heig-vd
HAUTE ÉCOLE
D'INGÉNIERIE ET DE GESTION
DU CANTON DE VAUD
www.heig-vd.ch

Hes·so
Haute Ecole Spécialisée
de Suisse occidentale

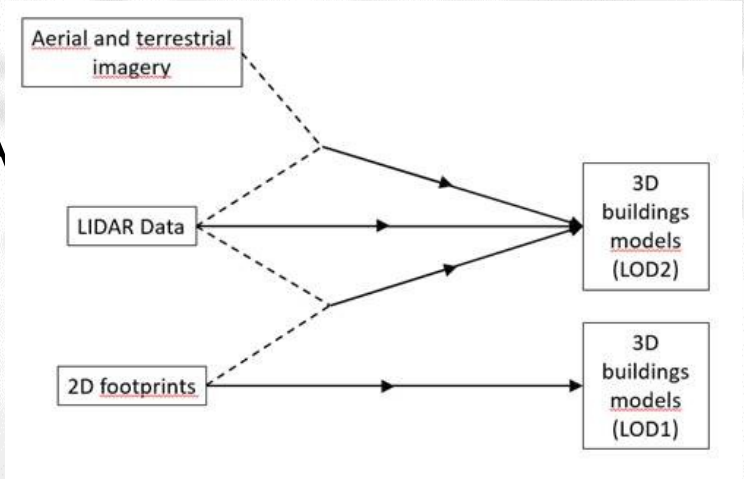
Automated reconstruction of 3D buildings in historic city centers from LIDAR data and 2D building footprints

3D GeoInfo 2018

Jens Ingensand, Marion Nappez,
Timothée Produit, **Thibaud Chassin**

Automated reconstruction of 3D buildings

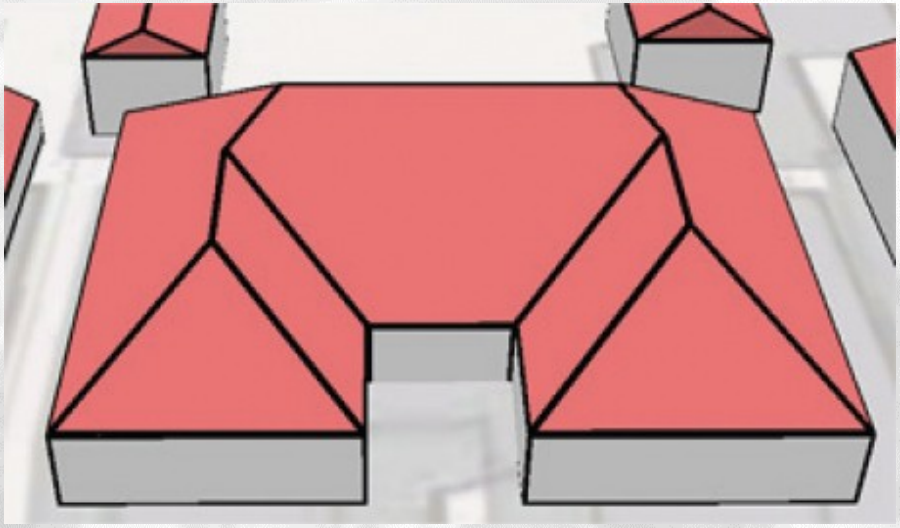
- Several methods exist where different data sources are combined (e.g LIDA + aerial images)
- Studies often based on "simple" contexts (e.g American cities)



vs

The idea

Observation



Roof surfaces – almost always oriented towards the corresponding walls.

