

Analyzing and fixing a 3D Mesh

Project Management and Software Development
for Medical Applications

General Info

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Project Abstract

The goal of the project is to use available libraries to a) compute a quality measure and characteristic for a given 3D mesh, b) identify problems/issues and c) fix it.

Background and Motivation

During a scanning process, it is not possible to acquire all parts of the scanned surface. Data are inevitably missing due to the complexity of the scanned part or imperfect scanning process. This create holes in the mesh, bad triangles, and numerous problems and issues.

A large number of algorithms [1] and [2] have been proposed in the current literature, which deals with fixing these problems and works very well. Libraries like CGAL [3] and Libigl [4] has already implemented a lot of these algorithms and are available online. In this project, we want to use these libraries and apply algorithms related to quality measure, characteristic and hole filling to our data.

Student's Tasks Description

- The student will have to get familiar with libraries like CGAL and libigl
- Apply algorithms to compute mesh quality and characteristic (eg. Curvature of a mesh, number of triangles, ...)
- Apply algorithms to fill holes and missing parts
- Create a GUI to combine these different algorithms (both libraries have GUI interface, can be used instead)

Technical Prerequisites

Necessary: know how to read a library documentation and use their algorithms

Necessary: C++, development under Ubuntu, know how to read code and modify it

Beneficial, but not required: basic knowledge of surfaces and meshes

References

- [1] Centin, Marco, and Alberto Signoroni. "RameshCleaner: conservative fixing of triangular meshes." (2015).2.
- [2] Zou, Ming, Tao Ju, and Nathan Carr. "An algorithm for triangulating multiple 3D polygons." Computer Graphics Forum. Vol. 32. No. 5. Oxford, UK: Blackwell Publishing Ltd, 2013
- [3] Jacobson, Alec, and Daniele Panozzo. "libigl: prototyping geometry processing research in C++." SIGGRAPH Asia 2017 courses. 2017. 1-172.
- [4] Fabri, Andreas, and Sylvain Pion. "CGAL: The computational geometry algorithms library." Proceedings of the 17th ACM SIGSPATIAL international conference on advances in geographic information systems. 2009