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Using back-propagation networks to predict landslides based on an airborne LiDAR DEM

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Landslides are one of the most destructive geological disasters affecting Japan every year, causing huge loss of human lives and properties in Japan over past decades. Although many methods for predicting landslides have been proposed, accurate predictions of landslides are not always realized. This study aims to develop an accurate and efficient method for landslide prediction based on an artificial neutral network (ANN) built from seven factors using a back-propagation (BP) algorithm. The method of this study consists of two major phases: 1) data integration and analysis, 2) ANN training and prediction. This study analyzed a mountainous region of Niigata Prefecture. Landslides data are taken from the database of the National Research Institute for Earth Science and Disaster Prevention (NIED). The first phase involves GIS-based statistical analyses related to landslide occurrence, geology, and geomorphological properties derived from a 2-m airborne LiDAR digital elevation model (DEM). The seven factors are elevation, slope angle, curvature, aspect, lithology, distance to geological boundaries, and density of geological boundaries. A total of 1225 potential cases of landslides were used to test the BP algorithm for training and testing the model. The accuracy of the prediction reached $>$90%, indicating that the presented model with the seven factors is reliable and can be used for hazard mitigation and warning systems.

Keywords: Airborne LiDAR DEM, landslide prediction, Artificial Natural Network, Back-propagation