+

Accurate data set

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

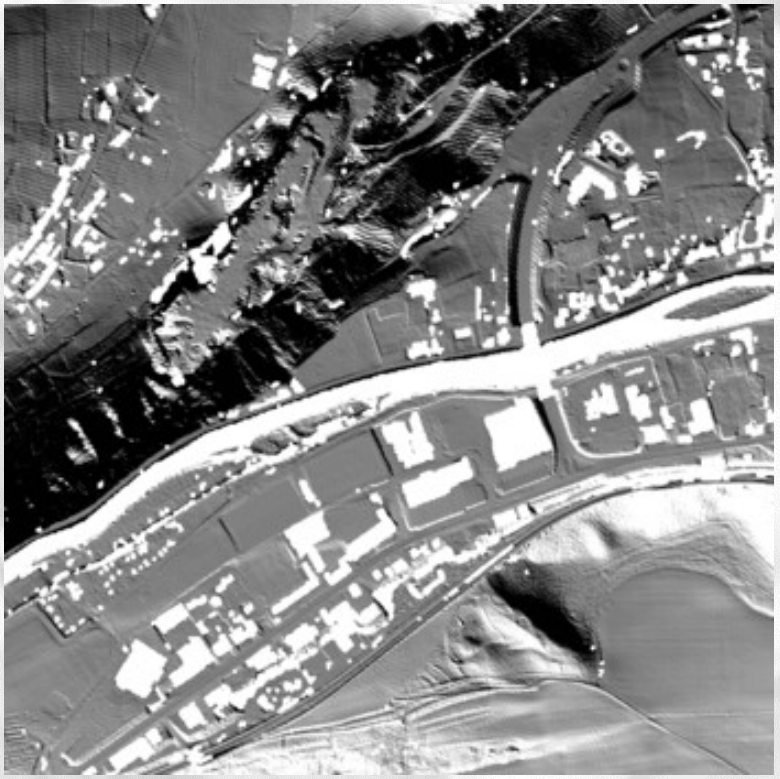
➢ **Use the azimuth angles of a wall to find matching triangles of a TIN extracted from a LIDAR point cloud**

