Automated Upgrading of LOD2 Building Models to LOD3 for City-Scale 3D Fiscal Cadastre

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Ratri Widyastuti[1]*, Deni Suwardhi[1], Irwan Meilano[1], Andri Hernandi[1], Zainab Ramadhanis[2], Arnadi Murtiyoso[3], Fabio Remondino[4]

[1] Spatial System and Cadastral Research Group, Institut Teknologi Bandung (ITB), Indonesia – (ratri, deni.suwardhi, irwanm, andri.hernandi)@itb.ac.id
[2] Geodesy & Geomatic Eng. Graduate Program, Institut Teknologi Bandung (ITB), Indonesia - 35126003@mahasiswa.itb.ac.id
[3]Université de Strasbourg, CNRS, INSA Strasbourg, ICube Laboratory UMR 7357, Photogrammetry and Geomatics Group, 67000, Strasbourg, France– arnadi.murtiyoso@insa-strasbourg.fr
[4]43D Optical Metrology (3DOM) Unit, Bruno Kessler Foundation (FBK), Trento, Italy – remondino@fbk.eu

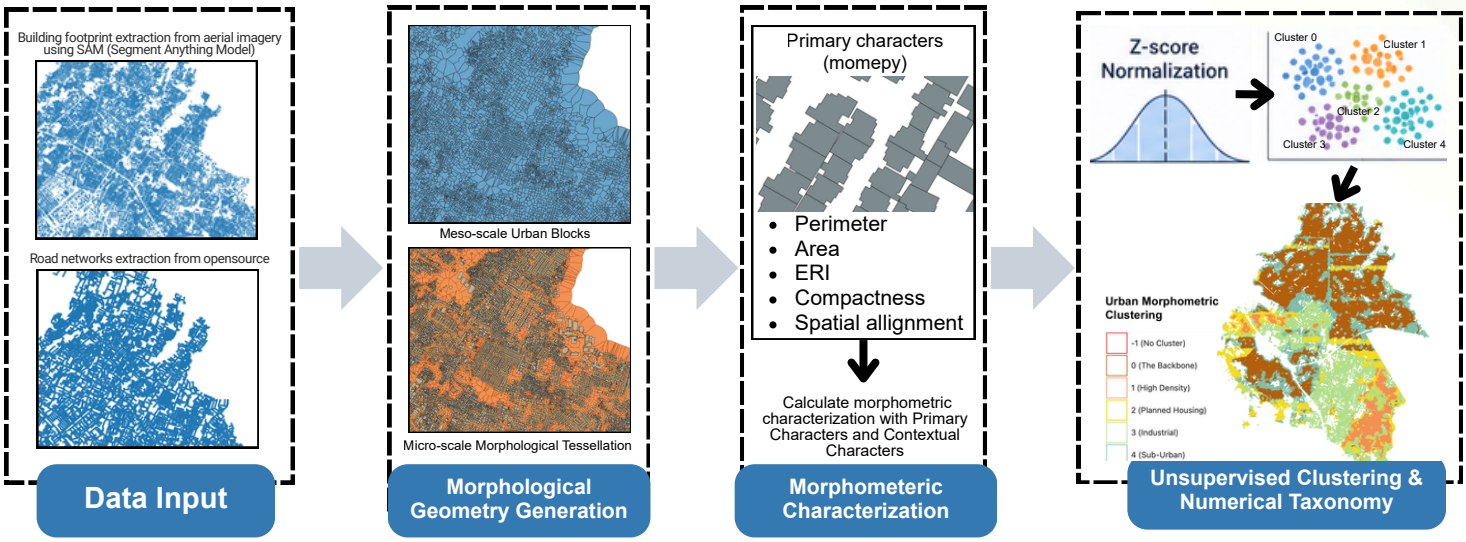
Research Background

3D building models are increasingly important for 3D fiscal cadastre and property valuation, as property values are influenced not only by building geometry but also by spatial characteristics such as natural lighting, ventilation, and visual quality. However, commonly available Level of Detail 2 (LoD2) models lack explicit representations of façade openings, such as windows and doors, limiting their ability to capture these property-related characteristics. Upgrading LoD2 models to Level of Detail 3 (LoD3) can provide more realistic building representations. Nevertheless, conventional LoD3 reconstruction is often time-consuming and costly, particularly at the city scale. This research proposes an automated videogrammetry-based approach that integrates image-based semantic detection with 3D photogrammetric reconstruction to identify and reconstruct building openings and update existing LoD2 models into LoD3. The resulting models are expected to provide more detailed and reliable spatial information to support fairer and more transparent 3D fiscal cadastre and property valuation.

Research Method

The methodology comprises seven phases, integrating urban morphological classification, representative sampling, automated 3D building reconstruction, and property valuation optimization. Initially, city-wide 2D building footprints and street networks from multiple cities were collected, standardized, and integrated to characterize urban morphology at both meso- and micro-spatial scales. Geometric, spatial, and contextual characteristics were subsequently extracted to identify distinct urban morphological patterns, which were classified into five morphological clusters using Gaussian Mixture Models (GMM). Proportionate stratified medoid sampling was then applied to select representative building prototypes from each morphological class. These sampled buildings served as the basis for developing automated 3D reconstruction workflows across different Levels of Detail (LoD1-LoD3.1), integrating building geometry, elevation information, and architectural characteristics. The resulting 3D models were subsequently evaluated to determine the optimal level of geometric and semantic detail for property valuation within each morphological class, balancing model complexity, reconstruction efficiency, and valuation accuracy. Finally, the optimized modeling approaches were generalized according to morphological characteristics, establishing a scalable framework for urban-scale 3D property valuation across different cities.

Urban Morphometric Clustering



3D Modeling

