Identification and Evaluation Methods for Highway Landslides in Densely Vegetated Mountainous Areas Using Airborne LiDAR: Postprint

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Abstract

To mitigate the adverse effects of concealed landslide hazards in dense vegetation mountainous areas on the full life cycle of expressways, this study leveraged the vegetation-penetrating capability of airborne LiDAR to obtain a high-precision DEM with a spatial resolution of 0.2 m for the under-construction G0321 expressway section from Qimen to the Anhui-Jiangxi border (K2+430~K14+750 segment). A remote sensing interpretation methodology applicable to dense vegetation mountainous regions was formulated, a landslide hazard sample database for the study area was constructed, and the accuracy of remote sensing interpretation was validated through manual field verification. By comprehensively considering topographic, meteorological, hydrological conditions and field investigation findings, eight landslide causative factors were selected, and the Information Value coupled MaxEnt model (IV-MaxEnt) was employed to perform landslide susceptibility assessment in dense vegetation mountainous areas. The evaluation results indicate that the empirical AUC value of the Receiver Operating Characteristic (ROC) curve for the assessment model reaches 0.901, signifying high model accuracy, which bears important engineering significance for the route selection, construction, and operation stages of expressways.

Full Text

Preamble

Title: Research on Landslide Identification and Evaluation Method for Mountain Highways in Dense Vegetation Areas Based on Airborne LiDAR

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Abstract: To mitigate the adverse effects of concealed landslide disasters in densely vegetated mountainous areas on the entire life cycle of highways, this study utilizes the vegetation-penetrating capability of airborne LiDAR to obtain high-precision DEM data with a spatial resolution of 0.2 m for the under-construction highway section G0321 from Qimen to the Anhui-Jiangxi border (K2+430–K14+750). A remote sensing interpretation methodology specifically applicable to densely vegetated mountainous regions was formulated, establishing a comprehensive landslide hazard sample database for the study area. The accuracy of the remote sensing interpretation was verified through meticulous field validation. Integrating topographic and geomorphic characteristics, meteorological and hydrological conditions, and field investigation findings, eight causal evaluation factors were selected. The Information Value coupled with Maximum Entropy (IV-MaxEnt) model was then employed to conduct landslide susceptibility assessment in the densely vegetated mountainous environment. The results indicate that the model' s Receiver Operating Characteristic (ROC) curve achieves an empirical effective value of 0.901, demonstrating high predictive accuracy. This approach holds significant engineering implications for the route selection, construction, and operational phases of highway projects.

Keywords: mountain highway; airborne LiDAR; landslide identification; IV-MaxEnt coupling model; susceptibility assessment

Note: Figure translations are in progress. See original paper for figures.