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Street curb recognition in 3d point cloud data using morphological operations

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Accurate and automatic detection of cartographic-entities saves a great deal of time and money when creating and updating cartographic databases. The current trend in remote sensing feature extraction is to develop methods that are as automatic as possible. The aim is to develop algorithms that can obtain accurate results with the least possible human intervention in the process. Non-manual curb detection is an important issue in road maintenance, 3D urban modeling, and autonomous navigation fields. This paper is focused on the semi-automatic recognition of curbs and street boundaries using a 3D point cloud registered by a mobile laser scanner (MLS) system. This work is divided into four steps. First, a coordinate system transformation is carried out, moving from a global coordinate system to a local one. After that and in order to simplify the calculations involved in the procedure, a rasterization based on the projection of the measured point cloud on the XY plane was carried out, passing from the 3D original data to a 2D image. To determine the location of curbs in the image, different image processing techniques such as thresholding and morphological operations were applied. Finally, the upper and lower edges of curbs are detected by an unsupervised classification algorithm on the curvature and roughness of the points that represent curbs. The proposed method is valid in both straight and curved road sections and applicable both to laser scanner and stereo vision 3D data due to the independence of its scanning geometry. This method has been successfully tested with two datasets measured by different sensors. The first dataset corresponds to a point cloud measured by a TOPCON sensor in the Spanish town of Cudillero. That point cloud comprises more than 6,000,000 points and covers a 400-meter street. The second dataset corresponds to a point cloud measured by a RIEGL sensor in the Austrian town of Horn. That point cloud comprises 8,000,000 points and represents a 160-meter street. The proposed method provides success rates in curb recognition of over 85% in both datasets.