Natural Hazards and Earth System Sciences Discussions

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
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Comment on nhess-2022-125

Samuel Roeslin (Referee)

Referee comment on "Earthquake building damage detection based on synthetic-aperture-radar imagery and machine learning" by Anirudh Rao et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-125-RC1, 2022

Overall, a very well written paper that will appeal to earthquake engineers active in building damage assessment and the wider audience interested in the use of novel technologies (InSAR) and machine learning. Nevertheless, some points would benefit from additional explanations/clarifications. My comments are provided below.

Comment 1

Lines 175-176: "The SAR-derived DPMs published by the ARIA project are used as the primary remote-sensing proxy to identify surface-level changes that are potentially attributable to earthquake-induced building damage."

Could you please clarify how you interpret the correlation between surface-level changes and earthquake-induced building damage? Would it be possible to have seismic building damage without significant change in the ground surface level? If so, how would you proceed to remotely detect building damage using InSAR or EO?

Comment 2

Lines 185-188: “The problem presented is one of multi-class classification, and two ensemble machine-learning classification algorithms are employed—the Random Forest classifier for the cases involving only numeric features, and Histogram-Based Gradient Boosting classifier for the cases which also involve categorical features amongst the selected building attributes.”

Could you please explain why you selected the random forest algorithm and histrogram-based gradient boosting classifier? Did you try any other algorithms? How did they perform?

Comment 3

Lines 188-189: “The models are trained with a 70% subset of the available data, and then the best-fit models are tested against the 30% hold-out subset.”

Could you please explain why you chose a 70%/30% for the training and testing set? Did you try 80%/20% for example? Was 70%/30% giving the best performance?

Comment 4

Lines 211-213: “Another important reason to undertake a binary damage classification exercise is that it permits the aggregation of building damage datasets from different events into a larger training pool.”

Could you please clarify what you understand under a “larger training pool” for a machine learning model?

Lines 325-329: “Cross-regional training datasets will also help greatly improve the performance of these models for earthquakes in new regions previously unseen by the model. By expanding the datasets used to train the ML damage classification models, we can transfer the learning from regions with more damage data availability to data sparse regions. Cross-regional training is also critical as it will ultimately make such damage

classification models more robust as they can be more confidently applied to future disasters, which may affect regions the model has not been trained on.”

Could you comment on the performance of a ML model applied to region on which it has not been trained on? When creating a “larger training pool”, could you please explain how you would capture regional specificities?

This reviewer is of the opinion that each location/region has specificities (e.g., construction practices, seismic setting, ground conditions) and thus has concerns regarding the applicability of a "one-fits-all" ML damage prediction model.

Comment 5

Lines 320-323: " The training of the machine learning models happens prior to the disaster event, and the trained model can be deployed for damage detection following an earthquake as soon as the pre-event building inventory, ShakeMap, and DPM become available ".

Could you please clarify the process? Why does this information only appear in the conclusion? Did you try to train a ML model for a region prior to a disaster and test the ML model after the earthquake event?

Comment 6

Lines 342-343: “Code availability. The Python code and Jupyter notebooks used for the analysis are available at https://github.com/gemsciencetools/eodamage-detection under the GNU Affero General Public License (v3.0).”

GitHub repo accessed by the reviewer on 29 May 2022

Data and code were found for the Gorkha, Puebla, and Zagreb earthquake, as well as the central Italy earthquakes. However, no folder/code related to the Puerto Rico earthquake could be found.