Process – step 1

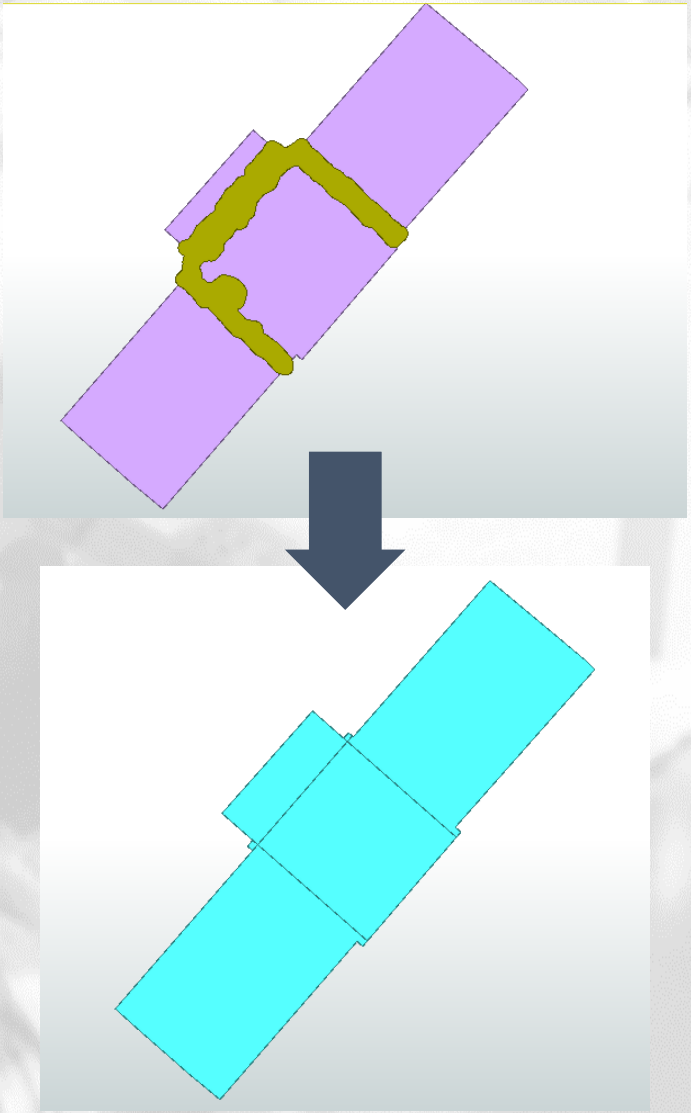
Generation of a DEM

+

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

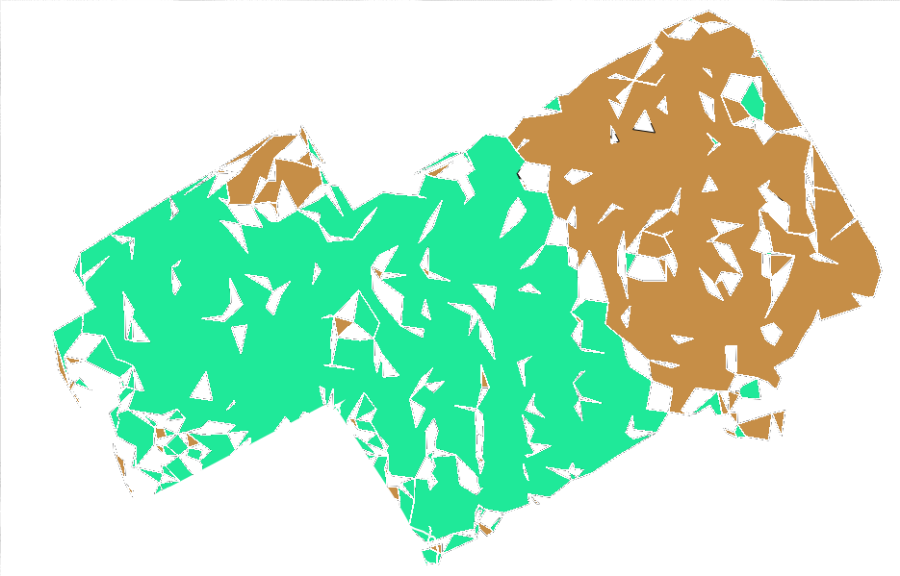
Identification of flat roofs
(threshold of angles)

