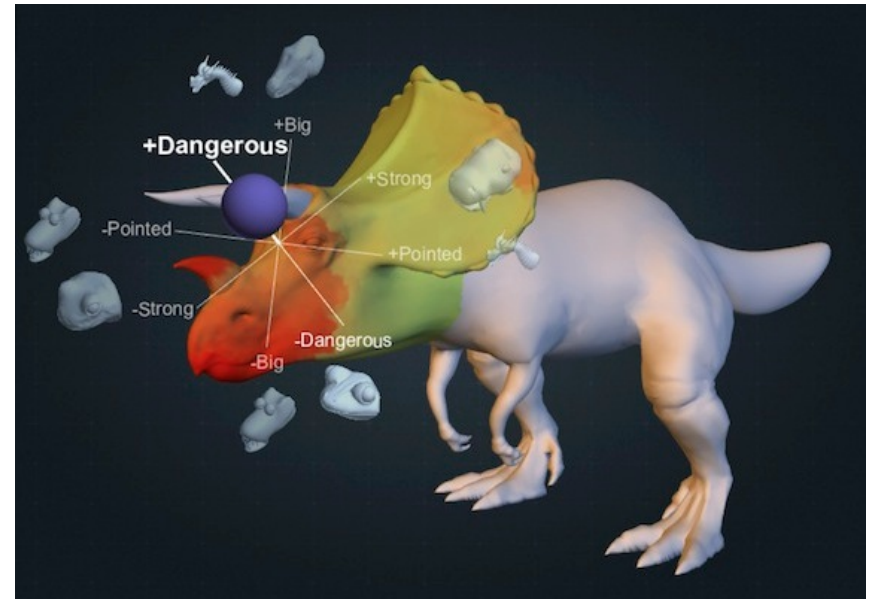
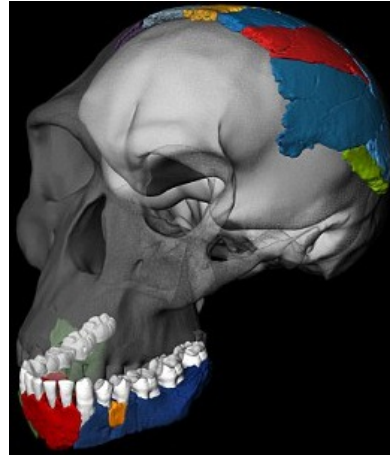
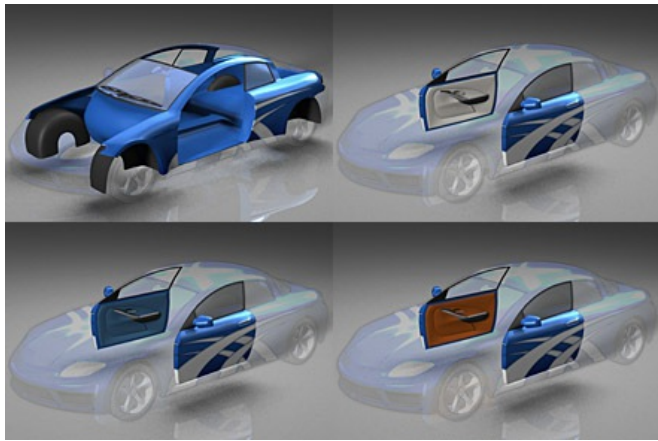
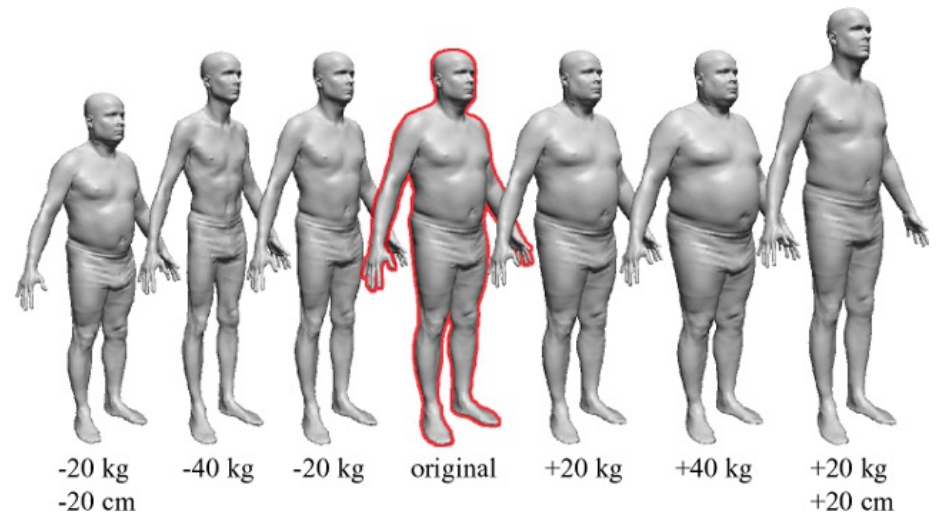


