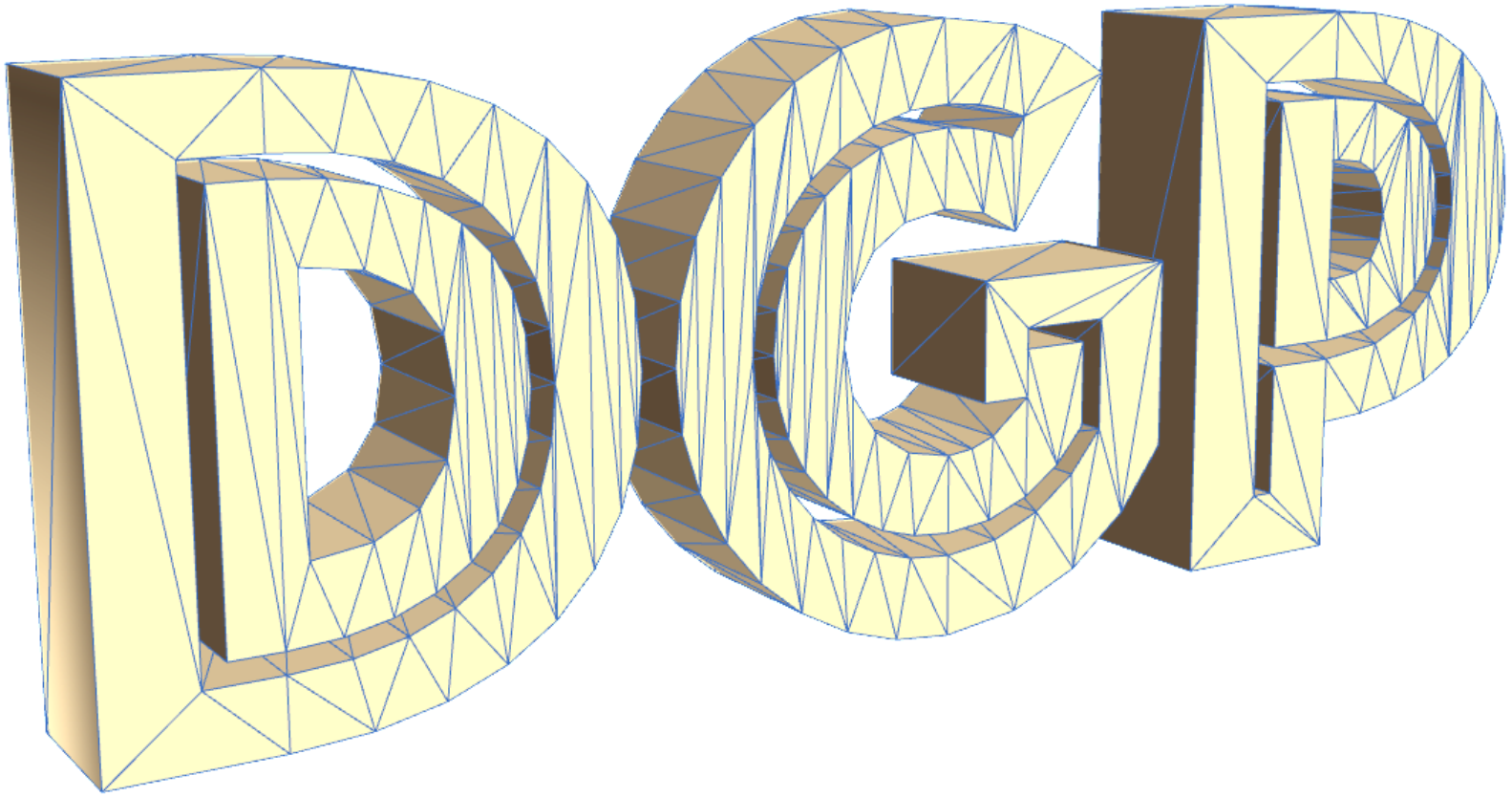
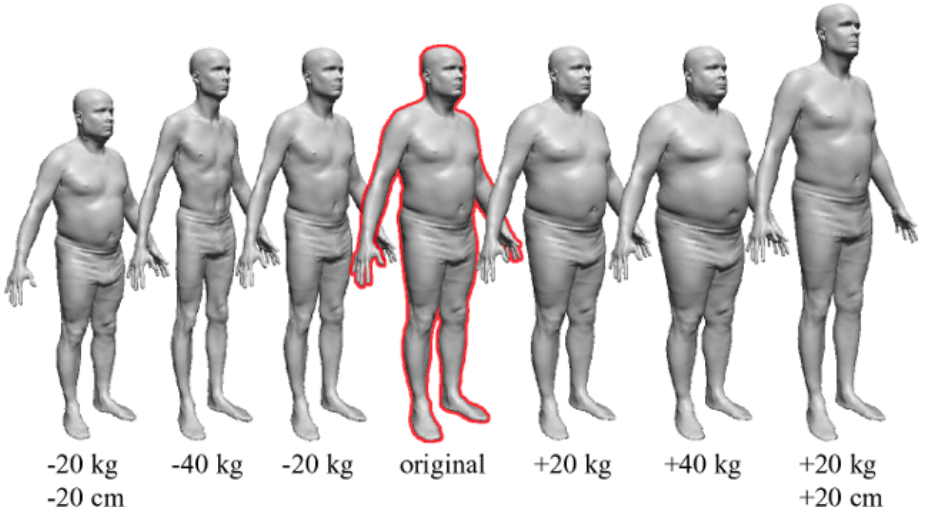
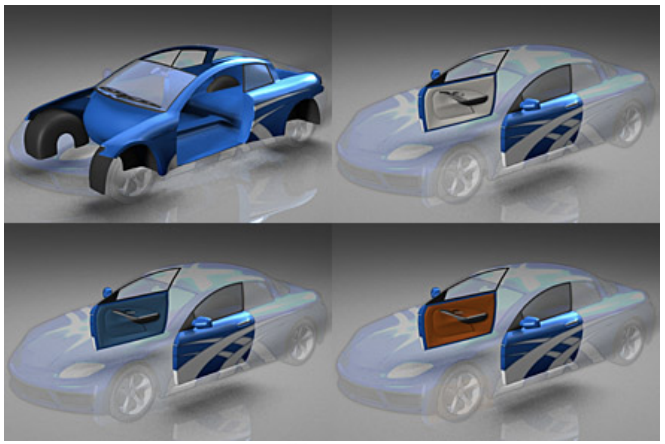
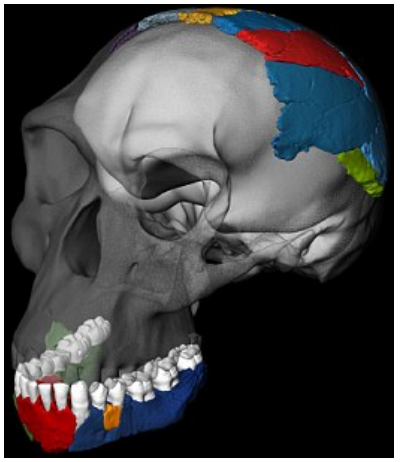


