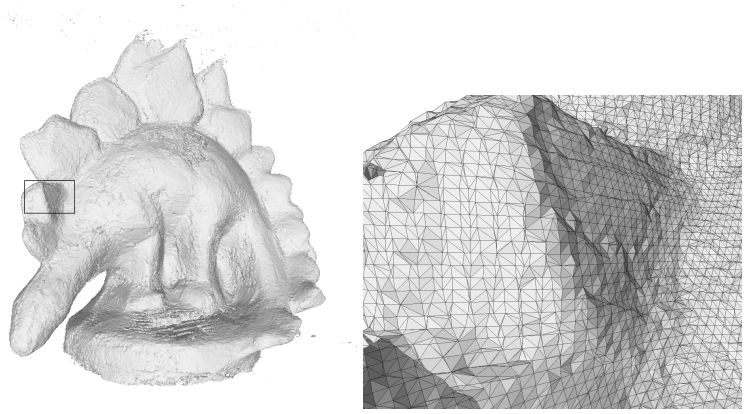
Mesh Post-Processing

Background

MultiView stereo reconstruction as well as the Fusion of range images [1] often employ the the Marching Cubes [2] algorithm for extracting triangle-meshes. A direct consequence of the uniform discretization of the 3d space through voxels is that every surface is represented by a set of evenly spaced triangles. In the case of planar surfaces this is highly ineffecient and leads to situations where far too many triangles are used to represent the surface without any gain in accuracy, degrading rendering performance and unnecessarily limiting the size of applicable models. An example of this can be seen in the figure below showing a zoomed in part of the mesh and the extracted triangles. To perform a mesh simplificaiton as well as many other operations for modifying the mesh, special data-structures like the Half-Edge data structure [3, 4] are well-suited.

Description

The task of this project is to implement a Half-Edge data structure [3, 4] in order to perform some post-processing operations on the extracted meshes. Various strategies for Mesh simplification can be implemented using the Half-Edge data-structure. The implementation of different strategies needs to be evaluated in terms of the mesh simplification quality and the reduction of size.



References

[1] B. Curless and M. Levoy, “A volumetric method for building complex models from range images,” in *SIGGRAPH ’96: Proceedings of the 23rd annual conference on Computer graphics and interactive techniques*, ACM Request Permissions, Aug. 1996.

[2] W. E. Lorensen and H. E. Cline, “Marching cubes: A high resolution 3D surface construction algorithm,” in *SIGGRAPH ’87: Proceedings of the 14th annual conference on Computer graphics and interactive techniques*, ACM Request Permissions, Aug. 1987.

[3] L. Kettner, “Designing a data structure for polyhedral surfaces,” in *SCG ’98: Proceedings of the fourteenth annual symposium on Computational geometry*, ACM Request Permissions, June 1998.

[4] K. Weiler, “Edge-Based Data Structures for Solid Modeling in Curved-Surface Environments,” *Computer Graphics and Applications, IEEE*, vol. 5, no. 1, pp. 21–40, 1985.

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BA

Research area:
Computer Vision, Computer Graphics

Programming language:
C++

Required skills:
Basic math knowledge

Language:
english

Date of submission:
21. März 2014

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