The proposed method for a 3D semantic labeling uses supervised machine learning based on features extracted from LiDAR point-attributes, textural analysis, and geometric attributes:

- The used LiDAR point-attributes are intensity value, a return number and a number of returns.
- Textural properties are acquired by applying methods LoFS (Locally Fitted Surfaces) [1, 2], k-NN (k-nearest neighbors) and with an extraction of verticality ratio within the local neighborhood of LiDAR points.
- Geometric attributes are achieved with DMP (differential morphological profiles) [1, 3] and top-hat operators [4].

In order to obtain a 3D semantic labeling, a multiclass machine learning with an OvO (One-vs.-One) strategy is applied, where for each instance of machine learning, a genetic algorithm is applied in order to select only the relevant attributes for the process of learning.

Authors: Robi Cvirn, Denis Horvat, Domen Mongus

Bibliography

[1] D. Mongus, N. Lukač and B. Žalik, "Ground and building extraction from LiDAR data based on differential morphological profiles and locally fitted surfaces," *ISPRS Journal of Photogrammetry and Remote Sensing,* vol. 93, pp. 145-156, 2014.

[2] D. Horvat, B. Žalik and D. Mongus, "Context-dependent detection of non-linearly distributed points for vegetation classification in airborne LiDAR," *ISPRS Journal of Photogrammetry and Remote Sensing,* vol. 116, pp. 1-14, 2016.

[3] D. Mongus, N. Lukač, D. Obrul and B. Žalik, "Detection of planar points for building extraction from LiDAR data based on differential morphological and attribute profiles," in *ISPRS Workshop on 3D Virtual City Modeling*, Regina, Canada, 2013.

[4] D. Mongus and B. Žalik, "Parameter-free ground filtering of LiDAR data for automatic DTM generation," *ISPRS Journal of Photogrammetry and Remote Sensing,* vol. 67, pp. 1-12, 2012.