Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

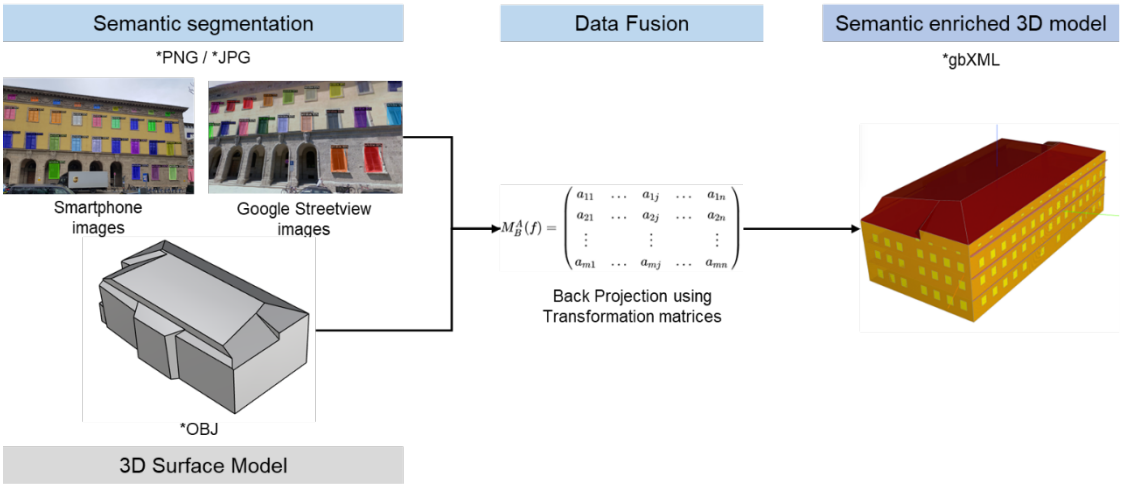
Modeling:
Mathematics:
Programming:
Science:

Software Lab:

2D Window Segmentation & Fusion with 3D Models for Energy Simulation

Description

Energy simulation applications require semantically rich 3D models as input. While there are various data sources for such 3D data [1], they rarely carry sufficient semantic information – so in n order to automatically create models for energy simulations, these models need to be enriched. Using Computer Vision methods, we can automatically extract relevant information from 2D images, such as the window faces using semantic and instance segmentation. While various solutions are available for the task of segmentation, even tailor-made for building-specific requirements such as window segmentation [2], usually this information found in 2D is not fused with 3D model. The general goal of this topic is to automatically fuse these different data and enable automatically enriched building energy models (BEM).



Task

Develop a pipeline to automatically fuse segmented 2D images of Windows to the related faces of a 3D surface model:

- Test existing Deep Learning approaches to semantically segment Windows in 2D images, such as DeepFacade or DeepWindows [2]
- Develop an approach to fuse window surfaces detected from the 2D images to the corresponding 3D surfaces in the model by projection, e.g. by parameters from data acquisition or estimated using photogrammetric methods
- Test the pipeline with several case studies from the TUM Stammgelände using different data sources (see [1])

Supervisor

Kasimir Forth & Florian Noichl, Computational Modeling and Simulation, kasimir.forth@tum.de/ florian.noichl@tum.de

References

[1] Forth, K.; Noichl, F.; Borrmann, A. (2023): LCA Calculation of Retrofitting Scenarios using Geometric Model Reconstruction and Semantic Enrichment of Point Clouds and Images. In: Proc. of the ASCE International Conference on Computing in Civil Engineering.

[2] Sun, Yanwei; Malihi, Shirin; Li, Hao; Maboudi, Mehdi (2022): DeepWindows: Windows Instance Segmentation through an Improved Mask R-CNN Using Spatial Attention and Relation Modules. In: IJGI 11 (3), S. 162. DOI: 10.3390/ijgi11030162.