EGU21-1523
https://doi.org/10.5194/egusphere-egu21-1523
EGU General Assembly 2021

From Point Clouds to Surfaces: Overview on a Case Study

Kacper Pluta[1] and **Gisela Domej**[2]
[1]Technion–Israel Institute of Technology, Computer Science Department, Haifa, Israel
[2]Università degli Studi di Milano-Bicocca, Dipartimento di Scienze dell'Ambiente e della Terra, Milano, Italy

The process of transforming point cloud data into high-quality meshes or CAD objects is, in general, not a trivial task. Many problems, such as holes, enclosed pockets, or small tunnels, can occur during the surface reconstruction process, even if the point cloud is of excellent quality. These issues are often difficult to resolve automatically and may require detailed manual adjustments. Nevertheless, in this work, we present a semi-automatic pipeline that requires minimal user-provided input and still allows for high-quality surface reconstruction. Moreover, the presented pipeline can be successfully used by non-specialists and only relies commonly available tools.

Our pipeline consists of the following main steps: First, a normal field over the point cloud is estimated, and Screened Poisson Surface Reconstruction is applied to obtain the initial mesh. At this stage, the reconstructed mesh usually contains holes, small tunnels, and excess parts – i.e., surface parts that do not correspond to the point cloud geometry. In the next step, we apply morphological and geometrical filtering in order to resolve the problems mentioned before. Some fine details are also removed during the filtration process; however, we show how these can be restored – without reintroducing the problems – using a distance guided projection. In the last step, the filtered mesh is re-meshed to obtain a high-quality triangular mesh, which – if needed – can be converted to a CAD object represented by a small number of quadrangular NURBS patches.

Our workflow is designed for a point cloud recorded by a laser scanner inside one of seven artificially carved caves resembling chapels with several niches and passages to the outside of a sandstone hill slope in Georgia. We note that we have not tested the approach for other data. Nevertheless, we believe that a similar pipeline can be applied for other types of point cloud data, – e.g., natural caves or mining shafts, geotechnical constructions, rock cliffs, geo-archeological sites, etc. This workflow was created independently, it is not part of a funded project and does not advertise particular software. The case study's point cloud data was used by courtesy of the Dipartimento di Scienze dell'Ambiente e della Terra of the Università degli Studi di Milano–Bicocca.