers (Cnam), a prestigious French higher education institute. It is comprised of 80 faculty members and researchers, for a total of more than 180 people including postdoctoral fellows and PhD students. Its eight teams cover most areas in computer science, from data science to interactive media, discrete optimization, telecommunications and the Internet of Things. The new hire will join the *Complex Data, Machine Learning and Representations* team<sup>1</sup>. Their research will be performed inside the MACE project under its principal investigator Dr. Nicolas Audebert.

**Organization:** the work contract is a fixed-term contract of 12 months (“CDD”). It is a full-time position of 35 hours/week. It can optionally be renewed once. The expected salary is from 2100€ to 2500€ net/month depending on the qualifications of the applicant. The starting date is expected at the earliest on the November 1<sup>st</sup> 2022 and at the latest on February 1<sup>st</sup> 2023, depending on the applicant.

**Location:** the laboratory is located in the heart of Paris, in the third “arrondissement”, at 2 rue Conté (subway “Arts & Métiers”, lines 3 and 11).

**Hiring:** the application process is done in two steps: first a short half-hour interview by phone or videocall, then a longer technical interview of about one hour.

**To apply:** send a resume to [nicolas.audebert@cnam.fr](mailto:nicolas.audebert@cnam.fr)

**Benefits:**

- 44 days of paid holidays
- on-site subsidized restaurant
- partial remote work is possible
- employees’ association (music classes, on-site gym...)

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<sup>1</sup><https://cedric.cnam.fr/lab/equipes/vertigo/>