Digital Geometry Processing, Spring 2016

Siddhartha Chaudhuri

<http://www.cse.iitb.ac.in/~cs749>



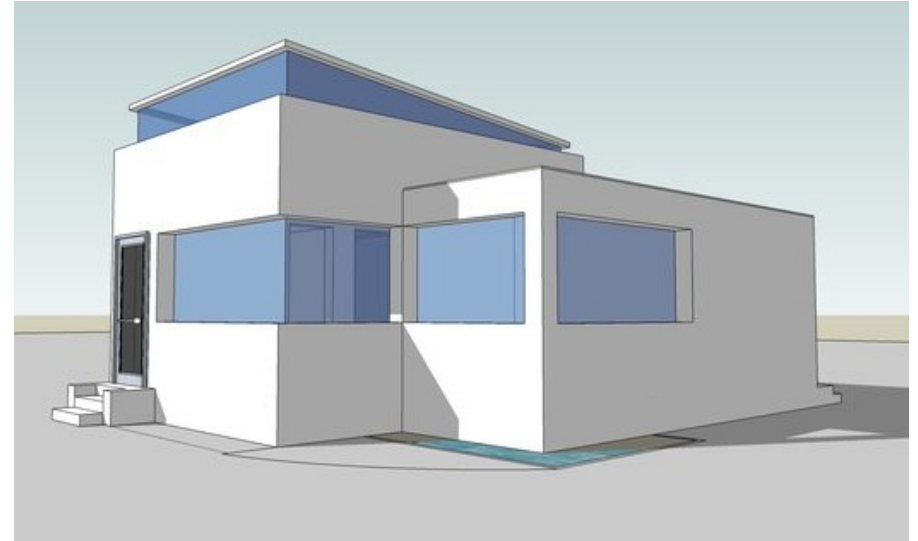




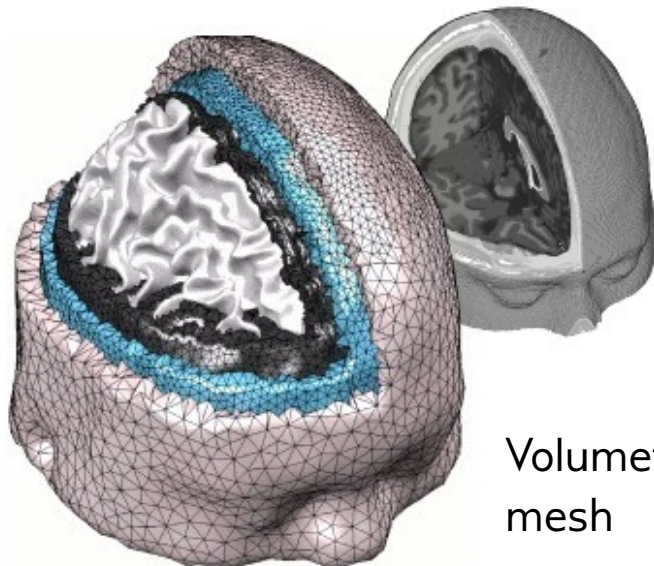
Shape Representations



