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A simple and unsupervised semi-automatic workflow to detect shallow landslides in Alpine areas based on VHR remote sensing data

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Landslide detection from Earth observation imagery is an important preliminary work for landslide mapping, landslide inventories and landslide hazard assessment. In this context, the object-based image analysis (OBIA) concept has been increasingly used over the last decade.
Within the framework of the Land@Slide project (Earth observation based landslide mapping: from methodological developments to automated web-based information delivery) a simple, unsupervised, semi-automatic and object-based approach for the detection of shallow landslides has been developed and implemented in the InterIMAGE open-source software. The method was applied to an Alpine case study in western Austria, exploiting spectral information from pansharpened 4-bands WorldView-2 satellite imagery (0.5 m spatial resolution) in combination with digital elevation models.
First, we divided the image into sub-images, i.e. tiles, and then we applied the workflow to each of them without changing the parameters. The workflow was implemented as top-down approach: at the image tile level, an over-classification of the potential landslide area was produced; the over-estimated area was re-segmented and re-classified by several processing cycles until most false positive objects have been eliminated.
In every step a Baatz algorithm based segmentation generates polygons “candidates” to be landslides. At the same time, the average values of normalized difference vegetation index (NDVI) and brightness are calculated for these polygons; after that, these values are used as thresholds to perform an objects selection in order to improve the quality of the classification results. In combination, also empirically determined values of slope and roughness are used in the selection process.
Results for each tile were merged to obtain the landslide map for the test area. For final validation, the landslide map was compared to a geological map and a supervised landslide classification in order to estimate its accuracy.
Results for the test area showed that the proposed method is capable of accurately distinguishing landslides from roofs and trees. Implementation of the workflow into InterIMAGE was straightforward. We conclude that the method is able to extract landslides in forested areas, but that there is still room for improvements concerning the extraction in non-forested high-alpine regions.