Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XXXIX-B3, 143-147, 2012
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XXXIX-B3/143/2012/
doi:10.5194/isprsarchives-XXXIX-B3-143-2012

STRUCTURE LINE DETECTION FROM LIDAR POINT CLOUDS USING TOPOLOGICAL ELEVATION ANALYSIS

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Keywords: Detection, Automation, Analysis, Point cloud, LIDAR, Building, Model

Abstract. Airborne LIDAR point clouds, which have considerable points on object surfaces, are essential to building modeling. In the last two decades, studies have developed different approaches to identify structure lines using two main approaches, data-driven and modeldriven. These studies have shown that automatic modeling processes depend on certain considerations, such as used thresholds, initial value, designed formulas, and predefined cues. Following the development of laser scanning systems, scanning rates have increased and can provide point clouds with higher point density. Therefore, this study proposes using topological elevation analysis (TEA) to detect structure lines instead of threshold-dependent concepts and predefined constraints. This analysis contains two parts: data pre-processing and structure line detection. To preserve the original elevation information, a pseudo-grid for generating digital surface models is produced during the first part. The highest point in each grid is set as the elevation value, and its original threedimensional position is preserved. In the second part, using TEA, the structure lines are identified based on the topology of local elevation changes in two directions. Because structure lines can contain certain geometric properties, their locations have small relieves in the radial direction and steep elevation changes in the circular direction. Following the proposed approach, TEA can be used to determine 3D line information without selecting thresholds. For validation, the TEA results are compared with those of the region growing approach. The results indicate that the proposed method can produce structure lines using dense point clouds.

Conference Paper (PDF, 1517 KB)

Citation: Lo, C. Y. and Chen, L. C.: STRUCTURE LINE DETECTION FROM LIDAR POINT CLOUDS USING TOPOLOGICAL ELEVATION ANALYSIS, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XXXIX-B3, 143-147, doi:10.5194/isprsarchives-XXXIX-B3-143-2012, 2012.

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