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Slope-units-based landslide susceptibility mapping based on graph convolutional network: A case study in Lueyang region

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Landslides are the most frequent and numerous geological hazards that pose a serious threat to human safety and property. Landslide susceptibility mapping (LSM) has been focused on over the years as an essential step of landslide risk assessment. Numerous statistical or machine learning models have been proposed for LSM, but few consider mapping units' spatial correlation. This study proposed a deep learning model based on graph convolutional network (GCN) and K-Nearest Neighbor (KNN), named KNN-GCN, for slope-units-based LSM and experimentally applied to the Lueyang region. It's constructed and validated with the following steps: First, 15 landslide causal factors and landslide inventory were collected, and a slope units map (SUM) was obtained based on slope unit division. Then, the training and test sets were divided with the ratio 7:3 after the multicollinearity analysis for landslide causal factors. Next, a four-layer GCN model was constructed based on the slope units graph (SUG), in which the SUG was generated from the SUM by the KNN algorithm. After that, the proposed KNN-GCN model was trained and validated on training and test sets separately, then applied for LSM. Finally, the performance of the KNN-GCN model was compared with the three other models, including KNN, Support Vector Machine (SVC), and AutoML. The results show that the proposed model achieved the best performance (AUC=0.8473) than other models, and a more readable susceptibility map was generated with it, which has clear boundaries between different susceptibility levels. Notably, although the proposed KNN-GCN model shows excellent performance for slope-units-based LSM, it requires high computer hardware and is not recommended for small datasets.