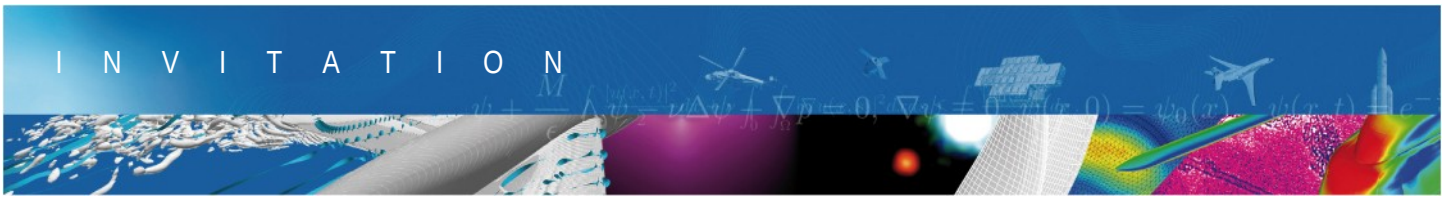

Convolutional Neural Networks for Change Analysis in Earth Observation Images with Noisy Labels and Domain Shifts

Thesis defence – Rodrigo Caye Daudt
06/11/2020 - 14h30
Salle Marcel Pierre
ONERA Palaiseau, 6 Chemin de la Vauve aux Granges, 91120 Palaiseau

The jury will be composed of:

Florence Tupin, Professeure, Télécom Paris (Présidente)
Begüm Demir, Professeure, Technische Universität Berlin (Rapportrice)
Friedrich Fraundorfer, Associate Professor, Technische Universität Graz (Rapporteur)
Devis Tuia, Associate Professor, École Polytechnique Fédérale de Lausanne (Examinateur)
Guillaume Charpiat, Chargé de recherche, INRIA Saclay (Examinateur)
Maria Vakalopoulou, Assistant Professor, CentraleSupélec (Examinatrice)
Yann Gousseau, Professeur, Télécom Paris (Directeur de thèse)
Bertrand Le Saux, Researcher, European Space Agency (Encadrant)
Alexandre Boulch, Researcher, Valeo.ai (Encadrant)

Abstract:

The analysis of satellite and aerial Earth observation images allows us to obtain precise information over large areas. A multitemporal analysis of such images is necessary to understand the evolution of such areas. In this thesis, convolutional neural networks are used to detect and understand changes using remote sensing images from various sources in supervised and weakly supervised settings. Siamese architectures are used to compare coregistered image pairs and to identify changed pixels. The proposed method is then extended into a multitask network architecture that is used to detect changes and perform land cover mapping simultaneously, which permits a semantic understanding of the detected changes. Then, classification filtering and a novel guided anisotropic diffusion algorithm are used to reduce the effect of biased label noise, which is a concern for automatically generated large-scale datasets. Weakly supervised learning is also achieved to perform pixel-level change detection using only image-level supervision through the usage of class activation maps and a novel spatial attention layer. Finally, a domain adaptation method based on adversarial training is proposed, which succeeds in projecting images from different domains into a common latent space where a given task can be performed. This method is tested not only for domain adaptation for change detection, but also for image classification and semantic segmentation, which proves its versatility.

Keywords: Remote sensing, change detection, convolutional neural networks, multitask learning, weakly supervised learning, domain adaptation.

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