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Towards Physics-Informed Neural Network for Earthquake Induced Landslide Modelling.

Ashok Dahal and Luigi Lombardo
University of Twente, Faculty of Geo-Information Science and Earth Observation, Applied Earth Science, Netherlands (a.dahal@utwente.nl)

For decades, regional-scale landslide prediction has predominantly relied on data-driven models, which are inherently detached from the underlying physics of the failure mechanisms. The widespread adoption of these models is due to their ability to utilize proxy variables instead of geotechnical parameters, which are often difficult to obtain across regional scale. In this study, we introduce a Physics-Informed Neural Network (PINN) approach that incorporates physical constraints into a conventional data-driven framework to predict the permanent deformations associated with Newmark slope stability methods. Specifically, the neural network is designed to extract geotechnical parameters from globally available proxy variables and optimize a loss function based on observed coseismic landslide inventories. The results demonstrate that this approach not only achieves high predictive accuracy in terms of traditional susceptibility outputs but also generates spatially resolved maps of inferred geotechnical properties at a regional scale. Consequently, this architecture presents a novel avenue for addressing coseismic landslide prediction and, if validated by further studies, holds the potential for enabling near-real-time PINN-based predictions.