Subject:

Managing and controlling urban areas is a topic of increasing importance. Synthetic Aperture Radar imagery allows day and night acquisitions on small areas (ground based radar) or on extended areas with aerial or satellite imagery. The wealth of information obtained by combining different acquisition modalities (different polarizations, different dates, different trajectories of the SAR sensor) leads to fine urban area analysis: separation of built parts and vegetation, discrimination of the position, height and properties of the different scatterers, change identification. These goals can only be reached with a perfect control of the processing chain starting from the radar data acquisition and going through synthetic aperture synthesis and signal and image processing for urban area characterization and change detection application.

The objective of the project is to exploit very high resolution (VHR) polarimetric aerial images to define new change detection methods relying on 3D tomographic reconstruction. The project is composed of two main steps: a first step for the processing of the VHR data to synthesize data in tomographic configuration, and a second step exploiting the tomographic results to develop new change detection methods.

Concerning the first part on the VHR data processing, the use of very high resolution presents the advantage of limiting distance decorrelation effects linked to a spectral shift. Nevertheless, 2D SAR tomography approaches rely on the hypothesis of a synchronization of the backscattered signals independently of their height. In the case of VHR data, this stationarity hypothesis is generally not verified and other approaches, specific to large band signals have to be proposed. The direct 3D focalisation is a solution needing numerous computations and does not allow for using HR parametric tomographic approaches. In this project new efficient HR techniques will be proposed which do not rely on the stationarity hypothesis. In the same way, an automatic method of trajectory correction will be developed to correct the focalized data with a very high accuracy.

The second part of the project will be dedicated to the exploitation of tomographic data in the context of activity tracking. Radars, as active systems, are well adapted to this kind of analysis: two acquisitions taken in similar conditions of identical scenes lead to the same SAR image whereas optic sensors are strongly influenced by sunlight, a non-controlled factor. It is thus adapted to use SAR images for such tasks. One of the method for activity tracking with SAR data is based on similarity measure between images, specially the complex coherence when dealing with images in interferometric configuration (« coherent change detection »). These methods give good results as long as there is only a slight change of view between the two images. But in urban areas, there are many overlay areas with mixture of signals close to a volumetric backscattering. These areas are very sensitive to the change of the viewing direction and can induce high false alarm rates in the data analysis due to the loss of coherency even for a small viewing angle variation. To solve this problem we propose to exploit the tomographic information for activity tracking. The objective is to be able to synthesize a new image for a given viewing angle starting from a set of tomographic
acquisitions. By synthesizing images with corresponding viewing angles, change detection would be more efficient and independent of the undesirable geometric effects.

**Requirements:** PhD in signal/image processing or research engineer with SAR experience. Mandatory skills in signal processing, good programming level (C/C++), radar experience will be appreciated. *European nationality required.*

**Salary:** monthly net salary starting at 2300 euros will be adjusted according to experience and qualification.

**Location:** Bi-location Paris and Palaiseau but half time in ONERA Palaiseau (*ONERA Chemin de la Hunière BP 80100 FR-91123 Palaiseau*)

**Context:** this project is part of the ANR project ALYS aiming at developing new tomographic approaches on urban areas. The candidate will be member of the project and will interact with the other teams of the project LTCI, ONERA and IETR (Rennes), in particular PhD student and post-doc working on related subjects.

**Application:** The candidate should send an extended CV including formation, experiences, list of publications and scientific responsibilities), a motivation letter and reference’s contacts to helene.oriot@onera.fr and florence.tupin@telecom-paristech.fr. Review of applications begins on Monday, January 2, 2016, and will be closed when the position is filled.