Integration of Machine Learning with Numerical Modelling for Landslide Susceptibility Assessment near Uma Oya Catchment, Sri Lanka

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Abstract
Landslides being an abundant source of risk prevailing worldwide, the mountainous regions in the central part of Sri Lanka, experience numerous slope failures throughout the year. Many such slope failures have been reported following extreme rainfall events. Comprehension of the causative factors underlying these hazardous events hold much significance in developing control strategies for future disaster mitigation efforts. Numerical modelling and machine learning are distinct approaches that are widely being used in simulating hydrogeological processes and other environmental phenomena leading to disasters, the objective of this study was to investigate the use of an integrative approach of these two disciplines in evaluating the risk of landslide susceptibility with specific application to a site near Uma Oya catchment, Sri Lanka. The model incorporates a finite difference scheme for groundwater modelling coupled with slope stability evaluations using raster-based grid operations in GIS, analysed for two historical landslide cases within the region. The gradient-descent optimisation algorithm was adopted in optimising the groundwater model in which the results were in good agreement with the true observations, where the predicted water table levels exhibited a 78% recovery rate of true positives, justifying the usability of the adopted research framework in future disaster reduction endeavours.

Keywords: Finite difference, GIS, Gradient-descent, Numerical modelling, Slope stability