Process – step 4

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

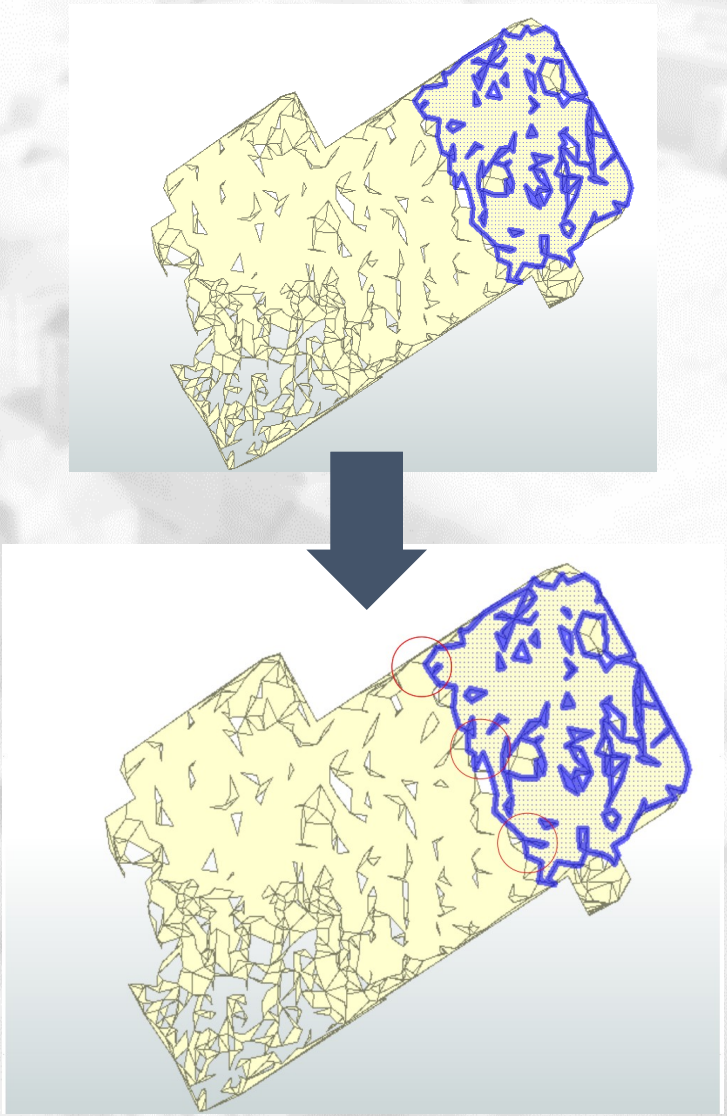
=

Forming surfaces



Process – step 5

Identification of ridge lines through points where surfaces touch

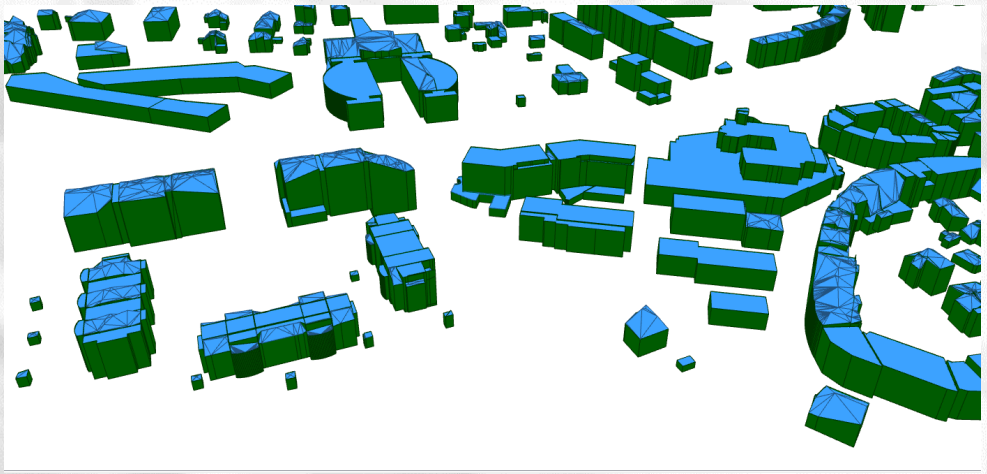


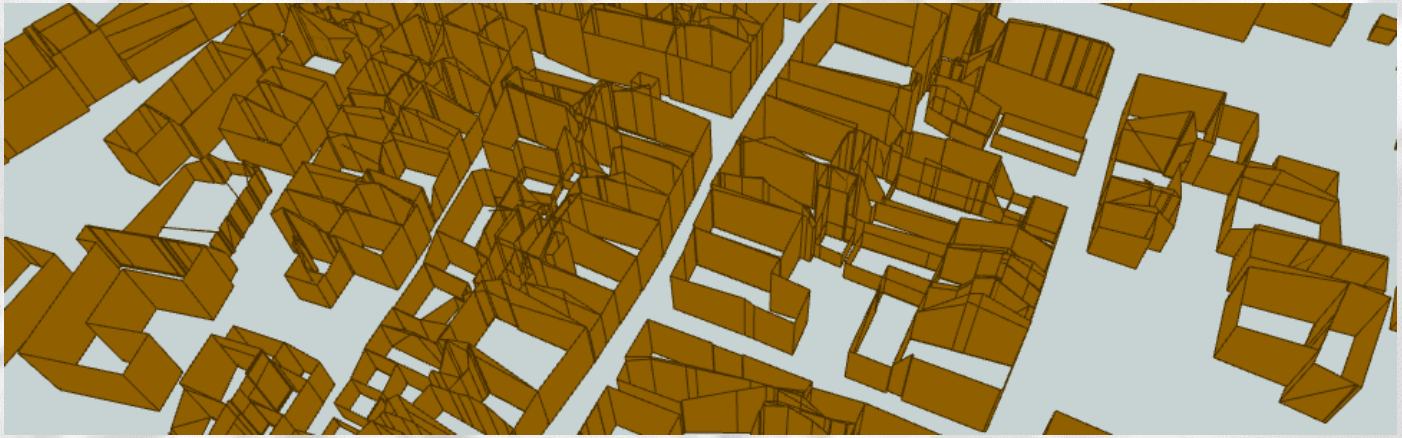
Process – step 6

