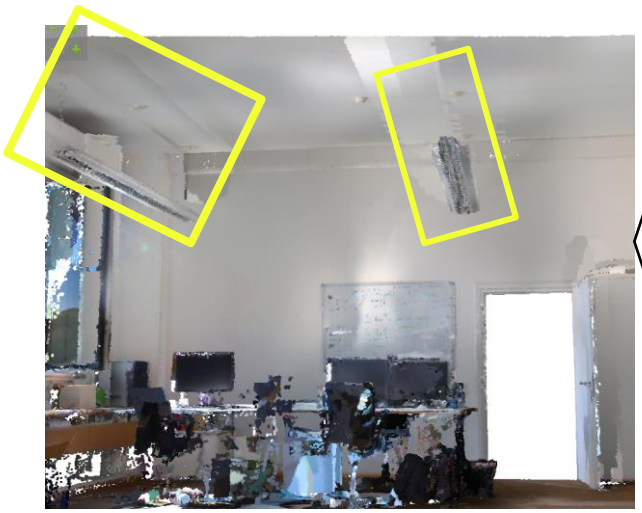
Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

Research internship or Master thesis:

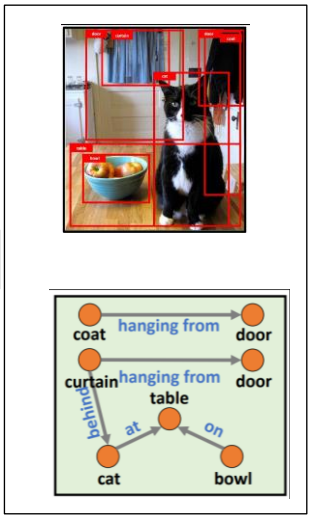
Using 2D scene graphs to enrich DT with topology

Description

Scan-to-BIM is a topic receiving close attention from researchers and industry practitioners. The reconstruction process, however, focuses primarily on identifying objects, assigning a semantic class, and reconstructing them individually. The topological relationships between th elements (e.g., "the lamp **hangs from** the ceiling" or "the fire extinguisher **is attached to** the wall") are often established by assumptions based on proximity. This becomes problematic if occlusions impede the proximity threshold.



Point cloud missing points between ceiling and lamps (proximity criterion not satisfied)



Scene Graph generation by Tang *et al.*, 2020

Scene Graphs are an important field of research aiming to improve capturing the content of images. For instance, instead of detecting "a girl with a dog" in an image, the scene graph method finds that "a girl is playing with a dog".
In this project, we aim to predict robust scene graphs on images of TUM hallways and offices and use the gained topological information to support the links between building elements in Scan-to-BIM. We will use pre-trained generic networks and fine-tune them on relevant building components such as walls, boards, door-signs, lighting, handrails, etc.

Task

- Perform a literature review of common scene graph predictors on images
- Retrain predictor with self-labelled images from TUM Campus with pytorch toolkit [1]
- Use the process of photogrammetric reconstruction to
    - Reconstruct 3D point clouds from images
    - Retrieve the 2D pixel-to- 3D point correspondences
- Generate a 3D geometric graph that includes the scene topology detected in 2D

Supervisor

Fiona Collins, TUM Chair of Computational Modeling and Simulation, fiona.collins@tum.de

References

Tang, K. *et al.* (2020) 'Unbiased Scene Graph Generation from Biased Training', *Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, pp. 3713–3722. doi:10.1109/CVPR42600.2020.00377.