

USE OF AIRBORNE LIDAR POINT CLOUDS TO GENERATE DIGITAL TERRAIN MODELS IN WOODED MOUNTAIN AREAS

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ABSTRACT: Terrain features like elevation, slope, aspect, and curvatures obtained from a digital terrain model (DTM) restrict the re-distribution of matter and energy on the Earth's surface and affect soil formation and vegetation development. Therefore, a high-precision DTM is needed to properly manage precious forest resources. The generation of DTMs from airborne light detection and ranging (LiDAR) point cloud data, often called "filtering", has become an effective method of terrain analysis or forestry investigation. However, it has been extremely difficult to automatically separate terrain and off-terrain points from LiDAR point cloud, especially for large wooded areas of varied terrain characteristics. The elevation error would increase with increasing terrain slope and the accuracy of derived DTM coincides with the gross canopy density classes. Thus, much more attention has been paid in recent years in developing efficient and practical filtering algorithms for DTM generation in wooded areas.

This paper addresses the problem of automated DTM generation in wooded mountain areas using airborne LiDAR point cloud data. In our method, a raw LiDAR point cloud is first divided into a series of voxels by a given size of a cross-section window. Each voxel is further sectioned evenly into two components along the X and Y directions, respectively. Then, laser intensity, multi-return and height variation data are utilized to remove a part of the off-terrain points from each three-dimensional (3-D) half voxel. Slope and distance thresholds are applied to search terrain points in each section plane by projecting a 3-D half voxel onto a two-dimensional (2-D) plane. Finally, the accuracy of DTMs is adjusted by merging or intersecting filtering results of four cross-section planes based on users' need. The results obtained with different datasets demonstrated that our method is particularly suited to the generation of DTMs in densely forested mountain areas.