

Post-doc or research engineer position (18 months)
Télécom ParisTech – LTCI / ONERA

High Resolution SAR tomography and change detection

Location : Télécom ParisTech, 46 rue Barrault / ONERA DEMR Palaiseau

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Dates : starting in february 2018

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 high (HR) and very high resolution (VHR) polarimetric aerial images to define new change detection methods relying on 3D tomographic reconstruction. The project is composed of three main steps: a first step for the tomographic processing of the HR/VHR data, a second step exploiting the tomographic results to develop new change detection methods, and the third one focusing on the impact on tomographic results of changes occurring in the tomographic dataset

Concerning the first part on the HR/VHR tomographic data processing, state of the art approaches will be evaluated on the available images (aerial and satellite dataset). Different approaches (beamforming, Capon, MUSIC, regularized inversion -available in the team) will be benchmarked and compared.

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 methods for activity tracking with SAR data is based on similarity measure between images, especially 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 that can be modeled as a volumetric backscattering. These areas are very sensitive to changes in 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. Comparison of this new approach to usual change detection methods will be led to investigate the interest and drawback of the proposed framework.

Finally, the third part of the project will concern the processing of tomographic datasets containing changes. This is often the case when considering acquisitions with temporal delays (moving objects, scene changes,...). The influence of such objects on the tomographic reconstruction should be evaluated and a new method to overcome and exploit these changes will be proposed..

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.

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

Location : Paris with frequent stays at 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 LTCl, 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, 2018, and will be closed when the position is filled.