Lehrstuhl für Geoinformatik

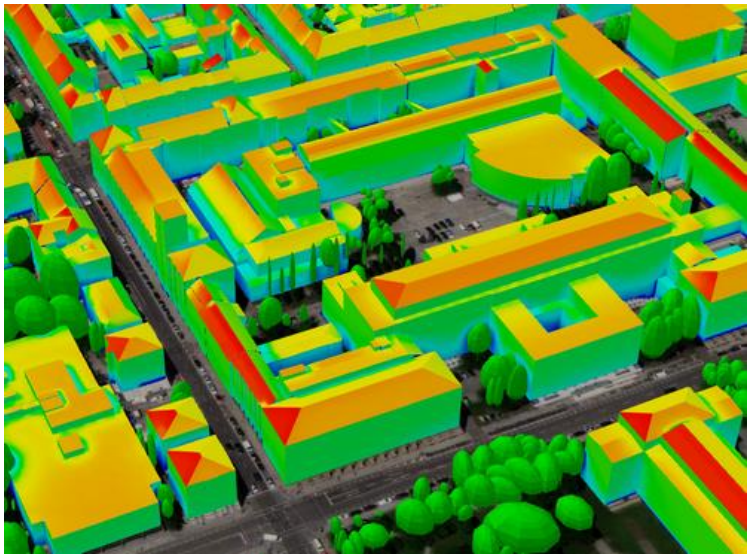
Lehrstuhl für Fahrzeugtechnik

Proposal Master's Thesis

Large-scale identification of PV potentials with semantic 3D city models and AI methods

Due to the climate problem, one of the primary goals of the German government is to optimize the energy and transport sectors. In this context, the coupling of the two sectors can offer synergies that compensate for the disadvantages of individual solutions (grid stability, costs, etc.). A current topic is, for example, the provision of a charging infrastructure for e-mobility that is fed with locally generated solar energy.

Semantic 3D city models based on the open source standard CityGML represent the geometry, appearance as well as thematic and topological aspects of city and landscape objects in a structured data model. CityGML city models are now available throughout Germany and provide an ideal basis for a variety of analysis methods, such as large-scale simulation of solar irradiance (see fig. on the left).
An existing problem here is that details relevant for the analysis, such as roof structures, are not yet included in the models. This can be remedied by existing AI methods that are able to recognize roof structures in aerial images (see fig. right).



The aim of this master thesis is to link an existing simulation tool for solar irradiance with an existing AI method for the detection of roof structures in order to enable optimizations for both approaches. In the course of the work, it will be investigated and quantitatively evaluated what added value the linkage brings to both methods.
The exact geometry representation of the city model will be used to improve the learning process of the AI by pre-segmenting roof surfaces. Subsequently, the roof structures recognized by AI are to be transferred to the 3D city model in order to improve the accuracy of the solar potential analysis. The entire analysis workflow will be encapsulated in Docker containers and implemented in a modern cloud environment.

Requirements: Sound programming skills in Python, basic knowledge of geodatabases (Post-greSQL/Post-GIS). First experiences with Deep Learning and GIS software are advantageous. Willingness to work in a team (possibility of cooperation with a thematically related master thesis exists).

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