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Master's Thesis Proposal

Generating Semantically Enriched Building Representations using Generative Deep Learning Methods

Description Progress in Generative Deep Learning has diversified the range of available models capable of generating various types of objects. Recently introduced models are capable of producing highly diverse shapes [1]. However, such newly generated objects commonly offer limited semantic information. A model that is capable of generating semantically enriched volumetric representations of buildings has numerous applications, particularly in the context of urban planning. Incorporating conditioning mechanisms could make such a model applicable to the field of scenario generation.

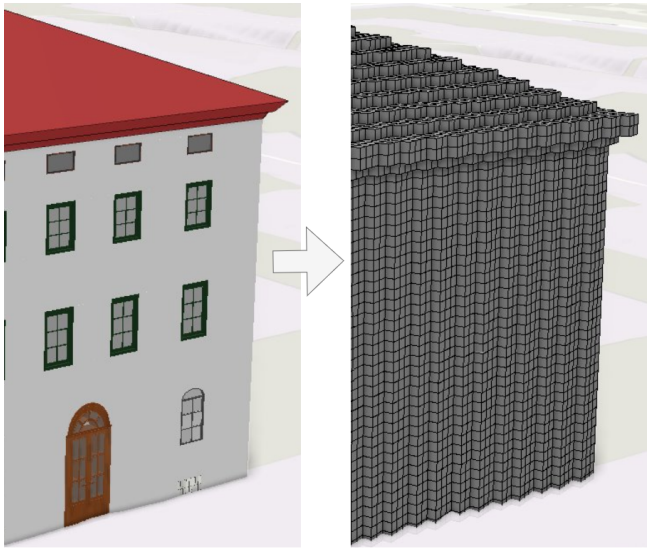

Figure 1: CityGML building model (a) and corresponding voxel representation (b)

This thesis aims to train a deep-learning model for generating semantically enriched voxel representations of buildings. This will involve curating a training dataset by developing a pipeline for deriving semantically enriched voxel representations from existing semantic city models [2]. Key attributes such as the corresponding city and city district, the building type and the number of stories, will be encoded to allow for further processing within neural networks. After investigating available Deep Learning models for generating volumetric 3D representations, a selected model will be augmented to incorporate the encoded semantic information for conditional object generation. Besides assessing the quality of the generated building representations, it is crucial to explore the diversity within generated outputs.

Requirements Sound programming skills in Python and Understanding the fundamentals of machine learning are required. Familiarity with Linux OS is highly advantageous. Hands-on experience with machine learning and cloud computing would be highly beneficial.

References [1] Wu J, Zhang C, Xue T, Freeman WT, Tenenbaum JB (2016): Learning a Probabilistic Latent Space of Object Shapes via 3D Generative-Adversarial Modeling. NIPS 2016. arXiv:1610.07584

[2] Wysokci O, Schwab B, Willenborg B, Knezevic M (2024): Awesome CityGML. https://github.com/OloOcki/awesome-citygml. Accessed: 20.02.2024

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