Draping of 2D footprint
on ridge lines

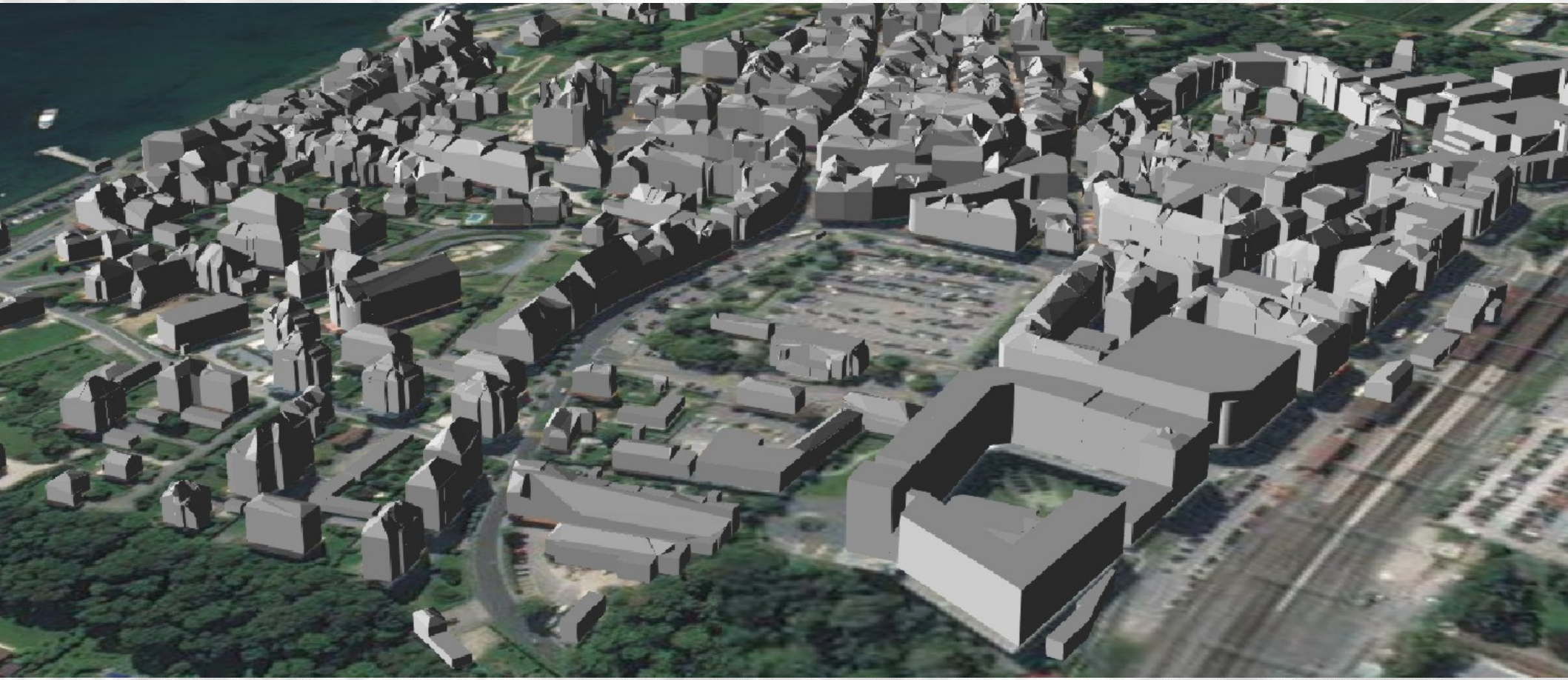
Process – step 7

Extrusion of facades





Results



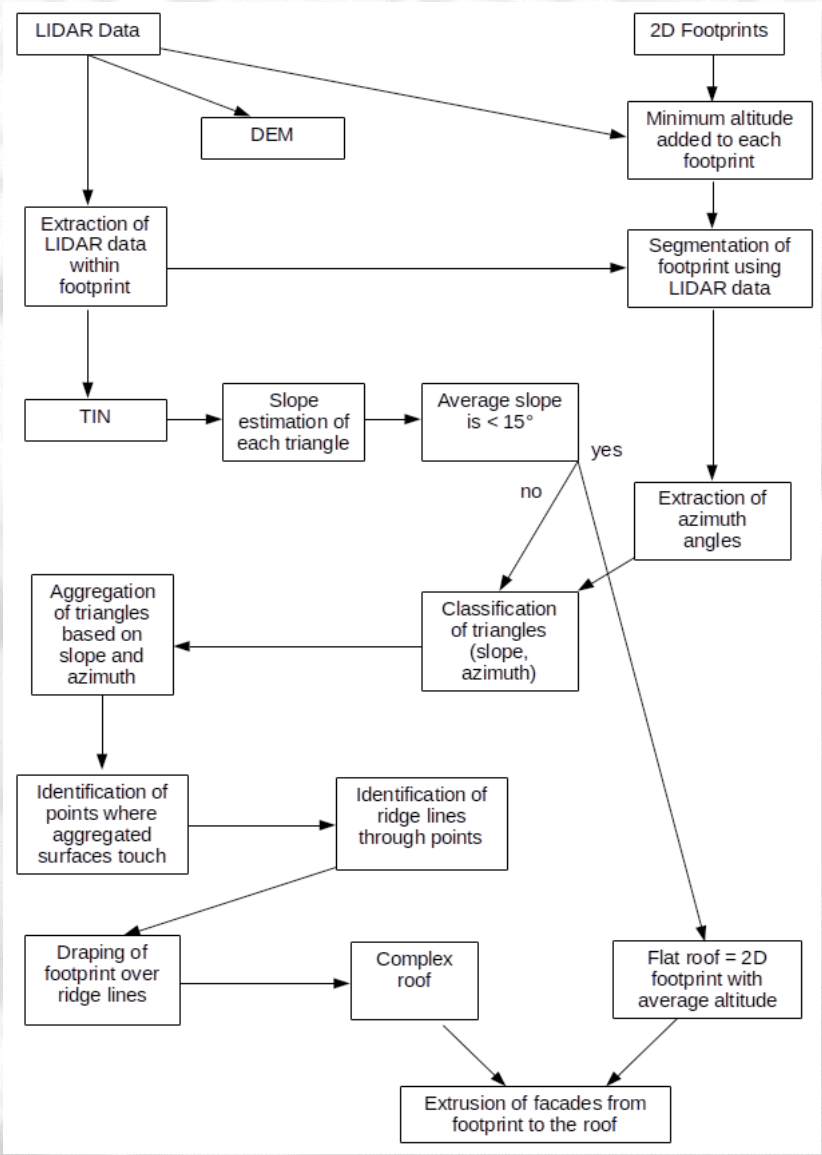
City of Nyon

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

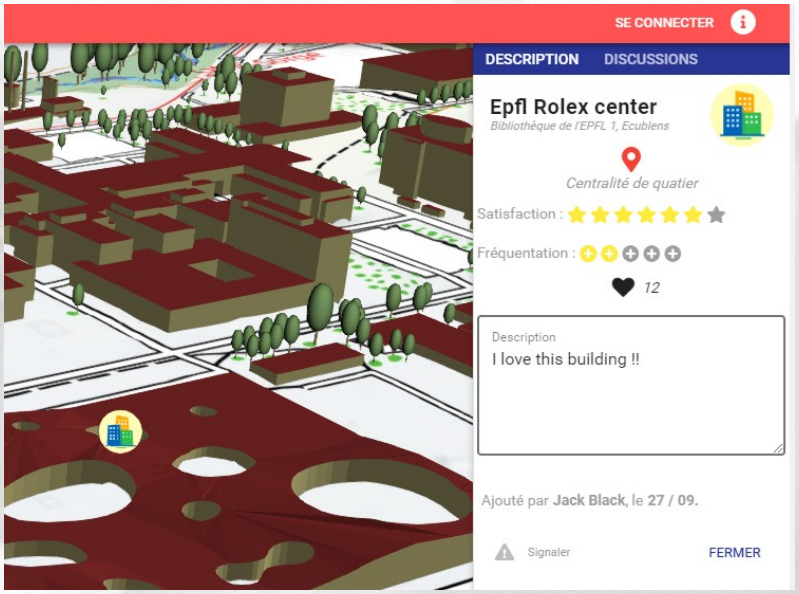
- **Problems**:
  - no awnings (yet)
  - classification problems of the point cloud
  - underground buildings
  - special buildings (e.g. castles or churches)



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



Thank you for your attention

Thibaud Chassin
PhD Student

thibaud.chassin@heig-vd.ch

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