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ML-based Surrogate Model for RC Bridge Pier Collapse Fragility Prediction

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Abstract

Fragility analysis is a powerful tool in performance-based earthquake engineering framework that facilitates in decision making and helps in communication between the stakeholders and design professionals. However, the fragility analysis requires performing a number of nonlinear dynamic analysis, which is computationally expensive and hinders design optimization. Therefore, surrogate models are developed to reduce the computational cost. In this paper, a computationally efficient machine learning based surrogate model framework is proposed for seismic fragility prediction of RC bridge piers. The framework utilizes Gaussian Process Regression to generate surrogate models that can predict the mean and standard deviation of the fragility functions as function of the influential material parameters. Despite using 100 samples for training, the surrogate model is mostly successful in predicting the fragility function parameters with error less than 20%.

Keywords: Bridge, Performance based earthquake engineering (PBEE), Fragility curves, Surrogate model, Gaussian process regression