Prediction Of Damage State Of Rc Buildings Using Machine Learning

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The capacity to swiftly estimate the seismic vulnerability of numerous buildings following a major earthquake is critical, and a rapid estimate of earthquake-induced damage is required to do so. This estimate gives emergency responders important information about the areas that are the most impacted. The traditional methods of damage investigation conducted manually following a main shock are complicated, labor-intensive, time-consuming, and error prone process. The fragility curves are developed using observed damage data considering the physical and mechanical properties of buildings and can be calibrated to various characteristics of building structures and hazards. However, developing the fragility curves from the observed data is time consuming and cannot easily develop curves for different regions or countries with diverse construction characteristics. Furthermore, the nonlinear finite element method can be used to assess the seismic damage of individual building; however, it cannot be used for numerous buildings as it requires higher time and cost. To overcome this, machine learning based rapid and reliable prediction of seismic damage of RC buildings is presented in this study. Both the seismic parameters of earthquake wave and the structural parameters of buildings are taken as inputs. Numerous RC buildings with different structural characteristics are subjected to earthquake waves that are recorded in the past and nonlinear time history analysis is carried out. These analyses led to the calculation of the buildings' damage indices expressed in terms of the maximum inter-story drift ratio. Four commonly used supervised learning algorithms, i.e., KNN, RF, SVM and ANN are used for the prediction of seismic damage state of buildings. The prediction of damage state is evaluated for buildings subjected to earthquake, neither of which are included to the training data set.