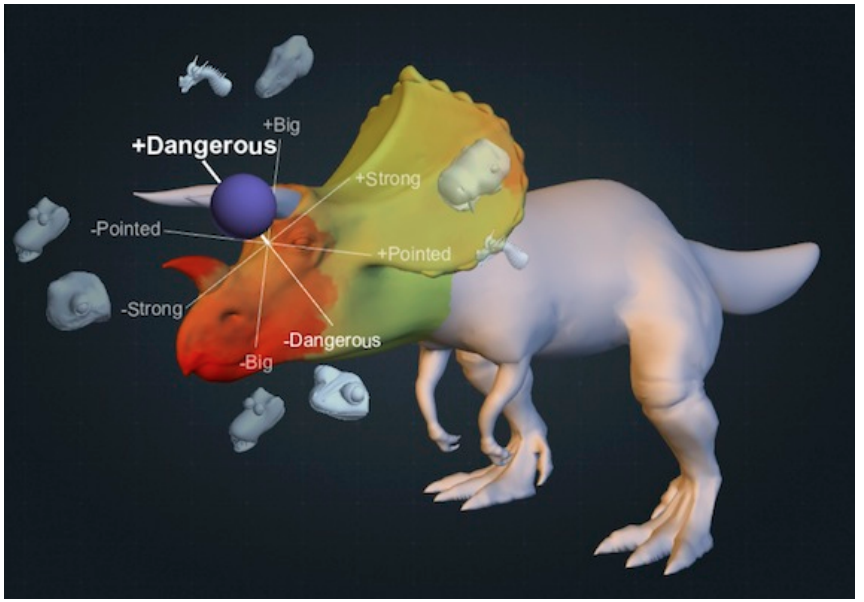
Digital Geometry Processing, Spring 2017

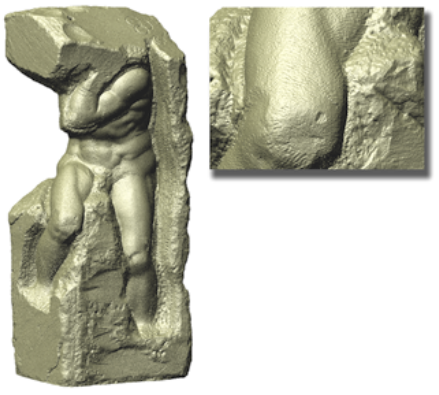
Siddhartha Chaudhuri http://www.cse.iitb.ac.in/~cs749


