

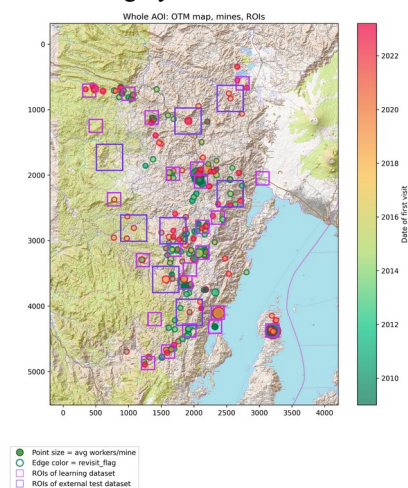
Change detection from SAR imagery and Machine Learning techniques

Description

Change detection techniques based on imagery analysis have applications in many different areas including in the socio-ecological domain of detection and monitoring of human activities as deforestation and buildings constructions or the study of soil quality for agricultural purposes. The increasing number of Synthetic Aperture Radar (SAR) satellites observing the earth on a regular basis provides image time series that can be used to detect changes. The manual analysis of SAR images for this purpose is a tedious task. However, the progress in Artificial Intelligence (AI) and in particular, in Machine Learning (ML), offers fast ways to perform change detection.

The “Signal Processing” lab of the Centre Spatial de Liège (CSL) has a long expertise in SAR imagery and has studied for a few years the exploitation of SAR imagery by ML techniques for diverse applications as detection of land changes. Currently, this lab is contributing to a research project targeted a specific application with an ongoing initiative aimed at detecting spatio-temporal environmental changes induced by mining activities in the Democratic Republic of Congo (DRC). For this work, with the help of one master student, a dataset made of SAR images times series selected from a spatio-temporal Area Of Interest (AOI) covering numerous mining sites in the Kivu Lake region of DRC has been created and a theoretical unsupervised ML methodology was designed. It based on a joint convolutional Auto-Encoder (AE) combining two convolutional AEs that are able, for each images-pair, to reconstruct each of the images from the other one. This method has been developed and assessed with the help of a second master student. The performances of this method can be improved trough some techniques as integration of additional data and data augmentation and trough extension to a self-supervised approach. Such approaches are typically divided in two stages: a pre-training (unsupervised) stage providing pseudo-labeling procedure to derive labeled data and a fine-tuning (supervised) stage for learning a model on pseudo-labeled dataset. For the proposed methodology, the pseudo-labeling is based on the reconstruction errors allowing to segment images-pairs with classes including high-probability of non-change and high-probability of change classes and two architectures for the Neural Network model used in the supervised step have been proposed: the PCBA-Net and the U-Net architectures.

In this context, this lab is looking for a motivated master student to explore the proposed methodology. The student will be responsible for understanding its theoretical concepts, developing it and analyzing its performances. The outcomes of the internship / master thesis are expected to contribute to the field of automatized detection of changes from SAR imagery.



Supervision

The internship / master thesis will be carried out under the supervision of Murielle Kirkove from the “Signal Processing” lab). Regular meetings (every week or every two weeks) will be organized during the year.

Recommended skills/courses

- Remote sensing
- Machine learning (Deep Learning)
- Programming (principles, algorithmic, Python language)

Contact person

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