« 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 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 (*e.g.* images acquired from a mobile mapping system) 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 computed from an external task – in order to estimate the best possible position and rotation (6DoF aka *pose*) 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 (in terms of outcome accuracy) 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 in March/April 2018.

Workplace: IGN (the French Mapping Agency – Public institution), LaSTIG lab, MATIS group, Paris area, Saint-Mandé (73 avenue de Paris, metro Saint-Mandé Line 1), France. MATIS is one of four IGN's research groups of the LaSTIG research laboratory of IGN, and hosts over forty researchers working in the field of photogrammetry, computer vision, pattern recognition 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

Until 31/01/2018, 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

Contacts

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- o Valérie Gouet-Brunet, researcher IGN/LaSTIG/MATIS, head of MATIS, coordinator of ALEGORIA – valerie.gouet@ign.fr

Bibliography

6-DOF Image Localization From Massive Geo-Tagged Reference Images, Yafei Song, Xiaowu Chen, Xiaogang Wang, Yu Zhang, and Jia Li, IEEE Transactions on Multimedia, Vol. 18, No. 8, August 2016.

N. Piasco, D. Sidibé, C. Demonceaux, V. Gouet-Brunet. A Survey on Visual-Based Localization: On the Benefit of Heterogeneous Data. Pattern Recognition, Volume 74, pp.90-109, February 2018.