Forschungsprojektarbeit des Profils Data Science

Automated Rooftop PV Systems Planning

Ausgangslage

Demand for photovoltaic (PV) systems in Europe is high. However, conducting a detailed analysis of potential locations can be time-consuming. The Swiss federal government provides a map (see sonnendach.ch) which shows the approximate suitability of every building roof in Switzerland for PV systems. This information is based, among other things, on the 3D building model swissBUILDINGS3D 2.0 which provides size, exposition and slope of the rooftops, and the assumption of an average occupancy rate that can be used for placing solar panels. Details of roof structures such as chimneys, dormers or air-conditioning systems are not considered. However, these can take up space or can cast shadows. As result, the estimate by sonnendach.ch is rough and cannot be used used as a basis for planning PV systems.

In a research project in collaboration with the company Enshift AG, we explore possibilities to significantly improve the quality of the estimate for the occupancy rate for a given rooftop so that it can be used for planning PV systems.

Zielsetzung

The goal of this master project work is to study, design and implement modeling approaches for more accurately predicting the suitability of given rooftops for PV installations. Different architectures for segmentation models will be explored to map (2D-)details of the rooftop situation, (LiDAR) point cloud data will be used to embed these details into 3D. All data (aerial imagery and LiDAR point clouds) are publicly available from Swisstopo.

Required Skills

Basic skills in machine learning, deep learning, and image processing; interest in data analysis (data wrangling, data exploration, statistical analysis, visualization), expertise in programming (Python).

Teilaufgabe für den Masterstudierenden

We see the following project phases:

P7: Evaluating state-of-the-art techniques for mapping rooftop details in 2D. Specific focus is given to techniques for mapping small details.

P8: Evaluating the use of pretrained models and pretraining strategies (such as self-supervised learning) in combination with (lots of) unlabeled data.

P9: Development of an approach to combine the mapping of high-resolution 2D details with coarse-grained 3D models mapped from point-cloud data.

Studienart: [x] Full-time study

                         [x] Part-time study (50%)

Arbeitsort: Windisch

Advisor: Prof. Dr. Martin Melchior (I4DS/FHNW)