# Opening of a Postdoc position in Machine Learning and Multi-modal Image Indexing

@COGIT and MATIS Teams of LaSTIG lab, IGN France

@Imagine Team of LIRIS lab, École Centrale de Lyon

A post-doctoral position of duration extensible up to 2 years will be opened on machine learning and multimodal image indexing within the COGIT and MATIS teams, LaSTIG lab at IGN and Imagine team, LIRIS lab at École Centrale de Lyon.

## Background, motivations and objectives

The french research project ALEGORIA aims to index, geolocalize and showcase iconographic institutional collections describing the French territory at different times, in a 3D, space-time, immersive and interactive visualization environment. These iconographic resources represent the territory from different points of view (aerial or terrestrial pictures), different orientations, under different lighting conditions, at different dates from the interwar period to the present day, etc. They are thus difficult to index and geolocalize with state-of-the-art approaches. However, they are described by metadata that can be linked to reference datasets: these important sources of knowledge could be leveraged to address these issues.

Many works in the field of multimedia information research have shown the interest of image search by multimodal matching combining visual content and textual metadata. The textual information associated with the images can be used both to filter the most relevant images and weight the importance of some visual content descriptors according to the type of expected visual content. This post-doctorate work follows the intuition that it would be possible to customize the choice and the weighting of the image descriptors to be implemented for image content matching and annotation by producing a visual context specific to each image based on external sources of knowledge.

The images collections to be indexed describe the French territory. They are thus very likely to represent geographic features, like buildings, roads, watercourses, forests, etc. A priori knowledge of their presence on the images, of their feature type, their spatial distribution or their resolution could be used to guide the strategy of images matching. The objective of this post-doc is thus to propose new approaches for defining and taking into account a visual context in a multimodal cross-domain image matching strategy.

## Missions

The successful candidate will work on the ALEGORIA's work-package on multimodal information harnessing for image indexing.

The main mission of the post-doctorate fellow would therefore be to propose new approaches to learn representations of the geographic features represented on the images by leveraging their contexts in different modalities (images, texts and vector geographic databases) and using them in an

image indexing approach. As a first step, spatial named entities and their relationships could be extracted from each image metadata, and linked to some geographic reference dataset to define a candidate geographic context for each image. Then, deep learning based object extraction approaches would be used to identify the most salient and perennial geographic feature types represented in the images. At this stage, the focus should be placed on remarkable landmarks, salient objects, visual structures or prominent spatial configurations that are particularly likely to last through time. This information would be used to better limit the extent of the image candidate geographic context. Eventually, semantic and spatial knowledge provided by large scale geographic reference datasets could be leveraged to produce a visual context that would be used to customize the choice and the weighting of the image descriptors to be implemented to index and annotate each image.

Evaluating the approaches proposed for images indexing and georeferencing requires benchmark datasets. These datasets must be designed carefully in order to have specific properties for the research questions addressed by each approach and to provide reliable reference links or values. The second mission of the post-doctorate fellow would then be to design and create benchmark datasets for each type of research question addressed by the project. This work will be promoted by making these benchmark datasets available to the scientific community through challenges organization.

## Profile

We are seeking a highly motivated postdoctoral fellow in the field of deep learning, with knowledge in content based image indexing and/or natural language processing. Curiosity, open-mind, creativity, persistence, and collaborative-work ability are the key personal skills we target. A Ph.D. in applied mathematics or computer science is required, with demonstrated experience and a high quality publication record on one or several of the following topics:

- Deep learning

- Multi-modal image indexing

- Natural language processing

The successful candidate should have advanced programming skills (Python, C/C++). While fluency in French is not required, fluency in English is mandatory. Both beginning and more senior postdoctoral candidates are encouraged to apply.

## Environment

The successful candidate will work in direct collaboration with researchers having an established expertise in image/video indexing, object recognition and knowledge engineering and management.

IGN (Institut National de l'Information Géographique et Forestière) is the French National Mapping Agency. It is a public state administrative institute responsible for producing and maintaining geographical information for France and its overseas departments and territories. The LaSTIG is a large geographic information sciences laboratory gathering IGN and Paris Est university researchers.

It is made up of four research teams, including COGIT and MATIS, which participate in ALEGORIA. The MATIS team ("Methods of Analysis for Image Processing and Stereorestitution") has developed a wide range of complementary skills in computer vision, photogrammetry and remote sensing applied to terrestrial, airborne and satellite imagery. The COGIT team ("Cartography and Geomatics") focusses on researches related to geographic data captured as vector and large-scale reference datasets. For several years now, these two teams have shared a number of common methodologies, particularly with regard to data matching (image, vector) and data restitution, making their joint participation in ALEGORIA highly relevant and complementary.

The École Centrale de Lyon is part of the top ten engineering schools in France (Grande Ecoles), part of the elite of "Grandes Écoles" offering access to excellent quality graduate and under-graduate students. The LIRIS lab is a large CNRS supported laboratory federating research groups in computer science from 4 universities in Lyon, namely Université Claude Bernard, Université Lumières, INSA de Lyon and École Centrale de Lyon. The Imagine team at LIRIS has a longstanding record in computer vision and machine learning, in particular in face biometrics and image/video analysis, segmentation and recognition. They were awarded the first performance at the SHREC 2011 contest for 3D face recognition and retrieval. In 2012, they took part to the ImageCLEF 2012 photo annotation challenge and won the golden medal in terms of three different performance metrics over 80 submissions from 18 groups coming from 11 different countries. Within this context, the Imagine team is willing to go beyond and develop new frontiers within these fields.

The Postdoc position offers full health, unemployment and retirement benefits and competitive salary. The candidate will be given the opportunity to develop his/her research skills by contributing to cutting-edge multimodal images indexing techniques applied to geographic information sciences, with possible teaching opportunities as well as student mentoring.

## Application

Applications should include a curriculum vitae, a cover letter focusing on this post-doc position, 2 reference letters with the contact information of the references (**all grouped together in the same PDF file**). Applications and letters should be sent via electronic mail to:

- Dr. Nathalie Abadie (nathalie-f.abadie@ign.fr)

- Dr. Alexandre Saïdi (alexandre.saidi@ec-lyon.fr)

- Pr. Liming Chen (liming.chen@ec-lyon.fr)

- Dr. Valérie Gouet (valerie.gouet@ign.fr)

- **Application deadline:** September 1st, 2018
- **Start date:** before end 2018
- **Post-doctorate duration:** 2 years
- **Location:** Depending on the candidate's profile, the position may be located either at the LaSTIG (in Saint-Mandé, Paris neighborhood, Metro line 1, direction Château de Vincennes) or at the Imagine Team (Lyon neighborhood).