Measurement and prediction of subway resilience under rainfall events: An environment perspective

Abstract

Rainfall events frequently disrupt the subway system, significantly impacting operational efficiency and service quality. It is challenging to measure and predict subway system resilience due to the different construction environments of subway stations. We develop a method based on probabilistic modeling techniques to measure subway system and station resilience. Random forest is used to analyze the heterogeneity of resilience patterns from an environmental perspective. Based on wavelet decomposition and voting networks, we design a neural network modeling framework considering environmental factors to predict system and station resilience. In a case study in Harbin, China, we find that subway system resilience decreases by 1/6 for every 10 mm increase in rainfall intensity when the rainfall is under 60 mm. 44.6% of low-resilience stations are near roads at the Level of Service III and IV. The proposed prediction model outperforms the state-of-the-art models with a prediction accuracy of 96.37%.

Keywords: Subway network; System resilience; Rainfall events; Travel environment; Neural network