High accuracy Digital Terrain Models Generation along Roads Using Mobile Laser Scanning Data

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SUMMARY

Transportation agencies in many countries require high-accuracy (2-20 cm) digital terrain models (DTMs) along roads for various transportation related applications. Compared to traditional ground surveys and aerial photogrammetry, mobile laser scanning (MLS) has great potential for rapid acquisition of high-density and high-accuracy three-dimensional (3D) point clouds covering roadways. Such MLS point clouds can be used to generate highaccuracy DTMs in a cost-effective fashion. However, the large-volume, mixed-density and irregular-distribution of MLS points, as well as the complexity of the roadway environment, make DTM generation a very challenging task. In addition, most available software packages were originally developed for handling airborne laser scanning (ALS) point clouds, which cannot be directly used to process MLS point clouds. Therefore, methods and software tools

to automatically generate DTMs along roads are urgently needed for transportation users.

This paper presents an applicable workflow to generate DTM from MLS point clouds. The entire strategy of DTM generation was divided into two main parts: removing nonground points and interpolating ground points into gridded DTMs. First, a voxel-based upward growing algorithm was developed to effectively and accurately remove non-ground points. Then through a comparative study on four interpolation algorithms, namely Inverse Distance Weighted (IDW), Nearest Neighbour, Linear, and Natural Neighbours interpolation algorithms, the IDW interpolation algorithm was finally used to generate gridded DTMs due to its higher accuracy and higher computational efficiency.

The obtained results demonstrated that the voxel-based upward growing algorithm is ivsuitable for areas without steep terrain features. The average overall accuracy, correctness, and completeness

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values of this algorithm were 0.975, 0.980, and 0.986, respectively. In some cases, the overall accuracy can exceed 0.990. The results demonstrated that the semiautomated DTM generation method developed in this thesis was able to create DTMs with a centimetre-level grid size and 10 cm vertical accuracy using the MLS point clouds.