Deep Neural Network for Determination of Ground Shaking's Seismic Intensity Level

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In Japan, the shaking of the ground during an earthquake can be represented by the Seismic Intensity Level (SIL) to express how strongly the shaking affects the human being. In contrast, the countries still adopt the Richter Magnitude, which shows the amount of energy released by an earthquake as a measure. The present study proposed an artificial intelligence methodology to determine the value of SILs based on state-of-the-art Deep Learning (DL) techniques. More than 600 ground accelerations recorded at seismic stations in Japan from 1996 to 2022 with SILs range of 5.0-5.5 are considered in the study. A 5-story building frame structure prototype is used as an example to verify the Deep Neural Network (DNN) performance. The dynamic time history structural analyses were conducted to produce more than thirty thousand datasets. The DNN model can predict the SIL value of the corresponding floor in the building within a 20% error margin by using only three input data of the Richter Magnitude, epicentral distance, and focal depth of a future earthquake. The DNN model can be a versatile tool for disaster mitigation measures as an early warning system during earthquake occurrences.

Experience:

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