

LANDSLIDE SUSCEPTIBILITY MAPPING USING PHYSICS- GUIDED MACHINE LEARNING (PGML): AN APPLICATION TO A DEBRIS FLOW EVENT IN THE COLORADO FRONT RANGE

Speaker

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Abstract

Physics-guided machine learning (PGML) is a new paradigm for applying machine learning (ML) techniques to solve engineering problems. This talk will demonstrate PGML's capability to improve traditional ML models for mapping and predicting debris-flow hazards through a case study of debris flows triggered by a storm event in the Colorado Front Range. The spatial distribution of the debris flows was assessed using three distinct classes of methods: a physics-based model, a traditional ML model, and a PGML model. For the physics-based model, the infinite-slope model under submerged conditions was used to calculate the factor of safety and assess debris-flow risk. For the PGML model, a physics-guided loss function was implemented to incorporate debris-flow physics into traditional ML models. It was found that PGML can improve ML model performance for mapping debris flow hazards by enhancing physical consistency and making ML models more generalizable across ecoregions.

Biography

Dr. Qiu received his B.S. degree in hydraulic engineering from Tsinghua University, China, in 2000 and M.S. and Ph.D. degrees in civil engineering with a focus in geotechnical engineering from UCLA in 2002 and 2005, respectively. Before joining the faculty and serving as Chair of the Department of Civil & Environmental Engineering at The University of Utah in 2024, he was a faculty member at Pennsylvania State University. Dr. Qiu was an associate editor for the Journal of Geotechnical and Geoenvironmental Engineering, ASCE, and the International Journal of Geomechanics, ASCE, from 2014 to 2023. He was an elected board member of the United States Universities Council on Geotechnical Education and Research. Dr. Qiu received the Excellent Paper Award from the International Journal of Geomechanics, ASCE, and the Faculty Early Career Development Award (CAREER) from the National Science Foundation and is an elected Fellow of ASCE.



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Room 3574 (Lift 27/28)
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Conference Room

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