

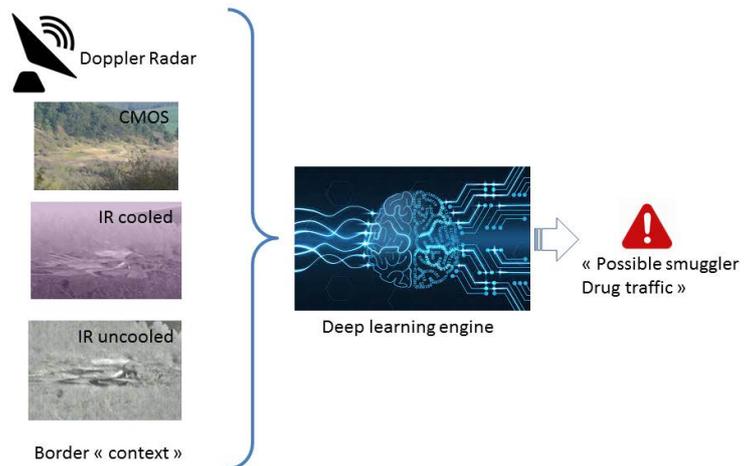
# 3 years PHD POSITION (CIFRE): Deep Learning on Multimodal Data for the Supervision of Sensitive Sites

## Context:

ATERMES is an international mid-sized company, based in Montigny-le-Bretonneux (near Paris) with a strong expertise in high technology and system integration from the upstream design to the long-life maintenance cycle. It has recently developed a new product, called BARIER™ (“Beacon Autonomous Reconnaissance Identification and Evaluation Response”) which provides operational and tactical solutions for mastering borders and areas. Once in place, the system allows for a continuous night and day surveillance mission with a small crew in the most unexpected rugged terrain. BARIER™ is expected to find ready application for temporary strategic site protection or ill-defined border regions in mountainous or remote terrain where fixed surveillance modes are impracticable or overly expensive to deploy.

## Problem:

The project aims at providing a deep learning architecture and algorithms able to detect anomalies (mainly persons) from multimodal data. The data are considered “multimodal” because information about the same phenomenon can be acquired from different types of detectors, at different conditions, in multiple experiments, etc. Among possible sources of data available, ATERMES provides Doppler Radar, active-pixel sensor data (CMOS), different kind of infra-red data, the border context etc.



The PhD candidate will need to survey the recent literature about multi-source and multimodal learning with deep neural networks (e.g. [1],[2],[3],[4],[5],[6]) as well as the literature on domain adaptation with neural networks (e.g. [3],[7],[8]) since the data will be acquired from different outdoor contexts. He is expected to propose new solutions that could be integrated in the BARIER™ system developed by ATERMES.

## Working environment

The PhD candidate will work part time at IRISA (Rennes and/or Vannes) and part time in the ATERMES company in Paris (the exact percentage of time spent in all the facilities will be discussed during the interviews). The two academic supervisors for this PhD thesis are:

- **Elisa Fromont**, Professor in Computer Science at Rennes 1 University since Sept 2017 (before she was associate professor at Saint-Etienne University). Her research activities take part in the INRIA LACODAM (“Large Scale Collaborative Data Mining”, <http://team.inria.fr/lacodam>) team from IRISA laboratory. Her research interest lies in developing new machine learning algorithms for specific applications. In particular, she works on new deep learning methods for semantic segmentation and anomaly detection (see <http://people.irisa.fr/Elisa.Fromont/>).
- **Sebastien Lefevre**, Professor in Computer Science at the University of Bretagne Sud since September 2010. His research activities take part in the OBELIX (“Environment Observation through Complex Imagery”, <http://www.irisa.fr/obelix>) group from IRISA laboratory. His

research topics are image analysis/processing, pattern recognition and indexing, machine learning (deep learning) and data mining with applications in remote sensing (see <http://people.irisa.fr/Sebastien.Lefevre/>).

The hosting research groups have established expertise in relevant domains including deep learning, multiview learning, domain adaptation and computer vision (see e.g. [3], [4], [5], [6], [7]). The **expected salary**, paid by ATERMES, is **33K€ to 35K€** (gross) per year depending on the skills of the candidate.

## **Required skills**

We look for highly motivated candidate with the following skills/diploma:

- A master's degree in computer science;
- Some proven skills in machine learning in general and deep learning in particular;
- Some background in computer vision;
- Some proven skills in programming, preferably in Python and Tensorflow;
- A very good level (written and oral) in English and a good ability to communicate with others;
- A good autonomy

## **Application instructions**

Send your application with 1) a CV, 2) your last grade certificate (if you are currently finishing your Master's degree, we need an official list of the grades you obtained so far in this degree with your rank among your peers), 3) some recommendation letters and 4) a specific motivation letter to [elisa.fromont@irisa.fr](mailto:elisa.fromont@irisa.fr) AND [sebastien.lefevre@irisa.fr](mailto:sebastien.lefevre@irisa.fr). Generic motivation letters will not be considered. **The application is opened until the 10<sup>th</sup> of March**. Some interviews will be offered between the 15<sup>th</sup> and the 31<sup>st</sup> of March. The final decision will be given mid-April. The PhD thesis is expected to start in **September (or October) 2018**.

## **Bibliography**

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- [3] Damien Fourure, Rémi Emonet, Elisa Fromont, Damien Muselet, Natalia Neverova, Alain Trémeau, Christian Wolf: Multi-task, Multi-domain Learning: Application to Semantic Segmentation and Pose Regression, Neurocomputing, 251:68-80, 2017.
- [4] Sébastien Lefèvre, Devis Tuia, Jan Dirk Wegner, Timothee Produit, Ahmed Samy Nassaar: Toward Seamless Multiview Scene Analysis From Satellite to Street Level, Proceedings of the IEEE, 105(10):1884-1899, 2017.
- [5] Nicolas Audebert, Bertrand Le Saux, Sébastien Lefèvre: Beyond RGB: Very high resolution urban remote sensing with multimodal deep networks. ISPRS Journal of Photogrammetry and Remote Sensing, to appear, 2018.
- [6] Nicolas Audebert, Bertrand Le Saux, Sébastien Lefèvre: Segment-before-Detect: Vehicle Detection and Classification through Semantic Segmentation of Aerial Images, Remote Sensing, 9(4):368, 2017.
- [7] Kevin Bascol, Rémi Emonet, Elisa Fromont and Raluca Debusschere: Improving Chairlift Security with Deep Learning, IDA 2017.
- [8] Yaroslav Ganin, Evgeniya Ustinova, Hana Ajakan, Pascal Germain, Hugo Larochelle, François Laviolette, Mario Marchand, Victor S. Lempitsky: Domain-Adversarial Training of Neural Networks. Journal of Machine Learning Research 17:1-35, 2016.