-20 kg
-20 cm
-40 kg
-20 kg
original
+20 kg
+40 kg
+20 kg
+20 cm



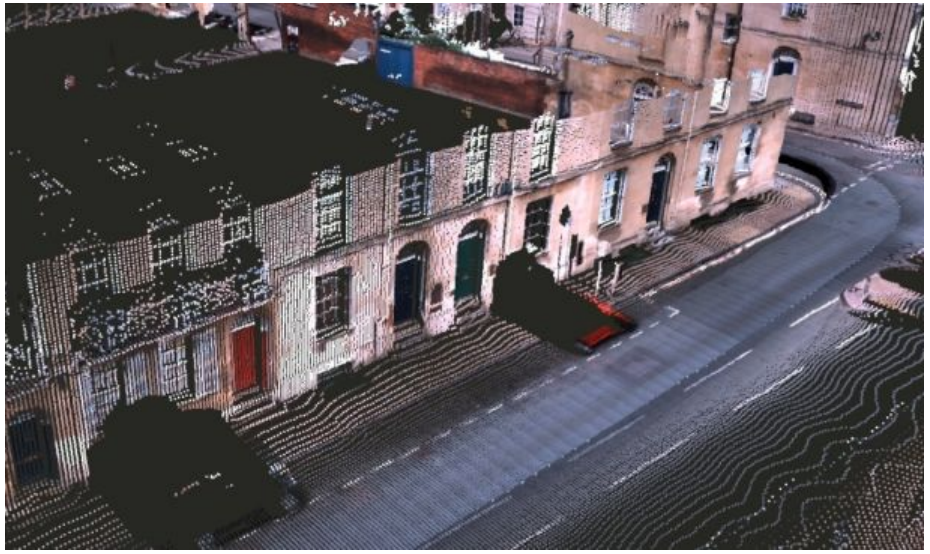



+Dangerous
+Big
+Strong
-Pointed
+Pointed
-Strong
-Dangerous
-Big

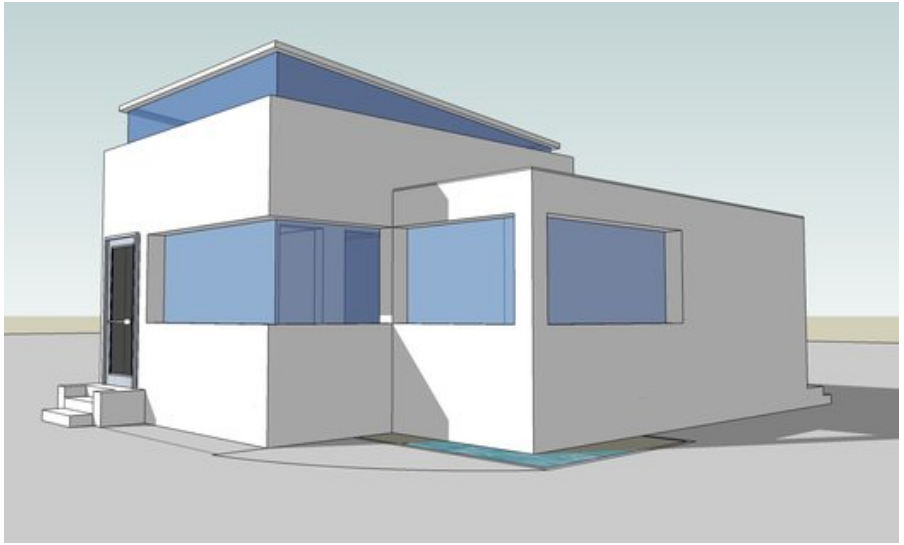


https://www.airbnb.co.in/rooms/2717703

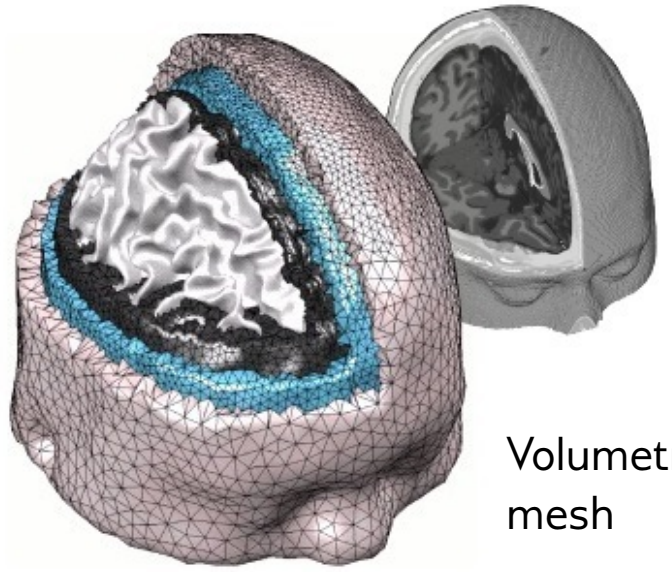
Shape Representations



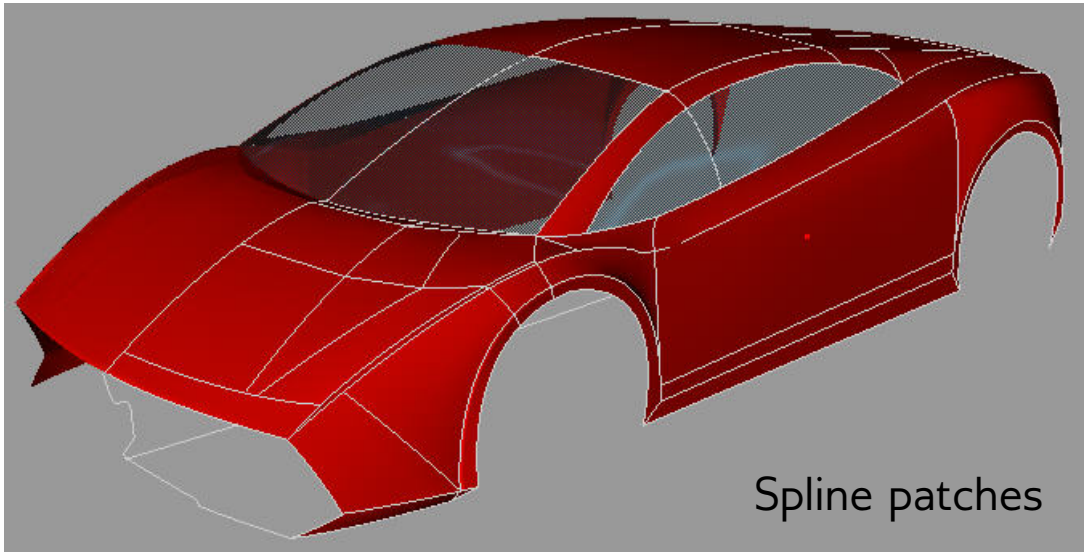
Point cloud



Polygon mesh

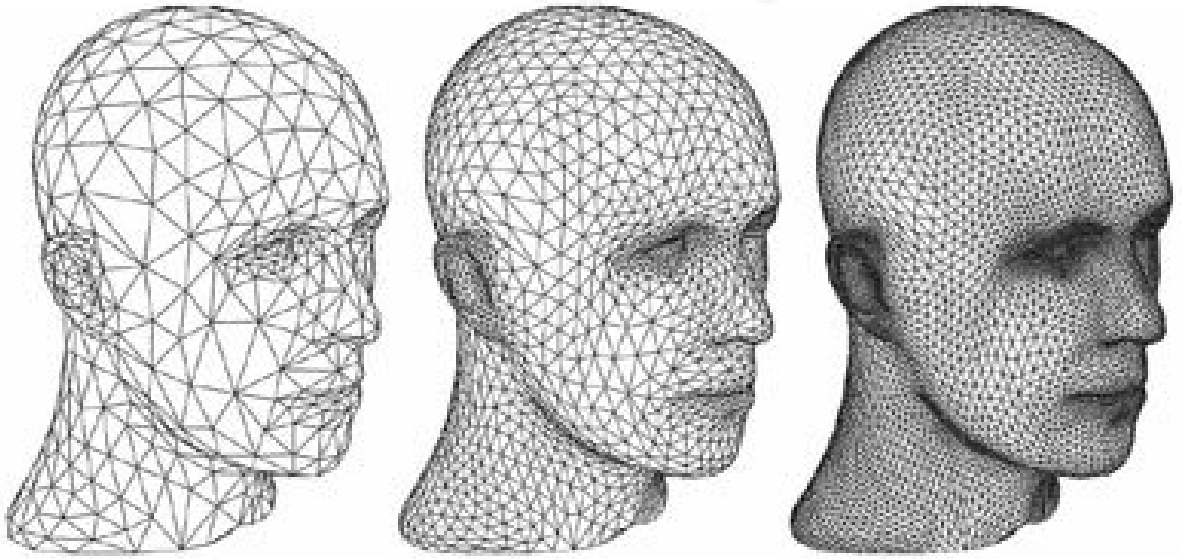


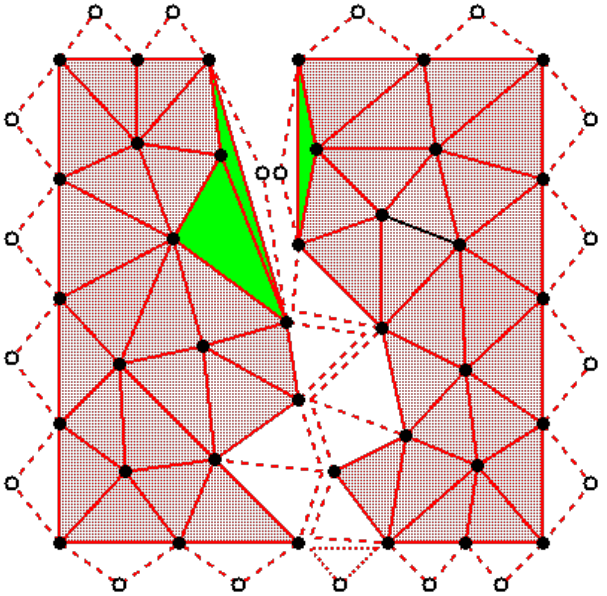
Volumetric mesh

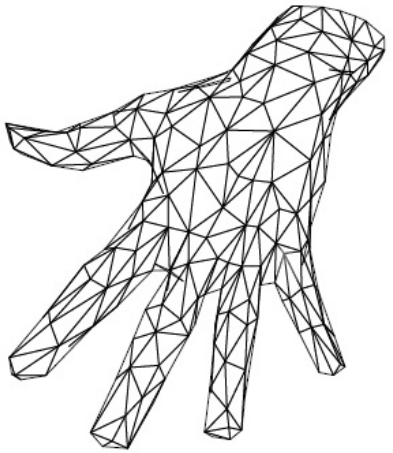


Spline patches

