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Multi-temporal multi-sensor classification of land cover classes and land cover transition for monitoring recovery after disasters and progresses in DRR policies.

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The proposed classification approach integrates multi-sensor, multi-source and contextual information associated with COSMO-SkyMed (CSK) and Pléiades images, thus formalizing the change-detection task in terms of a data fusion problem. Multi-temporal fusion “at the decision level” is used in this work. In particular, the change detection problem is operatively addressed through a multi-temporal supervised classification of multi-sensor CSK/Pléiades data. The method makes use of the Markov Random Field (MRF) theory to integrate the spatial context and the temporal correlation associated with the images acquired at the different dates, and is fully integrated with a region-based approach able to characterize the geometrical structures in the images through the employment of multiple segmentation maps at different scales.
The approach has been applied to bespoke multi-temporal series consisting of pairs of CSK/Pléiades images that have been acquired as much as possible simultaneously, and provided by the Italian Space Agency (ASI) and the Centre National d’Études Spatiales (CNES) in the framework of CEOS (Committee on Earth Observation Satellites) Working Group on Disasters activities. The target is to monitor the changes in land cover classes.
In order to exploit the potential of the change detection methodology and the spatial information of very high resolution (VHR) imagery, the proposed approach is implemented in the two following steps:
- a first analysis conducted on the acquired imagery subsampled at a resolution of 10 m;
- a second analysis performed on particularly interesting areas highlighted during the first step, making use of the imagery at the maximum available resolution.
The target of the project is to test the potential of the proposed approach to monitor changes in the land use/land cover that can be related to:
(i) the recovery phase after a natural disaster;
(ii) the implementation of Disaster Risk Reduction (DRR) policies (e.g. monitoring of Sendai Framework Assessment - SFA indicators).
Two case studies are presented:
(i) The monitoring of the recovery phase in the aftermath of Hurricane Matthew in Haiti, which struck the Caribbean in October 2016, with a dataset composed of CSK/Pléiades pairs acquired in November 2015 (before the event), in October 2016 (few days after the event) and a year later, in October 2017.
(ii) The monitoring of the surroundings of the city of Phnom Penh, Cambodia, at different time steps. The target is to monitor the changes in land cover classes related to SFA indicators. The focus is on a subset of the indicators C and D, which can be directly related to specific land cover classes. In particular C2-C, C-2FO, C-3, C-4, C-5, D2, D3, and D4.
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