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Enhancing large-scale footprint extraction evaluation: a two-level approach with proxy data and optimized building-unit matching

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Background

Recently, there has been a rapid development on deep-learning-based methods for extracting footprints from satellite images. However, evaluating result quality on a large scale remains challenging. Typically, evaluating requires detailed building data as a reference, which may be unavailable in certain developing countries. Additionally, evaluation based on aggregated footprint area or count as may result in either overestimation or underestimation.





- We developed a grid-level evaluation method using publicly available population and land use cover data as proxy reference data.
- We improved the building-level matching method to obtain more accurate result evaluation.

Proxy reference data:

WorldPop population counts data (100m grid) Esri 10m land cover data (2022)

• Reference footprint data: Urban planning survey data of Japan

• Test area: Hyogo prefecture & Numazu city



wo-level methodology



Result & Conclusion



Completeness index of Hyogo aggregated by 1000m grid



- Evaluation result
 - with difference matching methods

Matching method	Precision	Recall	F1
IoU > 0.5	0.792	0.720	0.754
Manually*	0.867	0.788	0.826
Proposed method	0.859	0.778	0.816



- Proposed building matching approach can well mitigate the impact due to geometric errors, and very close to the results of manually matching.
 - In terms of effects of different threshold, a suitable overlapping ratio (e.g., 0.55) in the study) can improve accuracy of building matching. However, the centroid distance only affects matching efficiency.

The completeness index calculated by combination of population and land cover



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Footprint matching

results for Numazu city