

The Department of Civil and Environmental Engineering at the University of Houston presents...

CIVE 6111 Graduate Seminar

Predicting Roadway Pluvial Flash Flooding Risk Using Crowd-Sourced Waze Traffic Alerts and a Hybrid Machine Learning Model



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Friday, September 30, 2022

2:45pm-3:45pm

Classroom Business Building (CBB) - Room 104

Zoom: [https://uh-edu-cougarnet.zoom.us/j/95702511696?](https://uh-edu-cougarnet.zoom.us/j/95702511696?pwd=VFlybkh4emhETHNITGV0dXRHS3pIZz09)

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Abstract

One important adverse impact of increased intensive rainfalls is traffic disruption due to roadway pluvial flash flooding (PFF, caused by inadequate stormwater drainage systems) and lane submersion, which can lead to injury and even loss of life. In a highly urbanized area, flood formation is a highly complex and uncertain process and its impacts on roadway mobility depend on numerous temporal and spatial variables. Despite the availability of many physics-based hydrodynamic, hydrologic, and empirical models to simulate PFF, their application on the highly localized scales at which traffic disruption occurs remains a challenge due to high computational time and lack of available data.

This study detects the risk of roadway PFF based on traffic data obtained from Waze, a crowd-sourced navigation app, and a physics-based model. A hybrid model is developed that combines a Graph-based Rapid Flood Spreading Model (GB-RFSM) with machine learning (ML) to predict the risk of roadway PFF flooding at the intersection scale. The model is applied to a case study of flood-prone intersections in Dallas, Texas. The performance of multiple ML classifiers [Random Forest Classifier (RFC), Extreme Gradient Boosting Decision Tree (XGBoost), and Support Vector Classifier (SVC)] are compared. The results showed that RFC was more precise in predicting flooded areas identified by Waze users, with a 73% recall score representing reported flood events that are identified using the hybrid model. More data, particularly on the location and configuration of the urban drainage system, are needed to improve predictions.

Bio

Dr. Minsker is the Bobby B. Lyle Endowed Professor of Leadership and Global Entrepreneurship at Southern Methodist University. She is also a Senior Fellow at SMU's Hunt Institute for Engineering and Humanity. Her research uses systems analysis and data analytics to improve understanding and management of coupled environmental and human systems, with a focus on water, infrastructure, and urban sustainability and resilience. Prior to joining SMU in 2016, Dr. Minsker was Professor and Arthur and Virginia Nauman Faculty Scholar in the Department of Civil and Environmental Engineering at the University of Illinois Urbana-Champaign. She earned a BS in Operations Research and Industrial Engineering with Distinction in 1986 and a PhD in Civil and Environmental Engineering in 1995 from Cornell University.