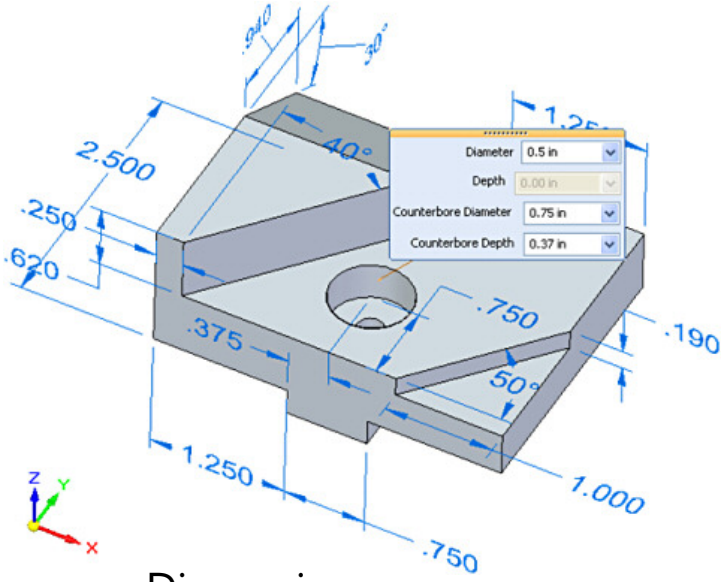
Polygon Meshes



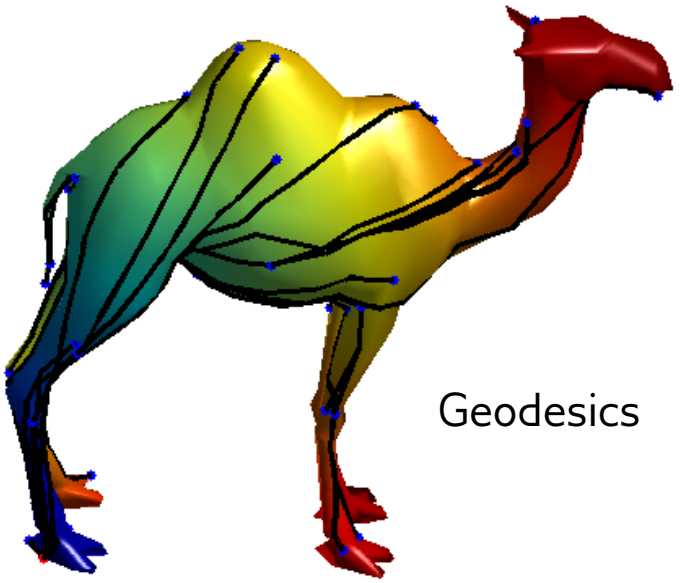




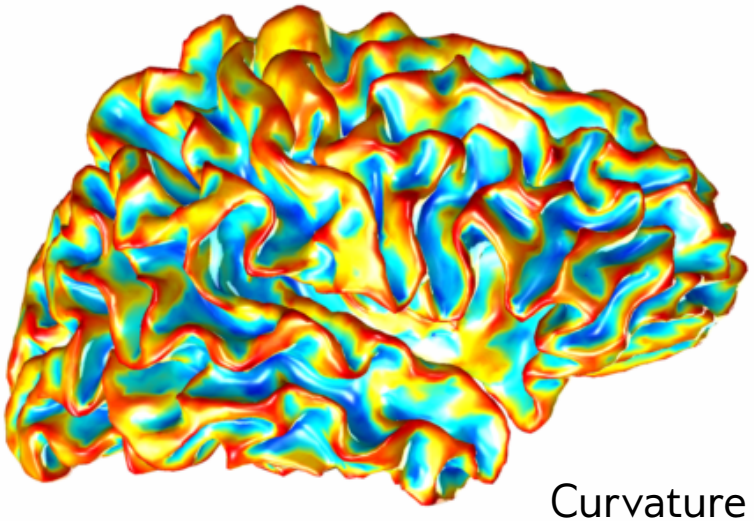
Basic Geometric Analysis



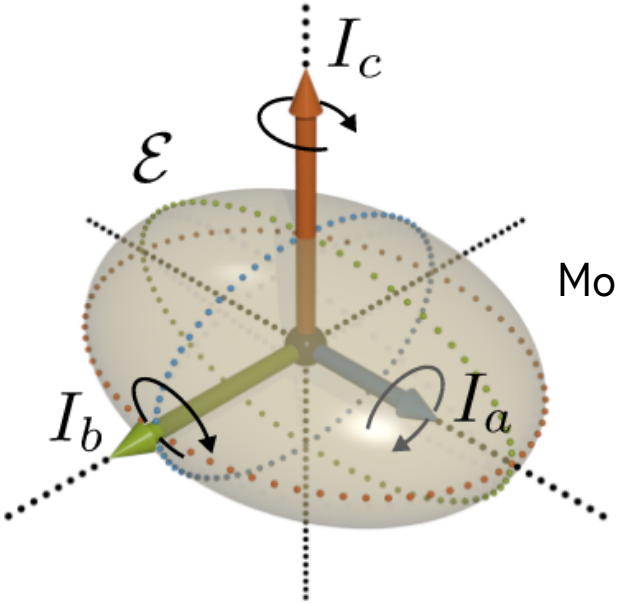
Dimensions



Geodesics

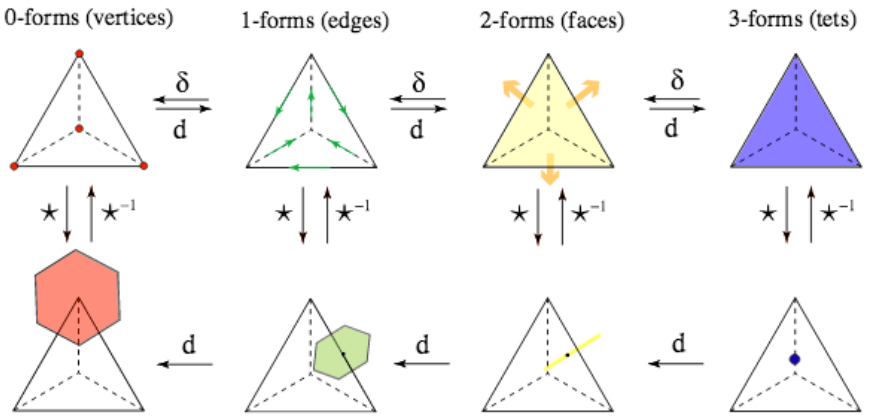


Curvature

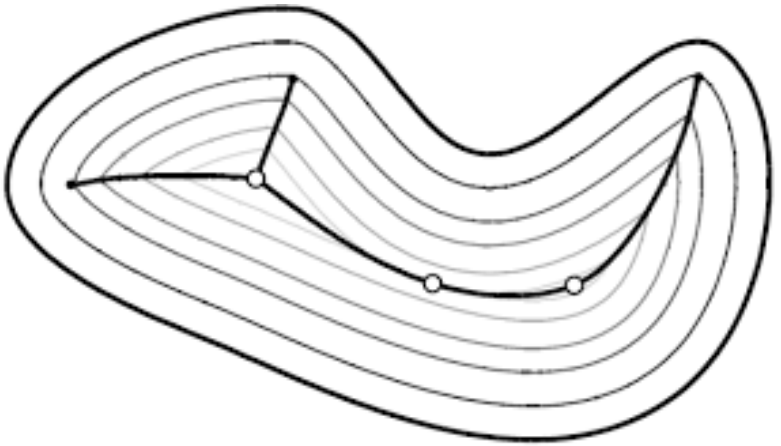


Moments

Advanced Geometric Analysis



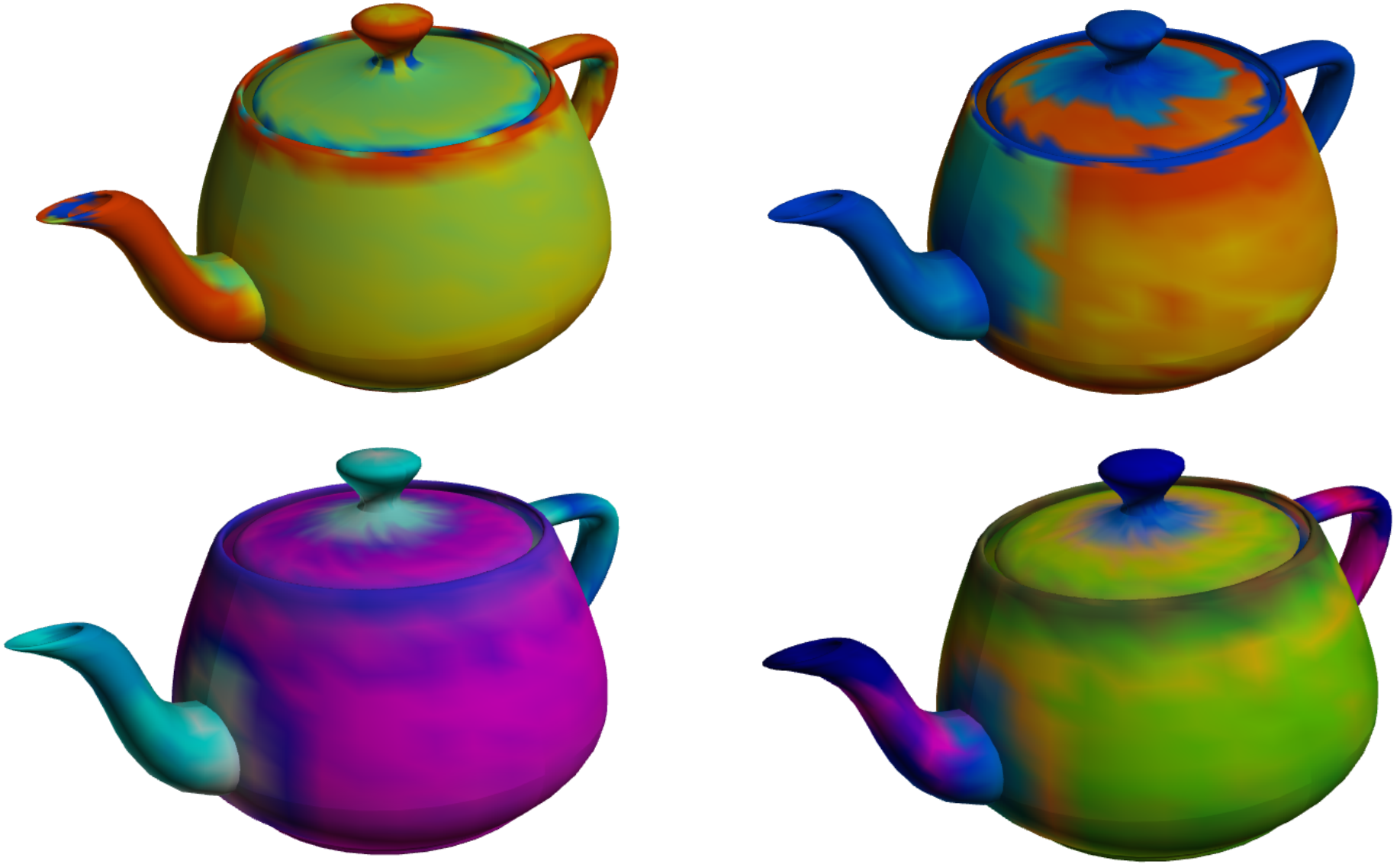
Discrete Differential Geometry



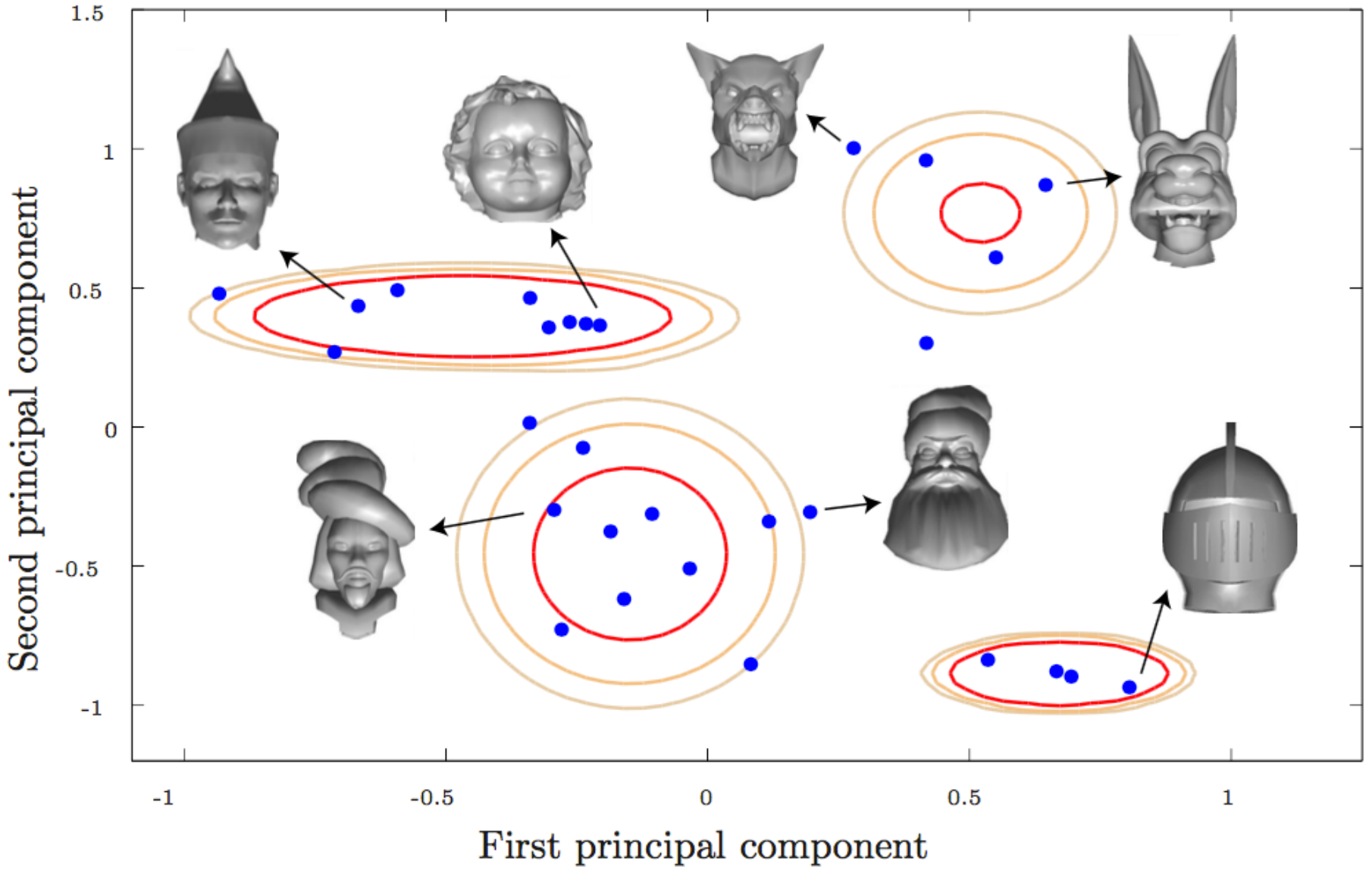
Medial Axis Transform

Spectral Decomposition

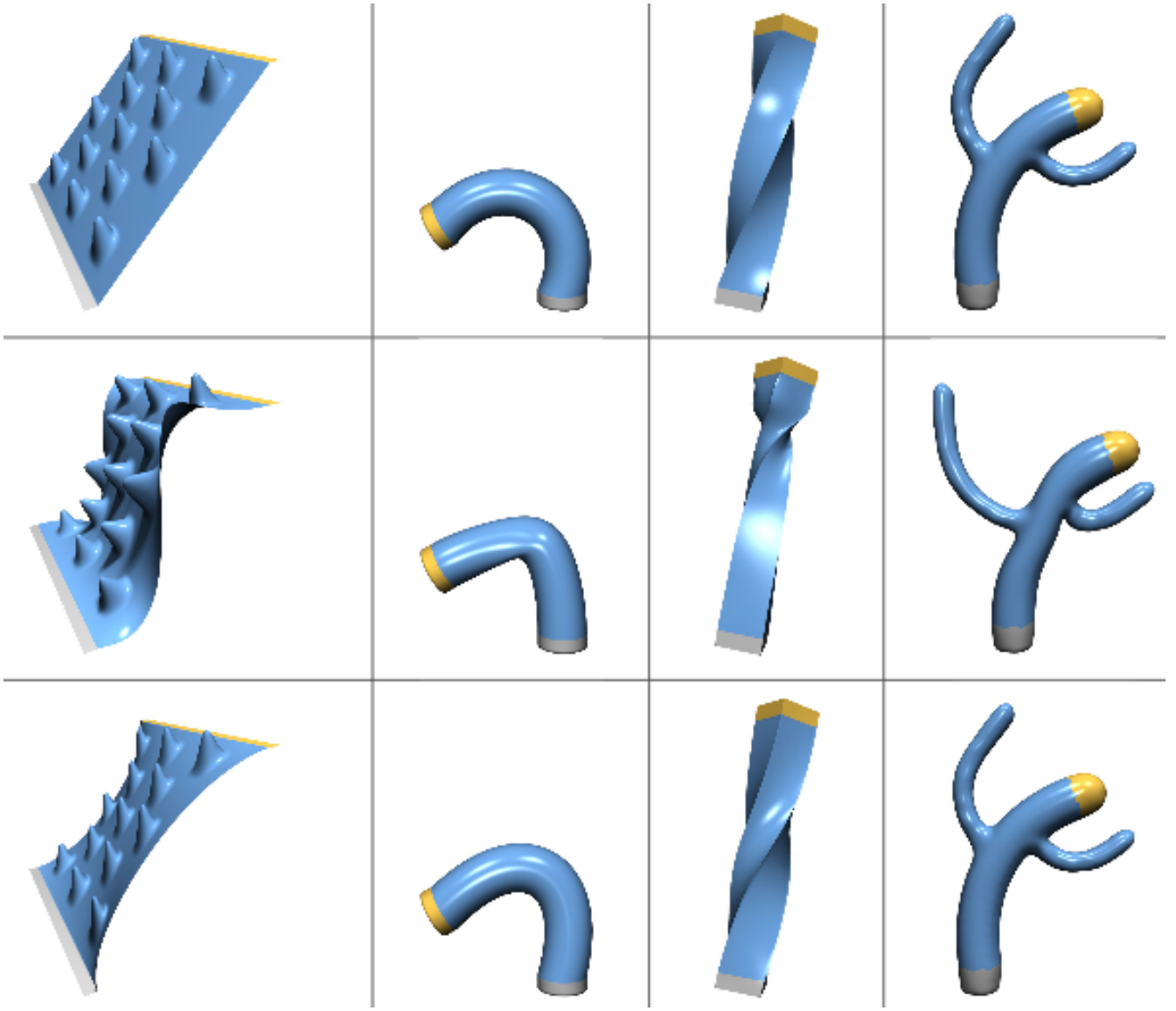
