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Detecting Earthquake-triggered Large-scale Landslides with Different Input Window Sizes Convolutional Neural Networks

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Earthquake-triggered large-scale landslides are considered one of the most destructive natural hazards to human lives and infrastructure in many mountain ranges of the world (Hölbling et al. 2012). Information about the exact location of earthquake-triggered landslides is important for post-disaster humanitarian response. Although some field surveying approaches are available, the remoteness of mountainous areas makes it often hard or even impossible to reach the affected area (Prasicek et al. 2018). Therefore, Earth observation (EO) data are widely considered as the most accessible data providing up-to-date information needed to support planning and crisis responses.
Since there is a growing demand for landslide susceptibility and risk mapping, several studies have been done for landslide detection and inventory mapping. Such inventories are an important basis for any subsequent landslide susceptibility and risk mapping. The semi-automated, exact and fast delineation of large-scale landslides that were triggered by an earthquake event and separating them from older landslides that have been caused by other triggers is a challenging task. Synthetic aperture radar (SAR) data acquired before and after a triggering event can be helpful for delineation of such landslides, especially since SAR sensors are able to acquire data during day and night and to penetrate clouds. This can be beneficial for rapid mapping of event landslides, since a limited availability of optical imagery might be compensated with SAR data to a certain extent. A surface displacement map was generated using the differential synthetic aperture radar interferometry (DInSAR) technique and Sentinel-1 images. The spectral information of high-resolution RapidEye images was used in addition to enhance landslide detection.
Several machine-learning (ML) methods have been used in different studies for landslide detection. During the past decade, the deep learning methods and in particular the convolution neural networks (CNN) marked a new epoch in the development of ML methods. In this study, a CNN was designed and different input window sizes were used for landslide detection. The CNN sample patches were selected within different input window sizes from the considered training region. Then the structured CNN was feedforwarded with the prepared sample patches and tested in the considered testing region. The impact of using different input window sizes on the landslide detection by the CNN method was evaluated by comparing the results to a manually mapped landslide inventory. The comparison was made using three different metrics, including precision, Recall and F1 measure, to assess the accuracy of the large-scale landslides detected by CNN. The optimal CNN input window size for earthquake-triggered large-scale landslide detection was designated based on the applied accuracy assessment metrics.
References:
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