Proposition de post-doc

IGN – LaSTIG Lab – 2019

« Supervised learning for interest points matching
in archive/analogue and modern/digital images »

Keywords

Image processing, Photogrammetry, Machine learning, Matching, homologue / interest points, application of image processing to Earth Sciences.

Context

This post-doctoral contract is proposed within an ANR project DISCRUPT (ANR-18-CE31-0012-0) which aims at improving the understanding of seismic events. One of the project's goals concerns quantification of deformations of the Earth crust using stereoscopic images pre- and post-event.

On the one hand, over the course of the last few years we have seen an emergence of software solutions capable of computing displacement maps from a set of diachronic images in a 100% automated manner (e.g., the commercial Cosi-Cor, the open-source MicMac developped at LaSTIG). On the other hand, the performance of these solutions deteriorates when applied to (1) archive/analogue images, (2) images with large time span between their respective acquisitions, or (3) images of very different resolutions.

All the same, such images are of particular interest for researchers in tectonics as they provide new pre-event observations and subsequently can contribute to enhancing the state-of-the-art in earthquake modelling.

Methodology

The principal difficulty in processing analogue images is in the extraction and sparse matching of interest points. Often, no *a priori* about the camera geometry is available and a dense distribution of interest points is required to model it *a posteriori*. Due to low contrast and image noise, however, *state-of-the-art* detectors, e.g. SIFT, fail to find enough corresponding points. Furthermore, sparse point matching between images taken with large time span is equally challenging because of the potential changes in the scene, as well as acquisitions done with different sensors (i.e., archive analogue and modern digital images).

Since recently, the learning methods, in particular deep learning, have shown its feasibility in sparse matching problems when enough ground truth data is available to learn a selected neural network. Within the hosting lab a new handcrafted interest point detector and descriptor has been developed. First experiments have proved that by the descriptors carried sufficient information do orientate and model geometries of images in classical configurations. The objective now is to employ supervised learning in order to optimise its performance. To generate the ground truth database of point correspondences (of practically any size, and invariant to scaling, rotation and to a certain extent to the view-point change) the classical photogrammetric processing chain will be employed.

Subject, calendar, key-issues

The objective of the post-doc is to define methods for automated matching between image patches. More precisely, the following tasks are planned:

- the candidate will familiarize himself/herself with the existing processing chain as well as work on establishing the learning database using photogrammetric acquisitions available in the lab;

- experiments and the choice of the classification method (random forest, svm, neural networks);

- the work will be carried out using the descriptors developed at LaSTIG, however, it is possible to improve / interfere with the existing detector and descriptor;

- the developments will be embedded in and therefore disseminated via MicMac the free open-source software for photgorammetry. Particular care will be given to the choice of the employed external libraries so as to ease the dissemination of the code.

Organisation

Salary et duration: salary is based on the "IGN grid" and depends on the experience of the candidate. Exact duration will depend on the base salary and is estimated for between 20 - 24 months.

Localisation :

- IGN (Insititut National de l'Information Géographique et Forestière), Saint-Mandé (ligne métro 1);

- LaSTIG lab, ACTE research group;

Superivision and candidature :

The candidates should forward the following documents to the supervising team:

- o CV
- o List of publications
- o the rapports of the PhD thesis
- o transcript of record from your MSc

The supervising team:

- marc.pierrot-deseilligny@ign.fr: https://micmac.ensg.eu/index.php/Marc_Pierrot-Deseilligny

- ewelina.rupnik@ign.fr : http://recherche.ign.fr/labos/matis/~rupnik

Required skills

- PhD in computer vision, mathematics, informatics

- experience in supervised learning

- good skills in C++ or python;

- interest for Earth Sciences

Bibliography

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