Local Shape Features



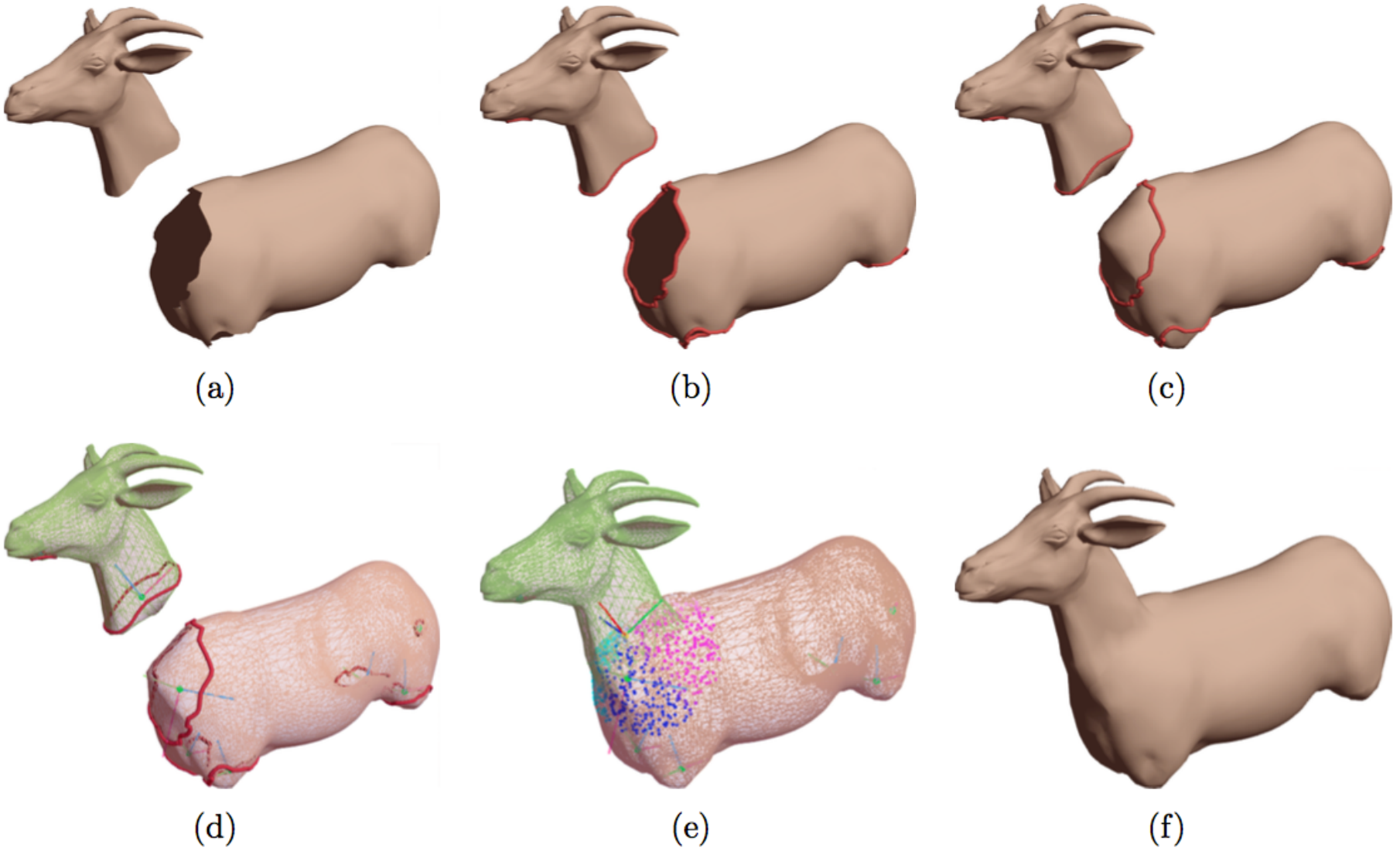
Global Shape Features



Shape Deformation

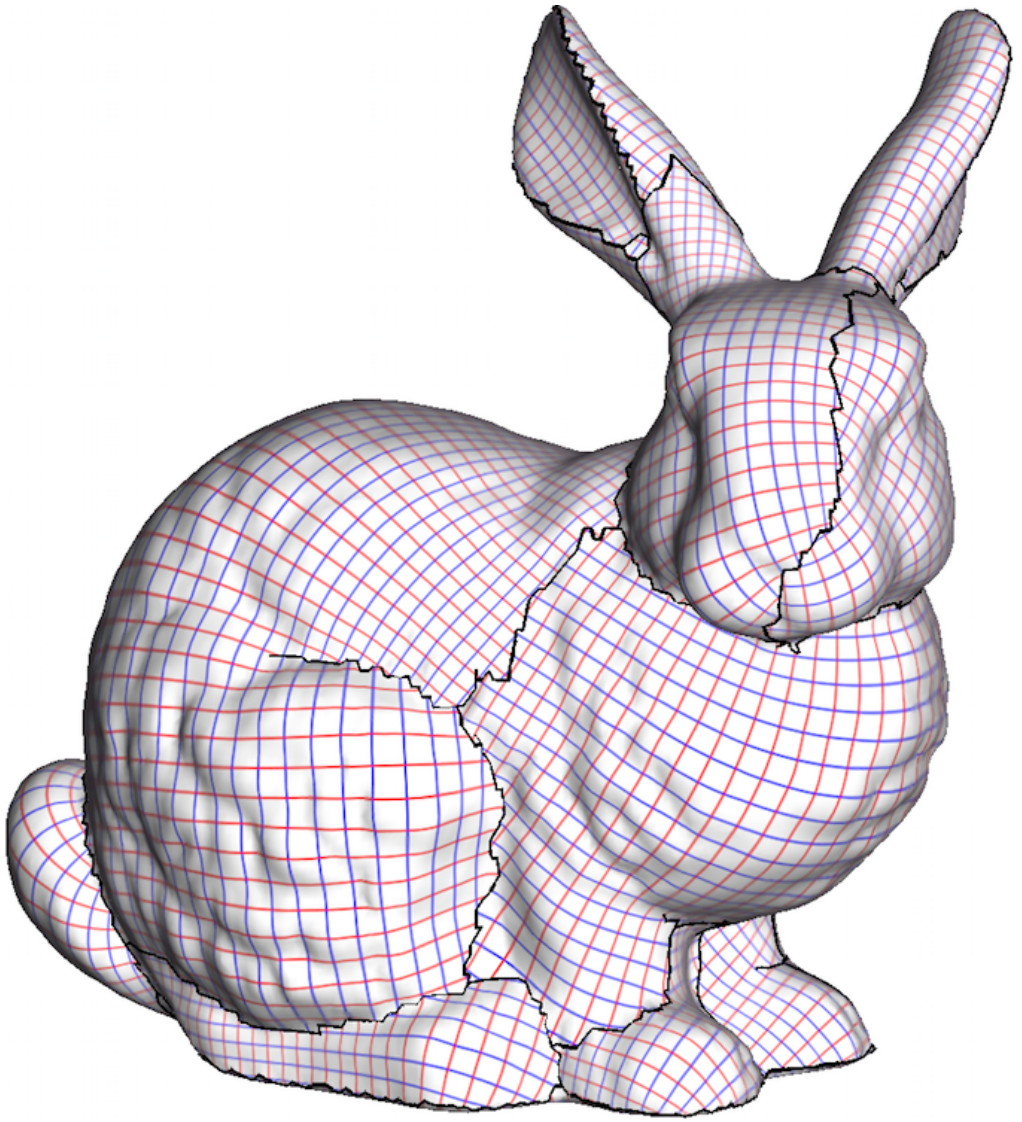


Shape Editing

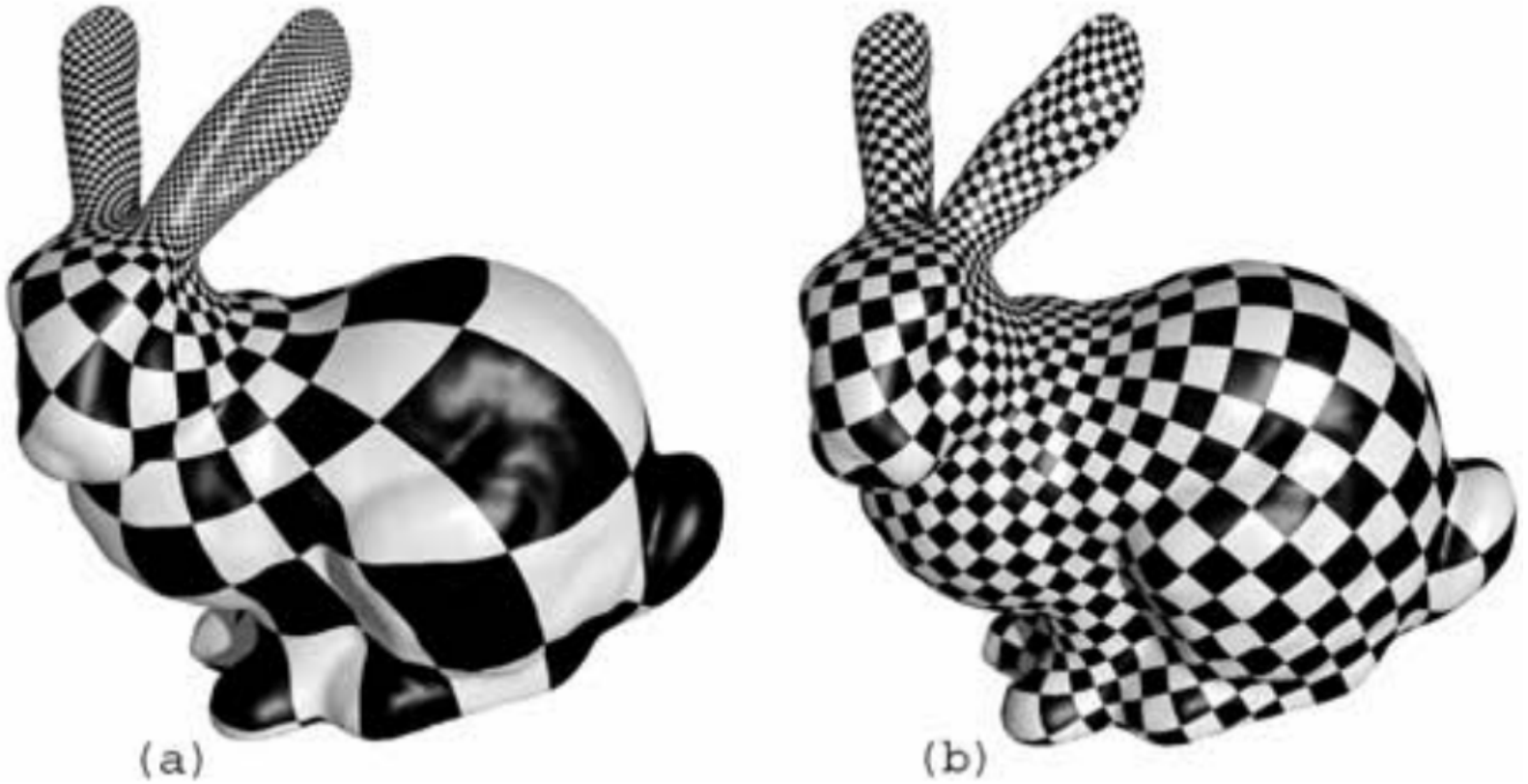


Shape Parametrization

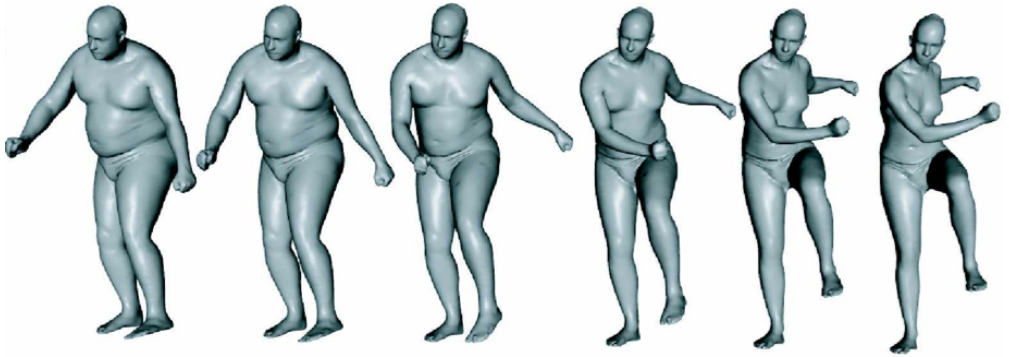
Shape Parametrization



Shape Parametrization



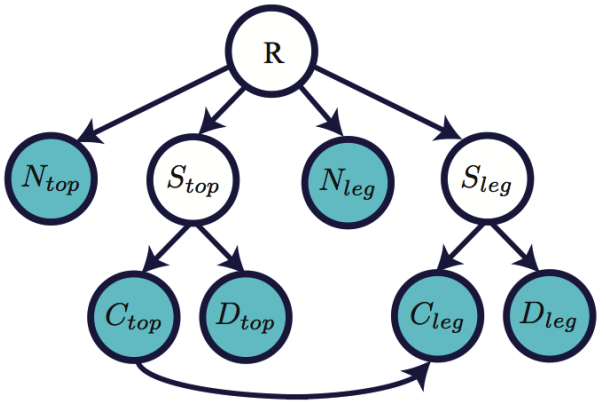
Statistical Shape Models



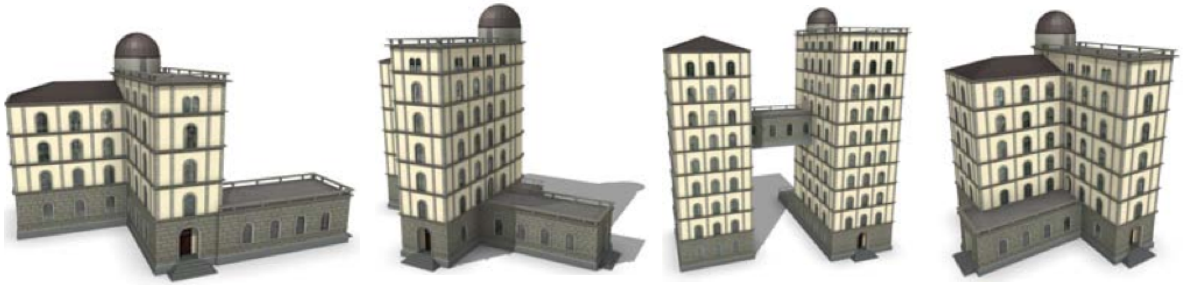
Template

Exemplars

Procedure



Probabilistic Graphical Model

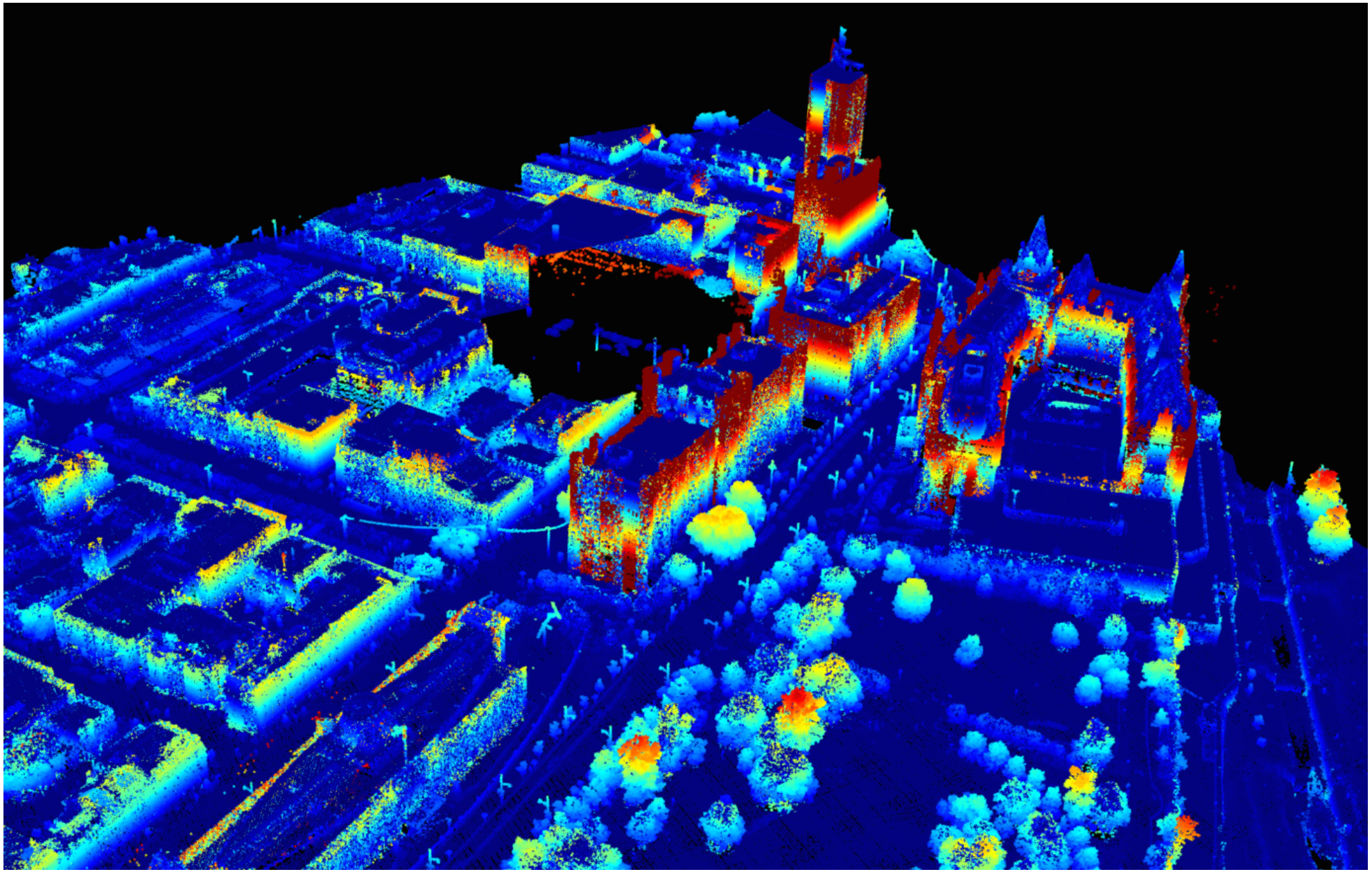


Grammar

