

Exploring Regularities for Improving Façade Reconstruction from Point Cloud

Reflection of P5

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This thesis focuses on regularities, shared by within an object and among objects, to improve the quality of facade reconstruction from point cloud. There are three main objectives in the research. The first is to detect the wall and its holes, which represent existence of windows, intrusions or extrusions on the wall. Second, local regularities within one hole and global regularities shared among holes are explored. Last, the quality of the procedure is evaluated by testing two datasets. The two results both show good effects of applying regularities and good matching with original point cloud.

The topic of the thesis is strongly related to Geomatics program and it is inspired by many courses such as 3D modelling, GIS and sensing technology. The thesis also encourages me to learn new knowledge, such as C++, image and point cloud processing, and machine learning. These new knowledge is helpful and widely used in Geomatics.

The thesis utilizes the geographic data from LiDAR for reconstructing façade model. The façade model can be widely applied to disaster management, geodesign and location-based services. This thesis is sponsored by Company Cyclomedia. Their productions are famous and widely used in Geomatics filed.

The main contribution of this thesis in scientific field is that it proposes automatic procedures to identify and apply the regularities among holes in the wall. Literatures show that there are limited researches by exploring regularities for façade reconstruction from point cloud. The common regularities need to be examined and listed, and the correspondent procedures for identifying and applying these regularities need to be designed. The result of applying regularities shows that the procedures can improve quality of façade reconstruction.

The output of this thesis can contribute to the market of LOD3 building model. The LoD3 building model including windows, doors and balconies is very useful for various applications. The model can be used for serious game. For example, fire brigade can create serious game by employing LoD3 model for emergency training, as the buildings have detailed information about windows and doors. Furthermore, more and more real applications in society and companies need LoD3 model. For example, evaluating the efficiency of buildings by taking advantage of illumination of sunshine requires a detailed window representation in the building model. However, quality of LoD3 models reconstructed from point clouds automatically is not satisfying yet. Therefore, the real application based on it is limited. Even though our research does not solve all the problems affecting quality of façade reconstruction, the output of the research provides an automatic approach to make up the effects of poor data quality and imperfectness of recognition algorithms.