Deep Learning for large-scale sub-metric 3D EO data
Postdoc (12-24 months) within CNES (Toulouse, France) & OBELIX group (Vannes, France)

CNES is preparing with its industrial partners a future Earth Observation mission named CO3D (Constellation Optique 3D, or 3D optical constellation) with the goal of providing 3D data with sub-metric resolution and global (worldwide) coverage. An image processing chain is currently being developed in CNES relying on the S2P software (https://github.com/MISS3D/s2p) to provide Digital Surface Models (DSM) and associated 3D point clouds from CO3D n-stereo images. Many partners have already expressed their interest for potential applications that could be derived from these 3D data (town and country planning, forest monitoring, glacier monitoring, etc.).

In this context, CNES is offering a postdoc position to conduct an algorithmic study aiming at designing a downstream service that will rely on the 3D data provided by the operational processing chain and generate various products with higher semantics and level of detail (LOD) from a scale varying from LOD 1 to LOD 3 (http://www.gdmc.nl/publications/reports/GLst62.pdf). The main goal of the project will be to detect buildings from RGBZ data or 3D points clouds, using recent deep learning architectures, and giving a specific attention to:

- Accurate spatial delineation of the detected buildings;
- Dealing with occlusions (countries not seen from images provided as inputs to S2P);
- Dealing with temporary objects perturbing the altimetric restitution;
- Dealing with altimetric restitution errors specific to the EO acquisition system (errors due to sensors and atmospheric perturbations);
- Robustness and performance analysis of the proposed algorithms;
- Scalability study of the proposed algorithms.

The postdoc hired on this project will then be asked to design and evaluate the processing chain, while bringing novel solutions based on recent developments in Deep Learning. The processing chain will be implemented and experimented on the CNES cluster.

The postdoc will work within the DNO/OT/IS service (Earth Observation/Imaging & Sensing) from CNES in Toulouse, France. He/she will interact with other services within CNES, namely the services “Image Quality” (IQ) for understanding the methods uses in the upstream chain, and the “Earth Observation Lab” (OT) for understanding the specific needs from potential end-users of this downstream chain.

From a scientific perspective, the supervision will be conducted jointly by CNES and by the OBELIX group (http://www.irisa.fr/obelix) within the IRISA research institute / University of South Brittany (Vannes, France). The OBELIX group has a strong expertise in deep learning applied to remote sensing.

**Requirements**

- PhD in computer science / signal processing / applied maths
- **Proven expertise in machine learning / deep learning AND/OR computer vision AND/OR remote sensing** (candidates with all skills will be preferred): convincing arguments should be provided in the cover letter
- Programming skills (e.g. Python or C++)
- Very good oral/written French or English communication abilities

**Scientific Supervision:** Sébastien Lefèvre – sebastien.lefevre@irisa.fr – http://people.irisa.fr/Sebastien.Lefevre

**References** see https://scholar.google.fr/citations?user=C_8NI7IAAAAJ

**CNES Supervision:** Pierre Lassalle – pierre.lassalle@cnes.fr and Simon Baillarin – simon.baillarin@cnes.fr

To apply, send ASAP cover letter, CV & publications, academic transcripts & ranks, and references by email.