Automatic Classification of Raw Lidar Point Clouds into Ground and Non-Ground Points

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LiDAR (Light Detection And Ranging) is a modern remote sensing technology which can provide accurate elevation data for both topographic surfaces and above ground objects. Derivation of accurate digital terrain models is one of its important applications. Because for many applications such as generation of contour lines for topographic maps, road engineering projects and flood modeling, it is required to derive accurate DTMs from the ground points. DTM can be produced by resampling extracted ground points from LiDAR data. The extraction of points representing the bare earth from point clouds acquired by airborne laser scanning is the most time consuming and expensive part in the production of digital elevation models. In recent years, many different approaches have failed at object complexities or require excessive computational time. This study presents a new rule based approach for automatic separation of ground and above ground points from raw LiDAR point clouds. The method entirely relies on the coordinates of points i.e is X,Y and Z of LiDAR data. Basically ground is a continuous surface. The main thing that can be recognized between ground points and objects points is their height difference which is larger than that from the ground points themselves. The point clouds are separated into 2D cells. The cell size was fixed (0.5m). Minimum Z value of each cell was stored and cells were replaced by 'NaN' string where the difference between minimum Z values of two neighboring cells were higher than the given threshold. The cell with higher Z value was replaced with 'NaN' string. Then these bounded objects were removed by replacing 'NaN' string. Ground points were extracted in four steps. In the 1st step, height threshold 5m above objects were removed and in the 2nd step height threshold 4.5m above objects were removed and then in the 3rd step 2.0m above objects were removed. All non-ground points were removed by considering height difference between objects and neighboring ground points. Finally, height difference more than 0.3m objects such as bushes were also removed from ground points. Both test sites i.e. Hermanni and Sennatti were classified accurately and efficiently. Five samples of Hermanni test site and two samples of Senaatti test site were used to check the accuracy of the classification. Each samples were taken with more than 90% accuracy in classification when grid size changed from 0.5m to 0.1m. Processing time increased when decreasing the cell size from 0.5m to 0.1m. By considering the processing time and accuracy of the classification, 0.5m cell size was the optimum for classification of LiDAR point clouds having density 7-9 points/m^2.

Keywords: classification, DTM, LiDAR, point clouds