SURFACE MODELING BASED ON POINT CLOUD RENDERING USING TERRESTRIAL LiDAR DATA

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Abstract: Point cloud data are acquired using 3D scanner, such as terrestrial laser scanner and land-based mobile mapping system, in a surveying, mapping, structure maintenance, and environment monitoring. The latest 3D scanners perform a rapid and massive data acquisition. However, the massive data require huge processing time in data sharing, visualization and 3D modeling. Thus, we focus on a performance improvement of 3D modeling.

We propose a methodology to improve a performance in 3D surface modeling using point cloud data projected into a panoramic space. First, point cloud data are projected into a multi-layered panoramic range image. The multi-layered panoramic range image represents point cloud data in a spherical panoramic space to achieve a simplification of point cloud processing including a data browsing, viewpoint translation, and spatial interpolation. Second, triangular patches are generated from projected point cloud data by a patch-based triangulation using Delaunay division. Third, we estimate a normal vector on a visible face of each triangular patch from a sensor position or arbitrary viewpoint. Finally, the triangular patches are classified using the normal vectors to reconstruct polygonal surfaces, such as roads and walls.

We conducted an experiment to confirm a performance of our approach using one million points of point cloud data taken from a terrestrial LiDAR. The processing time for the point cloud projection and surface modeling via single-thread MATLAB programming was 915.0 s using Intel Core i7 3.40 GHz processor.

We confirmed that acquired 3D point cloud data with terrestrial LiDAR can be classified on 2D panoramic range image using estimated normal vectors. This classification is based on 2D image processing. However, we also confirmed that a result from proposed modeling was equivalent to conventional 3D modeling. Finally, we have clarified that our approach can improve workability in 3D modeling.

Keyword: 3D scanner, 3D modeling, multi-layered panoramic range image