Department of Aerospace and Geodesy
TUM School of Engineering and Design
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Master's Thesis Proposal

Multiview and Multitemporal Texturing of Semantic 3D City Models from Street-Level Imagery

Figure 1: Real-world image with the wall surface to be automatically extracted

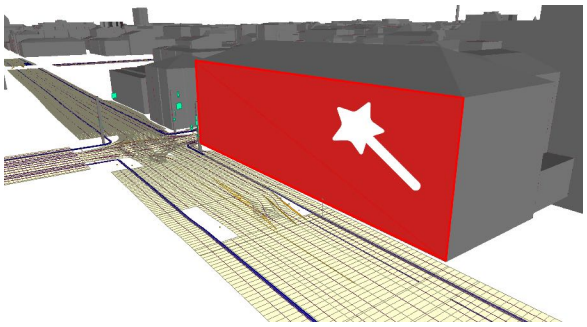

Figure 2: Semantic 3D city model with the corresponding wall surface to be textured

Description An increasing number of mobile mapping campaigns are carried out resulting in a high spatial and temporal coverage of districts and even entire cities. While the images and point clouds obtained are sufficient for geometry-focused applications, their combination with pre-existing geospatial base data is essential for applications that require semantic, geometric and topological information.

The objective of this thesis is to relate the street-level imagery with the semantic city model by associating image sections with the corresponding object surface in the model [1]. To ensure an accurate projection of the texture section onto the object surface, a fine alignment should first be carried out using, for example, edge detection [2]. Occlusions of static objects, such as city furniture or trees, are to be taken into account either by georeferenced LiDAR point clouds or photogrammetric approaches, such as Structure from Motion. Due to the varying coverage degrees of the target object depending on the camera perspective, a maximum-coverage texture is to be merged for each mobile mapping pass. To enable a scalable analysis at the city-district level, the associated image sections for multiple time epochs are to be imported into a geo database. The evaluation of the developed methodology should include an experimentation area of a small city district and should be assessed both qualitatively and quantitatively.

The thesis is conducted in collaboration with the City of Munich.

Requirements Proficiency in Python or C++ programming is essential. Experience with image and point cloud processing techniques is advantageous. Prior exposure to the CityGML standard, the 3D City Database and the FME tool is beneficial.

References [1] He, H., Yu, J., Cheng, P., Wang, Y., Zhu, Y., Lin, T., & Dai, G. (2021). Automatic, Multiview, Coplanar Extraction for CityGML Building Model Texture Mapping. Remote Sensing, 14(1), 50.

[2] Frueh, C., Sammon, R., & Zakhor, A. (2004). Automated texture mapping of 3D city models with oblique aerial imagery. In Proceedings. 2nd International Symposium on 3D Data Processing, Visualization and Transmission, 2004. 3DPVT 2004. (pp. 396-403). IEEE.

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