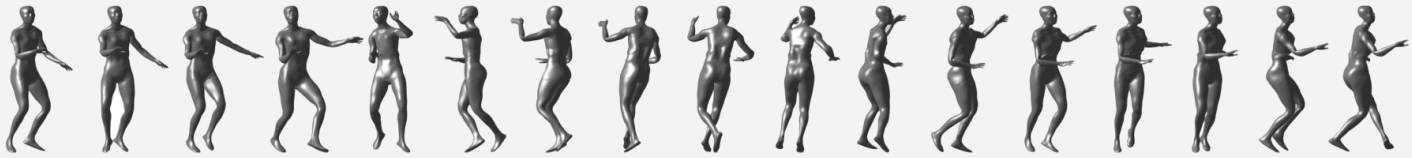
Student Project

Mesh Parameterization: Geometry Images and Videos

University of Zurich[UZH]



Topic

Many applications in computer graphics make use of fast and compact mesh processing techniques such as mesh parameterization. This concept builds a direct bridge between a 3D mesh and the domain of traditional Cartesian coordinates, allowing researchers to exploit a varied and long-existing supply of analytic and processing methods for $\mathbb{R}^2$ (bivariate calculus, compression, spectral decompositions, etc.).

Geometry images are a very compact form of mesh parameterization: vertices are mapped to a 2D square grid, and their (x,y,z) coordinates are encoded as RGB triplets therein. This has been used for compact mesh compression and efficient transmission. We would like to enrich this approach by **adding feature vectors to each vertex (pixel)**, thus providing a **compressible, easy-to-manipulate representation for mesh/shape matching**. Smooth mappings are tailored to preserve structure in the parameterized domain, so the input redundancies will still be compressible after the transformation into 2D.

Assignment

The project execution is three-fold. First, the student should get familiar with the concept of geometry images. Based on existing libraries, he/she will have to **obtain parameterizations** (possibly multipatch ones) of a range of mesh data sets. Second, **geometry videos** should be produced out of a set of time-varying meshes, ensuring that no temporal artifacts appear in the parameterization (i.e. the geometry video frames vary smoothly and coherently over time). If a correspondence between vertices across different timesteps is known (e.g. synthetic meshes), this should be exploited; otherwise the correspondence will have to be learned. Third, the student should **extract per-vertex shape descriptors**. He or she will use tensor-based methods (software will be provided) to **compress these features**, and then test the reconstruction quality with the proposed parameterization.

Requirements

Knowledge of linear algebra and computer graphics techniques (affine transformations, meshes, geometry processing). No restrictions on the programming language.

Work Load

- 25% theory
- 50% implementation
- 25% testing

Student Project Type

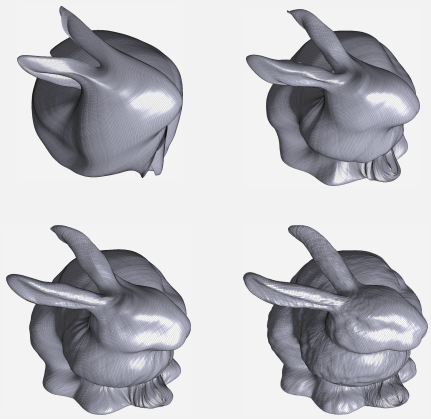
This project can fit into a Vertiefung, Facharbeit, or Master Basismodul. Goals will be adjusted depending on the project type.

Supervision

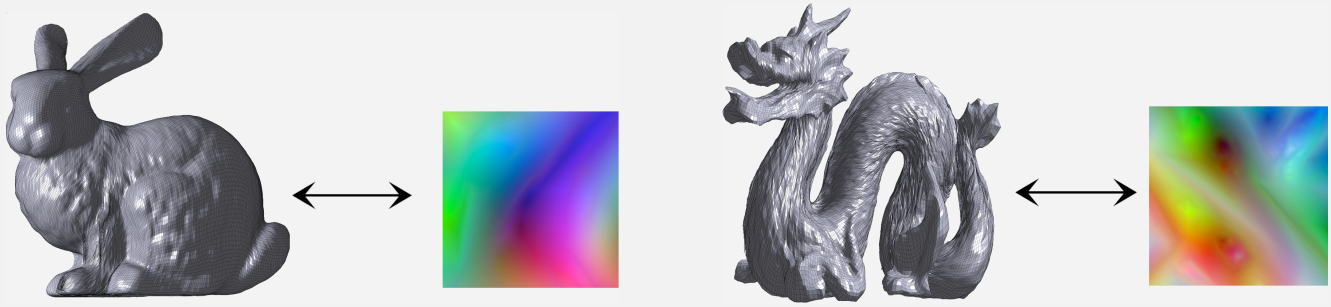
Prof. Dr. Renato Pajarola
Rafael Ballester (Assistant)

Contact

If interested, please write an email to rballester@ifi.uzh.ch.



Different compression rates



VISUALIZATION AND MULTIMEDIA LAB

Prof. Dr. Renato Pajarola
Visualization and MultiMedia Lab
Department of Informatics
University of Zürich