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Procedure for buildings and trees detection

1. LiDAR filtering

The gridded DSM with 0.25m resolution is filtered firstly in order to find the non-ground objects. These objects include buildings, trees, vehicles and so on. Here, we used a progressive morphological filter proposed by Zhang, Chen et al. (2003). It gradually increases the window size of the morphological filter and use difference threshold to determine the object. In our case, the parameters are set as following:

$$\begin{aligned} \text{window size: } & 1 - 200 \text{ (in 20 steps)} \\ \text{difference threshold: } & \text{window size} \times 0.05 \end{aligned}$$

2. Features selection

Both DSM and mosaic image are used to generate the features for classification. The three bands (IR, R and G) of image are directly used for classification, while the DSM data is used to generate morphological profile and contextual information. The morphological profile is derived similar to Benediktsson et al. (2003). Here, we used the opening operator to process the DSM with different structuring elements. The changes brought to the DSM by the opening operators are then stored as morphological profile. The contextual information is generated by simple pixel comparison [e.g. Lepetit, V. and P. Fua, 2006]. For each pixel, we randomly selected two nearby pixels and make the difference between them.

3. Classification using random forest

We then use random forest to classify the objects based on the features selected on step 3. Here, we are only interested on extracting buildings and trees. Some points from buildings and trees are firstly selected to train the random forest. Then, we input all the object points to determine which class they belong to.

4. Post-process

We finally apply a majority analysis to smooth the classified images. The class type of each point is replaced by the major class of its 11×11 neighbor points.

References:

Zhang, K., S.-C. Chen, et al. (2003). "A progressive morphological filter for removing nonground measurements from airborne LIDAR data." *IEEE Transactions on Geoscience and Remote Sensing*, 41(4): 872-882.

Benediktsson, J. A., J. A. Palmason, et al. (2005). "Classification of hyperspectral data from urban

areas based on extended morphological profiles." IEEE Transactions on Geoscience and Remote Sensing, 43(3): 480-491.

Lepetit, V. and P. Fua (2006). "Keypoint recognition using randomized trees." IEEE Transactions on Pattern Analysis and Machine Intelligence, 28(9): 1465-1479.