Scripts to generate: (1) attribute-based fuzzy scores for SARA and HAZUS building classes, and (2) probabilistic inter-scheme compatibility matrices. An application on the residential building stock of Valparaiso (Chile) for seismic risk applications

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1. Licence

1.1. Data

1.2. Code

2. Citation

When using the data please cite:

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Gómez Zapata, J. C., Pittore, M., Cotton, F., Lilienkamp, H., Shinde, S., Aguirre, P., & Santa María, H. (2022). Epistemic uncertainty of probabilistic building exposure compositions in scenario-based earthquake loss models. In Bulletin of Earthquake Engineering. Springer Science and Business Media LLC. https://doi.org/10.1007/s10518-021-01312-9

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3. Description

This repository is composed of two main folders: (1) "2021-002_Gomez-Zapata-et-al_Exposure_fuzzy_scores" and (2) "2021-002_Gomez-Zapata-et-al_Inter-scheme_mapping".

(1) 2021-002_Gomez-Zapata-et-al_Exposure_fuzzy_scores:

- In the folder ***"lib_fuzzy_scoring"*** there are the python modules implementing the basic properties of fuzzy numbers (file fuzzy.py) and the functions for the fuzzy scoring (file scoring.py) as proposed in the original method of (Pittore et al., 2018). These codes are required are used by the ipython notebook (wrote in python3) entitled: ***"Fuzzy_scoring_schemes_for_residential_buildings_classes_Valparaiso.ipynb".*** This notebook contains a complete description of two earthquake building schemes: SARA and HAZUS. Both schemes have already been proposed for exposure modelling at the third administrative division "commune" in Chile in earlier works. SARA with 17 classes, after the original proposal of Yepes-Estrada et al. (2017), and HAZUS (FEMA, 2003) with 11 classes according to Aguirre et al. (2018).
- Each building class within the two schemes has been disaggregated into attribute types, and values contained in the GEM v.2.0 taxonomy (Brzev et al. 2013). Fuzzy scores assign the corresponding compatibility between building classes and attribute values. Also included is a

weighting scheme that ranks the set of attribute types. After executing this .ipython notebook, the user will obtain the outputs contained in the folder “fuzzy_scored_schemes/” (each scheme in .JSON format, and their graphic representation in .PNG). They correspond to Figure 2 in Gomez-Zapata et al., (2021).

(2) 2021-002_Gomez-Zapata-et-al_Inter-scheme_mapping:

- This folder contains the script “Inter-scheme_conversion_SARA-HAZUS.py” written in Python3. It can be used to calculate inter-scheme compatibility matrices as proposed by Gomez-Zapata et al., (2021). This method is described in Section 3.2. Entitled “Probabilistic inter-scheme compatibility matrix”. This paper has been submitted to Bulletin of Earthquake Engineering in January 24th, 2021. And is available in preprint format in: https://doi.org/10.21203/rs.3.rs-178120/v1. The required libraries are listed in the header of the code.
- Please note that the Python code mentioned above requires as input files the SARA and HAZUS schemes in .JSON format, as well as the Python modules enclosed in the subfolder "lib_fuzzy_scoring”. Note that two weighting schemes that rank the attribute values are provided as presented in Gomez-Zapata et al., (2021). After running this script, the user will obtain .CSV files with the numerical values that represent these compatibility matrices. The two inter-scheme compatibility matrices for SARA (source) and HAZUS (target) in Valparaiso with weight arrangements: W.A-1 and W.A-2 are provided in the two .CSV files. At the end of the code, the option to generate its graphical representation is also provided and it can be used to generate figure 5 as presented in the pre-printed version of the aforementioned preprint.

4. File description

4.1. File inventory

A graphical representation of the repository is provided below:

```
├── 2021-002_Gomez-Zapata-et-al_Exposure_fuzzy_scores
│   └── lib_fuzzy_scoring
│   │   ├── __init__.py
│   │   ├── __init__.pyc
│   │   ├── fuzzy.py
│   │   ├── fuzzy.pyc
│   │   ├── scoring.py
│   │   └── scoring.pyc
│   │
│   └── fuzzy_scored_schemes
│   │   ├── Valparaiso_SARA_scheme_residential_building_classes.json
│   │   ├── Figure_Valparaiso_SARA_scheme.png
│   │   ├── Valparaiso_HAZUS_scheme_residential_building_classes.json
│   │   └── Figure_Valparaiso_HAZUS_scheme.png
│   │
│   └── Fuzzy_scoring_schemes_for_residential_buildings_classes_Valparaiso.ipynb
│
└── 2021-002_Gomez-Zapata-et-al_Inter-scheme_mapping
    ├── Inter-scheme_conversion_SARA-HAZUS.py
    ├── Matrix_SARA-HAZUS_WA-1_Valparaiso.csv
    └── Matrix_SARA-HAZUS_WA-2_Valparaiso.csv
```

5. Acknowledgments

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6. Related work

https://taxonomy.openquake.org/

https://sara.openquake.org/

7. References

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