From Airborne Laser Data to Spatial Information: Object Reconstruction and Accuracy Analysis

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SUMMARY

Recent years have seen airborne laser scanning technology revolutionizing the way in which spatial data is considered. The direct acquisition of 3D information of the terrain and of object on the terrain allows adding the vertical dimension in geographic databases in a relatively direct manner. Nevertheless, as the potential of Light Detection and Ranging (LiDAR) technology is realized, accuracy concerns must receive growing attention. Accuracy can be roughly divided into two parts, internal system accuracy, which concerns the system biases and errors, and "external" accuracy, which concerns with how accurate geographic objects can be reconstructed and delineated. Several studies have been devoted to analyzing internal accuracy, however the external accuracy concerns and the interaction of LiDAR data with geographic databases has hardly been investigated.

Considering laser scanning systems as mean to generate geographic data, we study aspects of external accuracy of LiDAR data. The paper elaborates on two aspects: the ability to reconstruct the shape of objects, and the sources that influence the accuracy of their delineation. We focus in particular on the effect of the data sampling and on the accuracy of the reconstruction. The study uses real data but also simulated laser scanning patterns. The simulator we have constructed allows testing data acquisition with different parameters (e.g., flight pattern, data density) and provides an exact knowledge of the objects shape and their true position.

The paper presents a novel delineation algorithm that was developed to convert the point cloud into a geographic data, and provide a study of the influence of the data characteristics on the accuracy of the correctness of the reconstructed geographic objects. It demonstrate how using knowledge about features of the data acquisition system allow improving the accuracy of the reconstruction in comparison with using off-the-shelf data processing tools.

TS 38 – Using Laser Scanning in Engineering Surveys   1/13
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