Landslide Detection from Remote Sensing Imagery Based on SPP-PCANet

*Yimei Wei[1], Takashi Oguchi[2]

1. The University of Tokyo, 2. Center for Spatial Information Science, The University of Tokyo

Landslides are complex geological phenomena that can cause serious damage to the natural and social environments and may result in a significant loss of lives and properties. Therefore, it is crucial to conduct a timely post-disaster investigation. Landslide detection is an important step of landslide studies such as mapping, inventory preparation, and specific analyses for the coordination of practical actions including rapid disaster responses. Remote sensing images have been widely used in disaster research with the aid of image feature analysis based on computer vision. Traditional feature extraction methods depend on visual interpretation of feature characteristics such as color, gradient, and corners. However, such methods usually require a large amount of prior knowledge and tedious work. They also tend to be subjective and are only applicable to some specific environments, meaning that generalization ability is low. In recent years, the increasing maturity of machine learning, especially deep learning, enables features to be automatically detected from images, providing more robust analysis and interpretation of remote sensing images. This study explores a landslide detection method that uses a simple and effective image feature descriptor based on a highly simplified network designated as Spatial Pyramid Pooling Principal Component Analysis Network (SPP-PCANet) combined with the SVM classifier. We analyzed landslides due to the 2018 Hokkaido Eastern Iburi earthquake, using vertical aerial photographs and orthophotographs provided by the Geospatial Information Authority of Japan (GSI) for model training and hyperparameters optimization. Then we performed landslide detection using Google Earth imagery. Experimental results show that the proposed landslide detection method has promising performance and may contribute to future rapid responses to landslide hazards.

Keywords: Landslide detection, Image feature extraction, Spatial Pyramid Pooling Principal Component Analysis Network, Machine learning