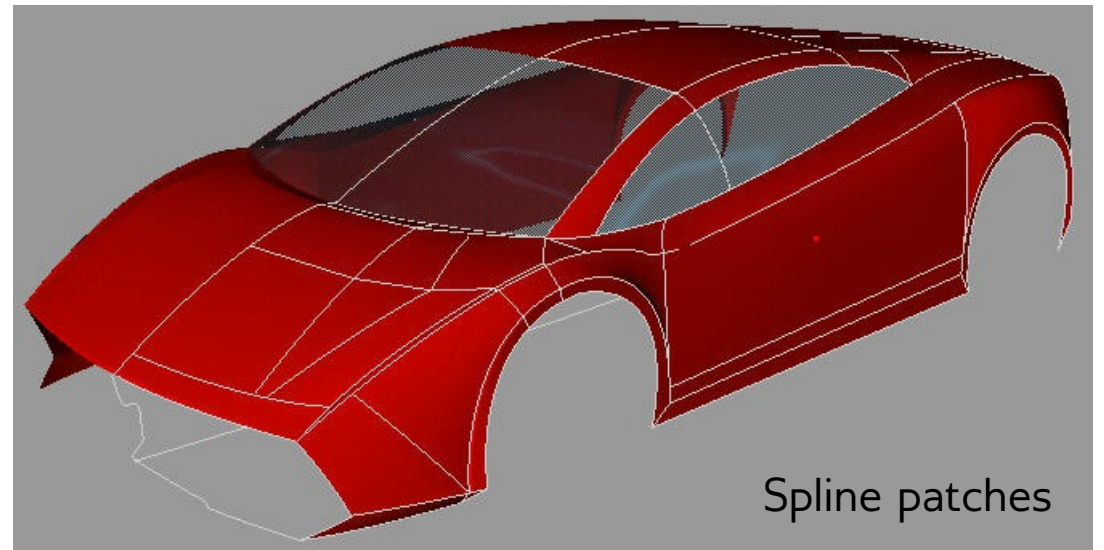
Point cloud



Polygon mesh

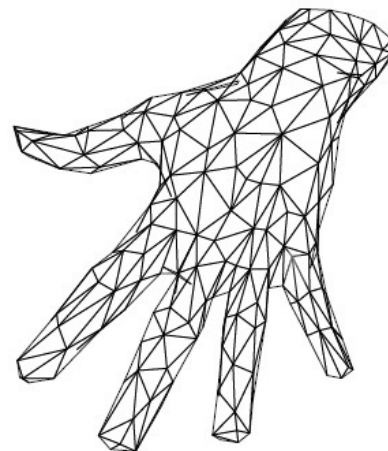
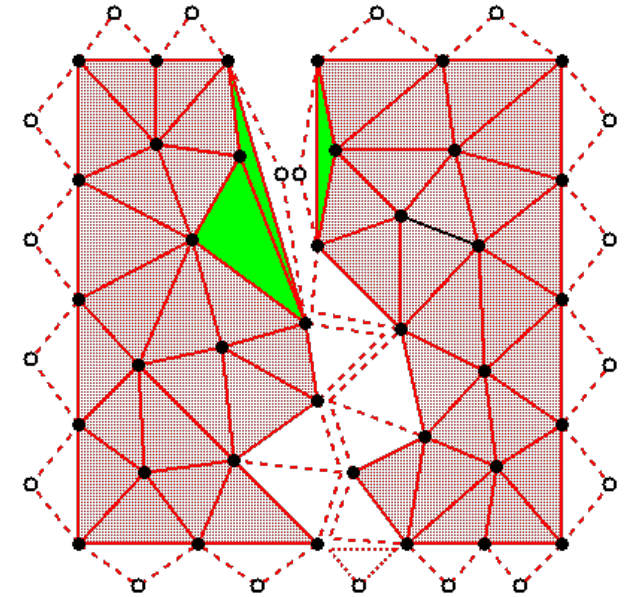
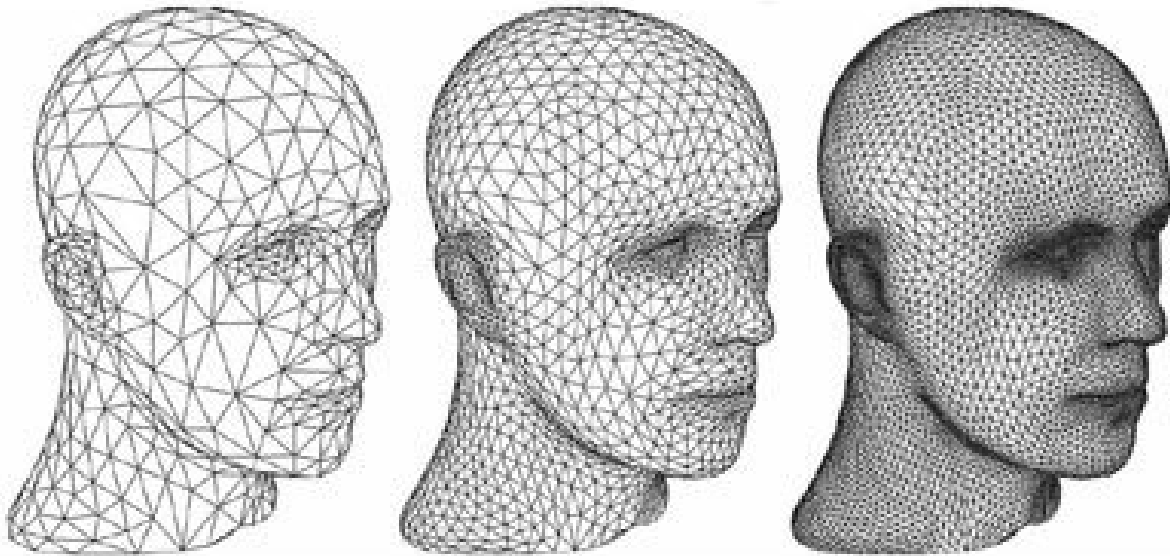


