Extracting Trees and Structure Parameters via Integration of LIDAR Data and Ground Imagery

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Abstract

Single-tree detection along road in urban area has been essential for various applications, such as monitoring tree survival, tree inventory, and evaluating tree damage. Therefore, detailed tree information, such as tree counts, tree heights, crown base heights, diameter at breast height (DBH), and tree biomass, is critical for the effective management and quantitative analysis of trees in urban area.
Automatic detection of trees, and their parameters using light detection and ranging (LiDAR) data has been widely employed. However, at the single-tree level along road in urban area, LiDAR data deposed the disadvantages such as space points, no texture information, so that the detailed tree parameters mentioned above cannot successfully be obtain at enough accuracy. This paper presented an integration of LiDAR data and ground mobile truck data. This development is driven by the enhanced capability of sensors, their diversity. The information obtained from ground-mobile truck images can be substantially complemented by the data from LiDAR, which provides a high-resolution representation of object surfaces in the form of a digital surface model (DSM). The advent of LiDAR technology prompted the development and application of tree-recognition methods dealing with height-measurement data from this type of sensor. However, some inherent difficulties arise when applying conventional pattern-recognition techniques to implement detection of individual trees. Varying tree heights and crown sizes, the absence or presence of leaves, the overlap of tree crowns in dense trees, and the variety of crown shapes are among the hindering factors.

This paper presents a comparison analysis of tree extraction from LIDAR data and ground-mobile truck data under the complicated urban environment. For the tree extraction from Lidar data, the DTM is generated from LIDAR data, non-ground points are extracted subsequently. Then, buildings will be removed using region-growing algorithm based on area threshold value, in which the gradient value is calculated at each point in order to use gradient threshold algorithm to obtain tree points. And finally, taking intersection set from region-growing segment and gradient threshold segment's results are final goal of tree extracting. For extraction of tree extraction from ground-mobile truck imagery, the traditional mobile mapping techniques are used for extraction, i.e., a stereo pair of imagery is used, and the stereo matching is implemented using feature matching method. Finally, the comparison analysis between two methods are conducted to summarize the advantages and disadvantages.

The initial results are

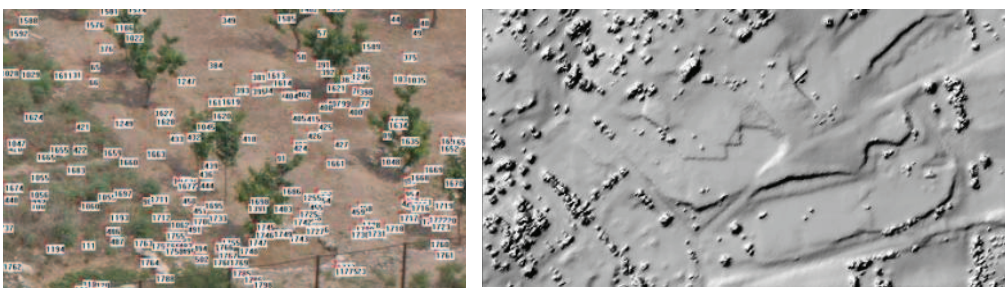

Fig. 1: The extracted tree from ground-mobile truck imagery data

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