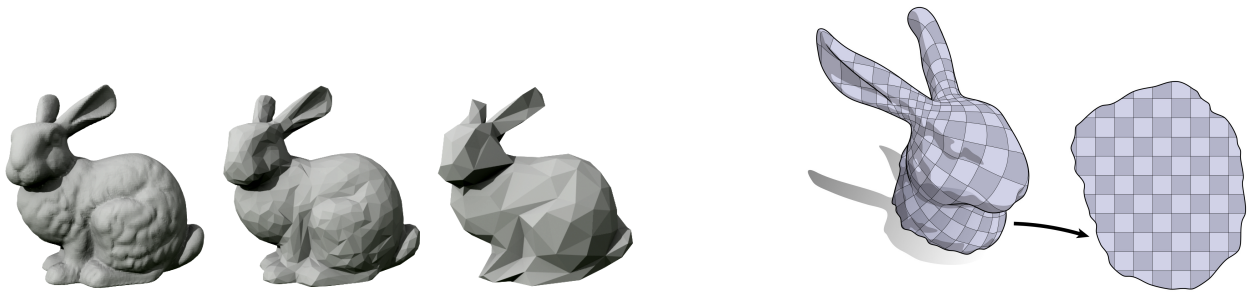
HEGL Seminar: Computational Discrete Differential Geometry & Geometry Processing

SoSe 2023

- **Organizer**: Dia Taha (dtaha@mathi.uni-heidelberg.de)
- **Time and location**: Friday from 9–11 AM. The location is TBA.
- **Language**: English
- **Registration**: Via **Müsli** (https://muesli.mathi.uni-heidelberg.de/)



Description

Discrete Differential Geometry is an interdisciplinary field that combines mathematics and computer science to study a discretized analog of Differential Geometry. It offers a powerful framework for discretizing and solving differential geometric problems, leading to various applications in computer graphics, geometry processing, topological combinatorics, robotics, and more.

Format

Aimed at bachelor's and master's students in mathematics and computer science, this seminar will begin with an overview of the principles and concepts of Discrete Differential Geometry. The second half of the seminar will delve into some theoretical work and practical applications of Discrete Differential Geometry, with the opportunity to work on (voluntary) hands-on computational projects. The first portion of the seminar will follow the excellent lecture notes by K. Crane available at https://www.cs.cmu.edu/~kmcrane/Projects/DDG/. A pool of relevant papers and project descriptions will be provided for the latter portion of the seminar. The projects will cover topics such as the geometric processing of data clouds, shape interpolation, 3d modeling of surfaces, surface reconstruction from data clouds, and more.

Topics

We will cover a proper subset of the following chapters from K. Crane's notes:

1. Combinatorial Surfaces
2. A Quick and Dirty Introduction to Differential Geometry
3. A Quick and Dirty Introduction to Exterior Calculus
4. Curvature of Discrete Surfaces

5. The Laplacian
6. Surface Parameterization

The topics assignment will be discussed in the first week of the Summer Semester.

Prerequisites

This seminar assumes basic knowledge of linear algebra and vector calculus. A background survey will be conducted before the start of the semester to tailor the seminar experience, including relevant applications and projects, to the participants' mathematical and computer science knowledge.