Automatic occlusion correction in car point clouds using bilateral symmetry

Jesús Balado[a] and Noelia Bazarra[b]

[a]Universidade de Vigo, CINTECX, GeoTech. 36310 Vigo, Spain

[b]Universidade de Vigo, Escola de Enxeñería de Telecomunicación, Departamento de Matemática Aplicada I. 36310 Vigo, Spain

Abstract

Symmetry is a common geometric feature in human-made objects. Urban objects are no exception and are guided by bilateral or radial symmetry. Symmetry has been used as a feature for object detection in images, although in many cases, the objects are not acquired in their entirety, so the symmetry detection is greatly complicated or not applicable. The same problem occurs in point clouds, Mobile Laser Scanning (MLS) technology allows acquiring 3D urban environments in precise and fast way and allows mapping the elements of the urban scene. Urban objects, although symmetrical, are often acquired partially.

This work studies the occlusions of urban objects and the relationship with the symmetry and the MLS acquisition trajectory. In the case of vehicles, objects with bilateral symmetry, a new automatic method is presented to correct the occlusions in vehicles by reflecting the point cloud with respect to the symmetry axis of the vehicle. The proposed method consists of three phases: (1) a quasi-axis symmetry is generated in the partially acquired object, (2) the point cloud is reflected, and (3) the input point cloud and the reflected point cloud are registered using the ICP algorithm. The method has been tested on data acquired with Terrestrial Laser Scanning to quantify the registration error and MLS for evaluation the results on large urban scenes.

Keywords: LiDAR; Mobile Laser Scanning; urban furniture; ICP algorithm; symmetry; occlusions