

Smooth Feature Lines on Surface Meshes

1 Goal of this project

In this project, the author will implement an algorithm to extract feature lines of 3D objects. The algorithm is described in *Smooth Feature Lines on Surface Meshes*. The author will construct a discrete differential geometry and use a filter to improve the stability and smoothness of the extracted lines.

2 Tasks

2.1 Discrete extremality

- Calculate the mean curvature and the shape operator at each edge e
- Calculate the vertex-based shape operator and the discrete principal curvatures
- Make consistent choice of sign of κ_i
- Remove singular meshes

2.2 Smooth discrete extremalities

2.2.1 A modification of Laplacian smoothing

- Compute the extremalities at each vertex of the mesh by using an arbitrary choice of sign of κ_i
- Compute the modified Laplacian for e_i using the cotan weights.

2.2.2 Spatial Fairing

A modification of the smoothing scheme presented in *Anisotropic Filtering of Non-Linear Surface Features*.

2.3 Trace feature lines in regular triangles

Compute ridge line segment for each regular triangle

2.4 Process singular triangles

Consider the adjacent regular triangles. Mark the endpoint of feature line segment in the common edge.

- Connect the endpoints, if there are 2 marked edges.
- Add a point: barycenter, and connect it with all endpoints, if there are 3 marked edges.
- Do nothing otherwise.

2.5 Remove small ridges by a threshold filter

Discard small and squiggly lines

3 Input

A 3D object in certain format (.off).

4 Output

Visualization of feature lines.