## « Geolocalization of photographs using a database of georeferenced images»

### Keywords

Computer vision, photogrammetry, geolocalization, pose estimation, CBIR.

### Context

The proposed internship is part of a French research project (ANR ALEGORIA) that brings together several research laboratories, including LaSTIG from IGN (the French Mapping Agency), LIRIS from Ecole Centrale de Lyon, LAVUE from University Paris-Nanterre, LIRSA from Le Cnam, the French National Archives and the museum Nicéphore Niépce. The aim of the project is to valorize the national iconographic collections which describe the French territory at different times, starting from the between-wars period until today.

The photographic collections consist of aerial imagery, vertical and oblique, as well as terrestrial acquisitions (e.g. postcards, old photographs). Despite their content richness, their documentation and spatial geolocalization remain poor or even unavailable. Hence, the ALEGORIA project aims at developing methods that will facilitate their exploitation by putting in practice automated processing methods dedicated to their indexing, interlinking and visualization.

Within this context, the internship will deal with the automated georeferencing of the images (i.e. of the cameras that produced them), given a large set of georeferenced image contents. The challenging aspect of the task is in the large variety of the input imagery – not only they were captured at different scales, with different sensors – but are also subject to territory evolution or changes over time.

### Subject

The methodology considered will as be as follows: the input image, initially with no *a priori* on its geospatial position and orientation, will be retrieved by visual similarity within a database of georeferenced images so that eventually, every un-georeferenced image will be linked with a set of "similar" images. These retrieved images, with their geolocalization, will then serve to estimate the position and orientation of that image.

This internship will in principle focus on how to exploit the set of similar images – already pre-computed by a CBIR engine – in order to estimate the best possible position, rotation (6DoF aka *pose*) and calibration (focal, principal point, etc.) of the un-georeferenced image. The work is planned to be divided into 3 parts:

1. The study and implementation of the state-of-the-art direct pose estimation algorithms (spatial resection, essential matrix, trifocal tensor, homography)

2. Development of a generic methodology that will optimally[1] combine:

   – the different algorithms

   – the different pose outputs (an output per an image couple/triplet)

3. Evaluation of the results against a ground truth data

All developments will be carried out within the free, open-source environment MicMac (https://github.com/micmacIGN/micmac), that provides relevant photogrammetric and computer vision tools relevant to the task.

## Organization

**Duration:** 6 months, starting from march/april.

**Workplace:** IGN, LaSTIG lab, Paris area, Saint-Mandé (73 avenue de Paris, metro Saint-Mandé, Line 1), France.

IGN (French Mapping Agency) is a Public Administrative Institution part of the French Ministry for Ecology and Sustainable Development. IGN is the national reference operator for the mapping of the territory. The LaSTIG is one of the research laboratories of IGN, it gathers more than 100 researches centered on geographical information, 35 of them focusing in image analysis, computer vision, AI, photogrammetry and remote sensing.

 **Salary:** yes.

## Skills

Bac+5 in computer science, applied math or geomatics (master or engineering school); good knowledge in image processing or photogrammetry/computer vision, as well as good skills in C/C++ programming or Python.

## Submitting your candidature

By sending by e-mail to the contacts, **in a single PDF file**:

- o CV
- o motivation letter
- o 2 recommendation letters
- o Transcript of grades from the last two years of study
- o A list of courses followed and passed in the last two years

## Contact

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1        Optimality defined in terms of the outcome accuracy.

o Valérie Gouet-Brunet, researcher IGN/LaSTIG/MATIS – valerie.gouet@ign.fr
http://recherche.ign.fr/labos/matis/~valerie.gouet-brunet

## Bibliography

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