

# Master's Thesis Proposal

## Detection of bicycle racks from geodata using Deep Learning



The bike infrastructure department of the City of Munich is responsible for the public bike racks and is looking for a way to inventory them. This involves more than 34000 bicycle stands at more than 1000 locations, so manual data collection would be very time-consuming. Therefore, an automated procedure is being sought that recognizes and possibly classifies the bicycle racks in high-resolution aerial photographs. The goal is to store the position, size and, if possible, type of the bicycle rack in a geo-database. Since aerial photographs of Munich are taken at least every two years, this procedure is to be re-

peated when more recent aerial photographs are available. The ArcGIS Pro software offers a "Deep Learning" tool set, which includes a function "Detect Objects using Deep Learning", as well as functionality for training Deep Learning models. ArcGIS Pro is used as standard software at the City of Munich and therefore shall be used in this thesis.

The goal of the thesis is to develop an automated procedure for the recognition and, if possible, classification of bicycle racks based on the mentioned functionality of ArcGIS Pro. It shall be examined whether the extension of an existing deep learning model (RGB data only) or a newly trained model using infrared data (CIR) and a normalized digital surface model (difference between DSM and DTM) is more appropriate. For the creation of training data, support can be provided by the bike infrastructure department of the City of Munich.

Essential steps are the familiarization with the tool set, ArcNotebook and Python as programming language, the training of the model on high performance computers of the LRZ using data (aerial photograph, CIR, DOM, DGM) from an earlier epoch, the application of the deep learning procedure on current data.

Knowledge in Python programming is required to accomplish the work. Knowledge of ArcGIS Pro and Deep Learning is an advantage, but can also be acquired during the course of the thesis project.

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