Volumetric
mesh

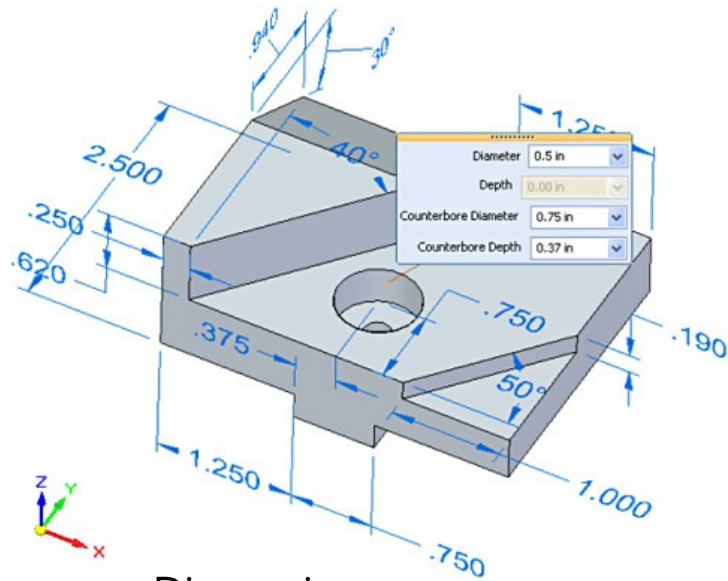


Spline patches

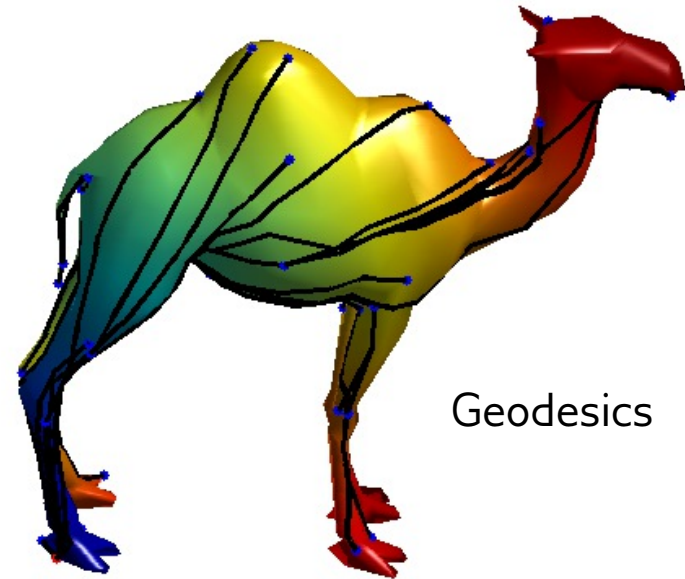
Polygon Meshes



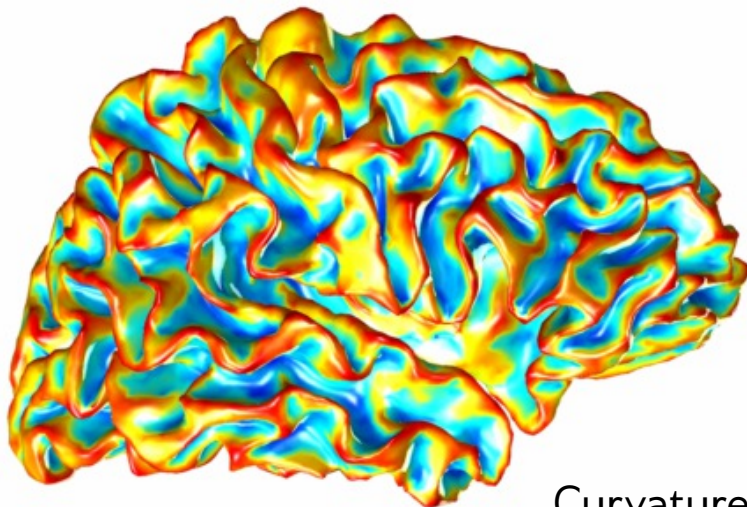
Basic Geometric Analysis



