

Graph Neural Networks For Efficient Seismic Reliability Analysis Of Highway Bridge Systems

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The highway bridge system is a critical part of the infrastructure system since the highway system carries a large volume of traffic flow and plays a vital role in connecting critical locations in extreme events. Seismic reliability analysis of bridge networks is an important task where network response measures, such as node-level connectivity conditions is calculated under probabilistic earthquake events. We propose a fast approach based on graph neural networks (GNN) to compute node-to-node connectivity given different target nodes. This GNN is generalizable to various earthquake events and even can be trained on one network, and be tested on another network. To train the model we use bridge information and condition assessments report for a large bridge network in Bay Area and demonstrate the accuracy and computational efficiency of the proposed approach. This can enable fast decision support systems that inform maintenance planning and asset managements to improve critical infrastructures.