Department of Aerospace and Geodesy
TUM School of Engineering and Design
Technische Universität München

CompleteRoof: Point cloud completion with deep learning (Student Research Assistant 8h/w)

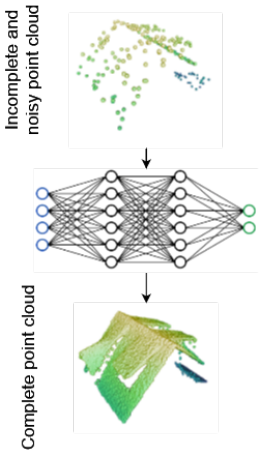

Figure 1: CompleteRoof: Tackle the task of creating a benchmark dataset for roof completion tasks, establishing baselines, and adapting SOTA networks.

Description Acquiring high coverage and high-quality point clouds has been a long-standing challenge in photogrammetry, remote sensing, and computer vision. In real-world scenarios, point cloud capturing sensors are prone to measurement noise and occlusions, frequently rendering the point clouds corrupted and incomplete. This phenomenon is particularly apparent when acquiring aerial-based point clouds of buildings, where roofs are often tree-occluded and noisy. Complete point clouds of buildings are pivotal to multiple downstream tasks, such as semantic 3D building reconstruction for solar potential analysis [1].

While there exist methods of completing 3D point clouds [2], the completion of 3D roofs remains in its infancy. They perform well on symmetrical shapes but are limited to more complex and highly occluded roof types. Notably, the current methods are primarily tested at the regional and city scales, neglecting the variability of roof types at a country-specific level.

Objectives In this project, you will be supervised by Olaf Wysocki (Photogrammetry & Remote Sensing) and work closely with Benedikt Schwab (Geoinformatics) and Dr Yan Xia (Computer Vision). This position is for 8 hours/week, starting in August/September until the end of the semester, March/April, with the possibility of extension; The joint publication at a top venue is foreseen. Your tasks will include:

- Acquiring open data point clouds, creating benchmark data;
- Adapting existing point cloud completion methods for the roof completion;
- Establishing baselines using the state-of-the-art methods for point cloud completion.

Requirements Sound programming skills in Python are required. Familiarity with libraries such as OpenCV, Open3D, and PyTorch is highly advantageous. Understanding machine learning, computer vision, and photogrammetry fundamentals is required. Student status, CV, and the current transcript of records are a must (send to olaf.wysocki@tum.de).

References [1] **Wysocki, O., Xia, Y.,** Wysocki M., Grilli, E., Hoegner, L., Cremers D., and Stilla, U. Scan2LoD3: Reconstructing semantic 3D building models at LoD3 using ray casting and Bayesian networks, CVPRW 2023, https://shorturl.at/qzSX0

[2] Lo, KSH., Peters, J., Spellman, E., RoofDiffusion: Constructing Roofs from Severely Corrupted Point Data via Diffusion, ECCV 2024, https://arxiv.org/pdf/2404.09290

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