

## Practical Assignment 1

(Mesh and Surface Analysis and Surface Registration)

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### Task 1 (Mesh and Surface Analysis).

Create a tool for mesh analysis that computes

1. the genus of the surface,
2. the volume enclosed by the surface,
3. the number connected components of the mesh.

### Task 2 (Rigid Registration).

Create a tool that offers a basic iterative closest point registration of two meshes  $P$  and  $Q$ . The tool should first select a random set of vertices  $\{p_1, p_2, \dots, p_n\} \subset P$  (experiment with different values  $n$ ). Then iterate the following steps until convergence or stopped.

1. For every  $p_i$ , find the closest vertex  $q_i$  in  $Q$ . Brute force search is ok for our implementation.
2. Compute the median distance of the set of pairs  $S = \{(p_i, q_i) | 1 \leq i \leq n\}$ . Remove the all pairs  $\{p_i, q_i\}$  whose distance is larger than  $k$  times the median distance from  $S$ . Find a good value for  $k$  in your experiments.
3. Compute the optimal rigid transformation for the set  $S$  (from which the pairs have been removed in Step 2) and transform the mesh  $P$ .

Extend the basic implementation by offering the user to select the point-to-plane distance instead of the point-to-point distance.

### Task 3 (User Manual and Summary of Experiences).

Write a report that describes and illustrates

- the algorithms and functionality implemented
- how the implementation can be used
- your tests for correctness of the implemented algorithms
- your evaluation (parameter settings, comparing alternative, discussion of benefits and limitations) of the implemented methods

In addition, you can report on the division of labor amongst the group members.

### Required deliverables on Brightspace.

- For Tasks 1 and 2, provide the source files and example meshes. Pack all the files in one ZIP archive.
- The report should be one PDF file

Deadline: May 13, midnight.