Post Doc title:

Assessing the sensibility of intervisibility on the quality of 3D geometry

Keywords: Intervisibility, 3D reconstruction, computational geometry, digital twin **Supervision:**

- Supervisor: Bruno Vallet (LASTIG, IGN)
- Co-supervisor: Teng Wu (LASTIG, IGN)

Hosting Laboratory: LASTIG Lab, IGN/ENSG, Champs sur Marne, France

Duration and start date: 1.5 years from the end of 2024

Context

Intervisibility is one of the application areas of 3D scene modeling, which consists of answering the question "Which points, which objects can be seen from which point?". It is a useful technique in application fields such as security and defense, real estate, simulation of physical phenomena, antenna placement, etc.

Modeling 3D scenes from various data sources is a subject widely studied by the scientific community. At IGN, the main data sources used are optical imagery and Lidar, acquired from terrestrial, aerial and space platforms. Depending on the data used and the reconstruction techniques, the quality of the modeling varies greatly. In the best case, the reconstruction method provides a more or less reliable indication of the geometric quality. In all cases, we can evaluate the quality externally by comparing the reconstruction to a ground truth known to be of much better quality. However, these evaluations are based on generic measurements not always adapted to the concrete use of 3D models.



Intervisibility computation between mobile cartography images and facades of a 3D model

Goals

The objective of this post-doc thesis is therefore to develop a methodology to evaluate the sensitivity of intervisibility to the quality of the 3D geometric representation used to calculate it. The geometric representations that we can use will be:

- Digital surface models, where the geometry is represented by a given height per pixel of a regular grid covering the area of interest
- 3D surface meshes, where the geometry is represented by a set of contiguous triangles, and ideally waterproof.
- Structured models like LoD1 or 2 of the CityGML standard where each object in the scene has its own representation.

Work description

The work to be carried out as part of the postdoc will be:

- Study of practical needs linked to intervisibility
- State of the art on intervisibility based on geospatial information
- Implementation of an intervisibility calculation tool to calculate all the points/triangles from which a given point can be seen
- Extension to lines, surfaces or volumes of interest.
- Development of an interaction tool allowing a user to define the intervisibility problem they wish to solve
- Development of a tool for visualizing and exporting the results of the intervisibility calculation
- Operational validation of the tool
- Evaluation of sensitivity to the qualities of the geometric representation and in particular definition of an adapted evaluation protocol.

Candidate profile

- PhD in computer vision, photogrammetry, remote sensing, physics.
- Knowledge of 3D geometry processing, computer graphics and computational geometry would be appreciated.
- Mastery of C++ and Python
- Fluent English

Application

Send an email to <u>bruno.vallet@ign.fr</u> and <u>teng.wu@ign.fr</u> with:

- Your resume, including a list of publications and an abstract of your PhD
- A cover letter
- Your PhD defense report if you have already defended
- One (or more) letter(s) of recommendation from your PhD supervisor(s)