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Evaluating the performance of geomorphometric variables for landslide detection using convolutional neural networks

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Deep learning has been successfully used in landslide detection, with convolutional neural networks (CNNs) being the most widely used framework. The characteristics of the terrain are often the best predictors in such tasks. However, it can be difficult to choose which geomorphometric variables to use as inputs for the deep learning model. A small area in the Moldavian Plateau, a region where landslides are often present in the landscape, was used to benchmark the performance of more than 30 geomorphometric variables in a binary classification task. The area was split into raster tiles of 100x100 pixels, each being labeled as either having a landslide present or not. To generate the geomorphometric variables, a high-resolution LiDAR DEM was used. Three CNN architectures were tested (AlexNet, ResNet, and ConvNeXt), and the model performance metrics were reported. Expectedly, ConvNeXt was the best-performing architecture, with over 20 of the variables having an F1-score of more than 0.8. The hillshade, the digital elevation model, and the profile curvature were the best-performing variables.