BUILDING BOUNDARY EXTRACTION FROM AIRBORNE LIDAR POINT CLOUDS

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Abstract: Building boundaries, referring to the intersections of roof and wall planes, are important spatial features to be recorded in topographic maps and three-dimensional (3D) city models. Airborne LiDAR Point clouds provide adequate 3D spatial information for building boundary mapping. However, information of boundary features contained in point clouds is implicit. Although manual extraction of boundary features is possible with an interactive visualization environment of point clouds, it is preferable to an automatic process of building boundary extraction. This study focuses on developing an automatic algorithm of building boundary extraction from airborne LiDAR data.

Some difficulties can be encountered in extracting building boundary features from point clouds. First, airborne LiDAR points are not evenly distributed on building surfaces. Usually top surfaces, such as roofs, may have densely distributed points, but vertical surfaces, such as walls, usually have sparsely distributed points or even on points. It means that while plane features of roofs can be extracted appropriately, plane features of walls could be very vague for extraction. The intersections of roof and wall planes are, therefore, not clearly defined in point clouds. Second, building boundary features could also be fragmented or vague in point clouds due to many possible installations or facilities on a building roof, such as water tanks, decorations or parapets. Third, a building may have roofs in different stories or slopes. Under these circumstances, building outlines should be composed of boundary features extracted from point clouds in different heights. The proposed algorithm is particularly designed to overcome these problems.

Two major process steps are included in the algorithm. The first step is to extract building boundary points from point clouds, and then the second step is to form building boundary line features based on the extracted boundary points. In the first step, boundary points of coplanar point group and the first echo points of multi-return scan are selected as candidates of building boundary points. In the second step, methods of the Hough transform,

line fitting and line segmentation are applied to find line segments belonging to building boundaries. The test data in our experiments include a variety of buildings. The experiments are still on going, but the preliminary test results show the effectiveness of the proposed method. The algorithm still needs further modification of details and tune-up of parameters maximize the correctness and completeness of building boundary extraction. The overall analysis and report of the experiments will be presented in the full paper.

Keywords: Building boundary extraction, Airborne LiDAR data, Hough transform, Line fitting.