PROCESSING OF A POINT CLOUD FOR A GEOMORPHOLOGICALLY HIGH QUALITY DEM

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Abstract

The aim of the study was to generate a high and homogeneous quality digital elevation model (DEM) as a 2.5D surface from point cloud: the DEM with the high level geometrical (numerical), geomorphological (shape), and semantic quality properties, and with the relevant high resolution. The lidar point clouds captured with airborne laser scanning (ALS) provide considerably more information about the terrain surface than most data sources in the past. This rich information is not simply accessed and convertible to a high quality DEM surface.

Main steps of DEM generation from the lidar point cloud are well known. Results depend on chosen methods, algorithms, parameters and especially on the different aspects of the data quality. The particular circumstances of this study are the areas which are covered with dense vegetation where leaves were present on the most trees. This makes extra difficulties for the DEM generation. We focused on extraction of terrain (bare earth) points from point cloud using a number of different filtering techniques accessible by freeware.

The proposed methodology consists of the following steps: (1) assessing advantages and disadvantages of different point clouds-filters across the study area, (2) regionalisation (division, classification) the area according to the most suitable filtering results considering the studied filters, (3) data fusion considering differently filtered point clouds and regions, and (4) interpolation with a standard algorithm.

The proposed and developed methodology uses techniques based on GIS-analysis, DEM and image processing, and data fusion principles. Numerous algorithms for filtering were tested: elevation threshold with expand window (ETEW), progressive morphology 1D and 2D (Morph, Morph2D), maximum local slope (Slope), adaptive TIN densification (ATIN), hierarchical robust interpolation (HRI), multiscale curvature classification (MCC), and the LAStools filtering. The resulting DEM was fused using the following filters: MCC, HRI, and the LAStools filtering.

The resulting DEM fulfils geometrical (numerical), geomorphological (shape), and semantic quality properties. An important advantage of the proposed methodology is that the selected area and datasets properties are more holistically studied with applied expert knowledge and automated techniques, in order to generate a high quality DEM.

Keywords: data fusion, filtering, lidar, digital elevation/terrain model, DEM, quality assessment

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