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## Landslide Detection of Hyperspectral Remote Sensing Data Based on Deep Learning With Constrains

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There is a growing demand for constructing a complete and accurate landslide maps and inventories in a wide range, which leading explosive growth in extraction algorithm study based on remote sensing images. To the best of our knowledge, no study focused on deep learning-based methods for landslide detection on hyperspectral images. We proposes a deep learning framework with constraints to detect landslides on hyperspectral image. The framework consists of two steps. First, a deep belief network is employed to extract the spectral-spatial features of a landslide. Second, we insert the high-level features and constraints into a logistic regression classifier for verifying the landslide. Experimental results demonstrated that the framework can achieve higher overall accuracy when compared to traditional hyperspectral image classification methods. The precision of the landslide detection on the whole image, obtained by the proposed method, can reach 97.91%, whereas the precision of the linear support vector machine, spectral information divergence, and spectral angle match are 94.36%, 84.50%, and 86.44%, respectively. Also, this article reveals that the high-level feature extraction system has a significant potential for landslide detection, especially in multi-source remote sensing.