Classification and quantification of city districts in Germany

CityGML building models as primary data for a novel approach of spatial analysis

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Abstract

The project presented here has the aim to introduce CityGML building models as primary data for analyses related to the urban fabric of city districts in Germany, which means the composition of buildings in delineated subspaces of German cities. The building models are processed by the use of a PostgreSQL/ PostGIS geospatial database. Spatial and non-spatial data analyses are performed either in the spatial database or using R connecting to the PostGIS database. The poster presents preliminary results showing the use of non-spatial and spatial clustering analysis algorithms for the building variables and a first idea how to classify and quantify city districts in Berlin, Germany.

Project Background

Archetype city districts and settlement structures in Germany have been defined for various reasons (e.g. for increasing the efficient use of energy for heating of buildings) during the last decades. Although the defined settlement structures were applicable for the examination of specific problems, none of the building focused definitions allows for a generalization without major limitations due to a lack of representativeness of the definitions' underlying data. As a result of the German National Spatial Data Strategy, the availability of 3D building models for all German cities may help to overcome this shortcoming and forms the basis for the presented work in progress.

Aim and Scope

The overall aim of the project is to develop a novel approach for the definition of archetype districts for German cities on the basis of 3D building models (LoD2) and further cadastral data. Whereas others use geospatial data and building models for building energy modelling (cf. [1]), this approach uses the limited number of available building information without additional, energy related estimations and modelling.

Methodology

The developed method is using mathematical and statistical algorithms for non-spatial and spatial data classification, such as clustering methods, to identify and quantify building archetypes and district archetypes. The geospatial data, which was provided by the Federal Agency for Cartography and Geodesy [2] is processed efficiently by the use of a PostgreSQL/PostGIS geospatial database with the 3D City Database and its importing routine [3]. For the non-spatial data analysis, a database connection between the software R and the spatial database is established. Spatial analyses are performed either in R or directly in the PostGIS database. Hereby, the method development builds upon experiences of other projects on clustering in the urban context (cf. [4]).

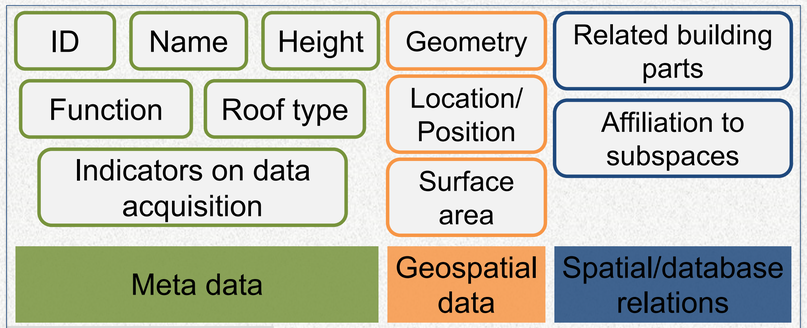

Figure 1: Building variables

Preliminary Results

While the development of the overall method is still work in progress, preliminary results for the method development are presented. Figure 1 gives an overview of the available spatial and non-spatial variables of the LoD2 buildings in German cities. At the moment, most promising is an iterative process resulting in delineated city subspaces corresponding to city districts:

1. **Non-spatial clustering of buildings**
2. **Agglomeration of building data on building block level**
3. **Non-spatial clustering of building blocks**
4. **Unification of neighboring blocks with a similar composition of buildings**

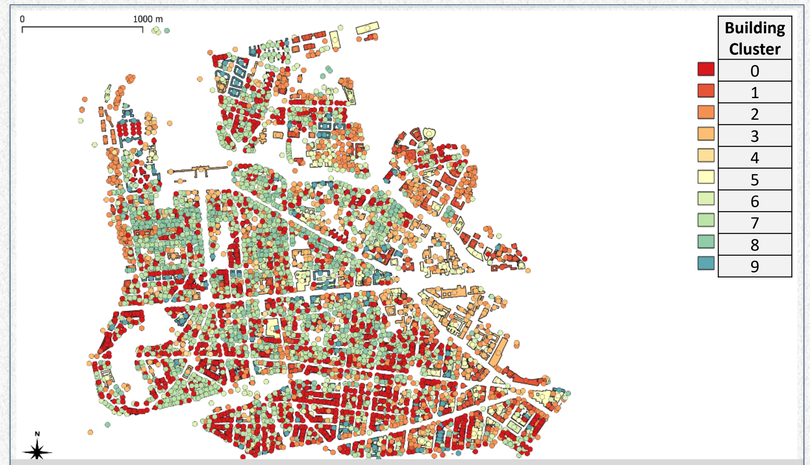

Figure 2: Non-spatial clustering of buildings by ground surface area and function (Cadastral data, Senate Department for Urban Development and Housing Berlin)

Conclusions & Future Plan

The preliminary results show that CityGML data can be used as a basis for clustering analyses with the aim to classify and quantify city districts in Germany (cf. Figure 2). However, major efforts still have to be made to a) examine the sensitivity of the method regarding input parameter sets when clustering as well as to b) ensure the robustness of the unficiation algorithm established for district creation from building blocks. Fruthermore, the impact of the CityGML data quality on the results has to be evaluated.

Works Cited

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