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EDGE-BASED REGISTRATION FOR AIRBORNE IMAGERY AND LIDAR DATA

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Abstract. Aerial imagery and LIDAR points are two important data sources for building reconstruction in a geospatial area. Aerial imagery implies building contours with planimetric features; LIDAR data explicitly represent building geometries using three-dimensional discrete point clouds. Data integration may take advantage of merits from two data sources in building reconstruction and change detection. However, heterogeneous data may contain a relative displacement because of different sensors and the capture time. To reduce this displacement, data registration should be an essential step. Therefore, this investigation proposes an edge-based approach to register these two data sets in three parts: (1) data preprocessing; (2) feature detection; and (3) data registration. The first step rasterizes laser point clouds into a pseudo-grid digital surface model (PDSM), which describes the relief with the original elevation information. The second step implements topological analyses to detect image edges and three-dimensional structure lines from the aerial image and PDSM. These detected features provide the initial positions of building shapes for registration. The third part registers these two data sets in Hough space to compensate for the displacement. Because each building may have prominent geometric structures, the proposed scheme transforms these two groups of edges, and estimates the correspondence by the Hough distribution. The following procedure then iteratively compares two groups of Hough patterns, which are from an aerial image and LIDAR data. This iterative procedure stops when the displacement is within a threshold. The test area is located in Taipei City, Taiwan. DMC system captured the aerial image with 18-cm spatial resolution. The LIDAR data were scanned with a 10-point density per square meter using the Leica ALS50 system. This study proposed a 50 cm spatial resolution of PDSM, which is slightly larger than the point spacing. The experiment selected two buildings to evaluate the performance of the proposed scheme. The manually edited building boundaries from the stereo aerial images are the reference data for validation. Comparisons indicated that the registration procedure could adjust the displacement within 50 cm, which relates to PDSM resolution. These preliminary results also demonstrated the possibility of providing locations for building reconstruction.

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