Automated reconstruction of 3D buildings in historic city centers from LIDAR data and 2D building footprints

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Automated reconstruction of 3D buildings

- Several methods exist where different data sources are combined (e.g. LIDAR + aerial images)
- Studies often based on “simple” contexts (e.g. American cities)
The idea

Observation

Accurate data set

Roof surfaces – almost always oriented towards the corresponding walls.

Swiss cadaster (legal value) – high precision, possibility to obtain the cadastral footprints for the date of a LIDAR flight

- Use the azimuth angles of a wall to find matching triangles of a TIN extracted from a LIDAR point cloud
Process – step 1

Generation of a DEM

Extraction of minimum altitudes for each footprint
Process – step 2

Fragmentation of the cadaster according to breaklines calculated from LIDAR (high differences in altitudes)
Process – step 3

Identification of flat roofs
(threshold of angles)
Process – step 4

Matching of the TIN triangles according to the walls’ azimuth angles

Forming surfaces
Process – step 5

Identification of ridge lines through points where surfaces touch
Process – step 6

Draping of 2D footprint on ridge lines
Process – step 7

Extrusion of facades
Results

City of Nyon
Conclusions

- **Automated process** that works for historic city center (some parameters need to be adjusted manually)

- **1-2 weeks** calculation time for 10,000 buildings

- **Problems:**
  - no awnings (yet)
  - classification problems of the point cloud
  - underground buildings
  - special buildings (e.g. castles or churches)
Perspectives

- **Improvement** of the automated process:
  - Awnings
  - Test with more dense point clouds
  - Automated detection of certain parameters (that are entered manually at the moment)
  - Comparison with a “ground truth”

- Use of 3D buildings as an input for a public participatory decision making platform
To Take Away:

Automated reconstruction based on LIDAR and 2D building footprints:

1. DEM and minimum altitudes
2. Cutting of 2D footprints
3. Flat roofs
4. Assembly of surfaces from triangles
5. Creation of ridge lines
6. Draping (roof creation)
7. Wall extrusion

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Thank you for your attention