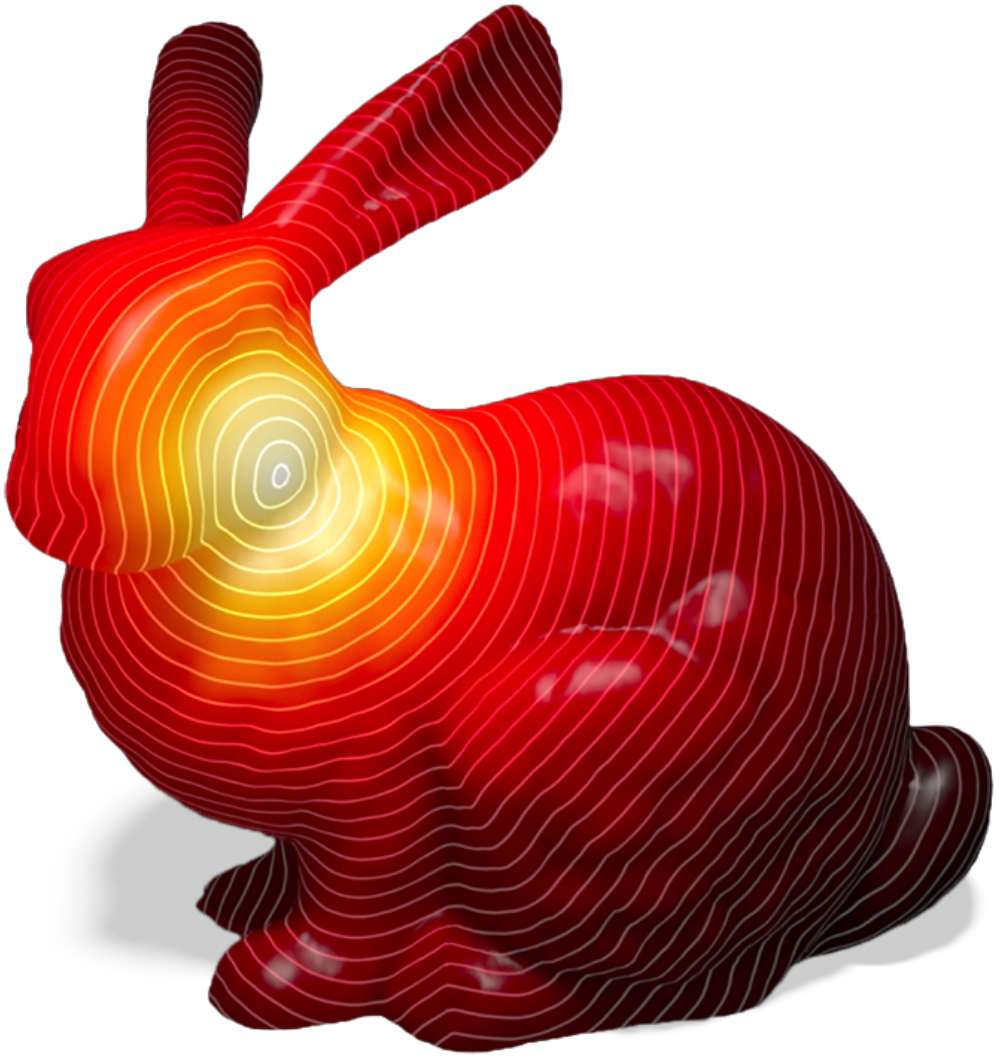
Research Topics: High-level shape understanding

Structure, function, semantics, attributes, materials, human and environmental impact, local context, manufacturability, sustainability, cost...

Research Topics: Reconstruction



Research Topics: Fundamental operators



Research Topics: Evolutionary Design

Karl Sims, “Evolved Virtual Creatures”, SIGGRAPH 1994, https://youtu.be/JBgG_VSP7f8

Things to keep in mind

- Class is not strictly math-oriented, nor just system-building
  - ... you will have to code!
- Attendance is not compulsory
  - ... but I expect you to come to class!
- There's no such thing as a stupid question
  - ... so please speak up
- The words “Professor” and “Sir” are outlawed
  - ... we're all on a first-name basis here

Background

- Familiarity with basic linear algebra, coordinate geometry, calculus, graph theory etc
  - If you've done 3 years of a CS undergrad, you should be prepared math-wise
  - We won't do proofs, but the algorithms will involve math.
- Familiarity with introductory graphics, image processing and/or vision
  - Ideally, you should have done CS475 (computer graphics) or CS663 (digital image processing), or an equivalent at another institution
  - If you haven't done any of these courses, please talk to me before signing up.

Assignments

- I will provide basic code frameworks (in C++)
  - I don't expect you to spend time coding stuff that's not directly related to what we're learning
- Start early!
  - They always take more time than you think
  - But no, I won't give very strenuous assignments
- Details of the final project will be announced soon
  - You will work in small groups

Questions?