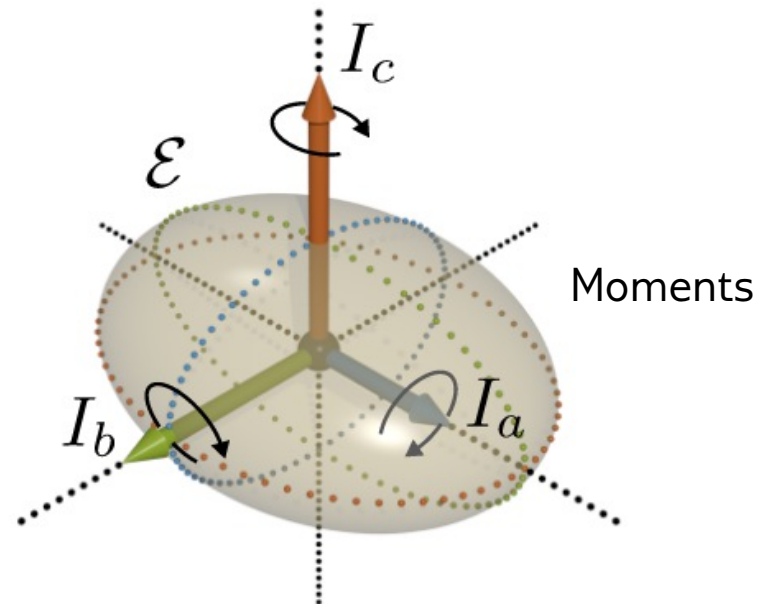
Dimensions



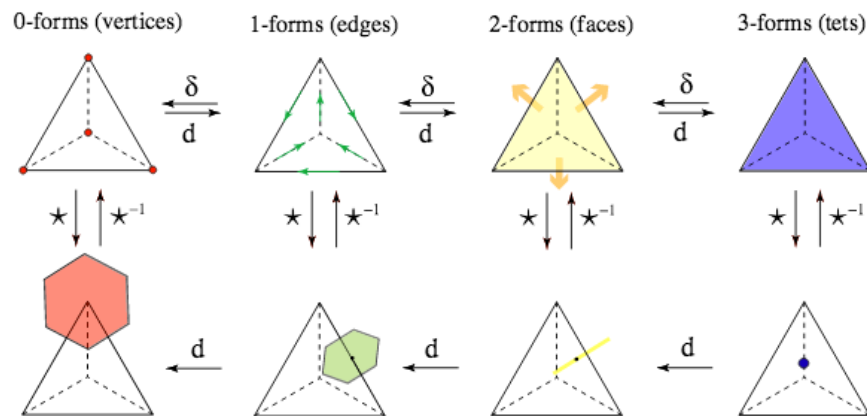
Geodesics



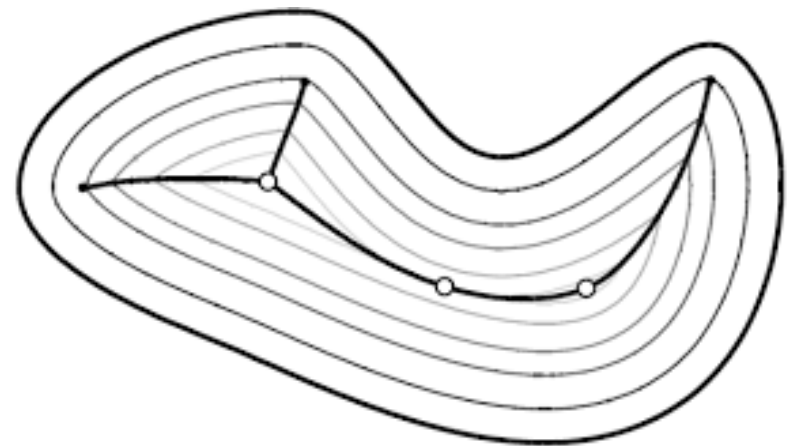
Curvature



Advanced Geometric Analysis



Discrete Differential Geometry

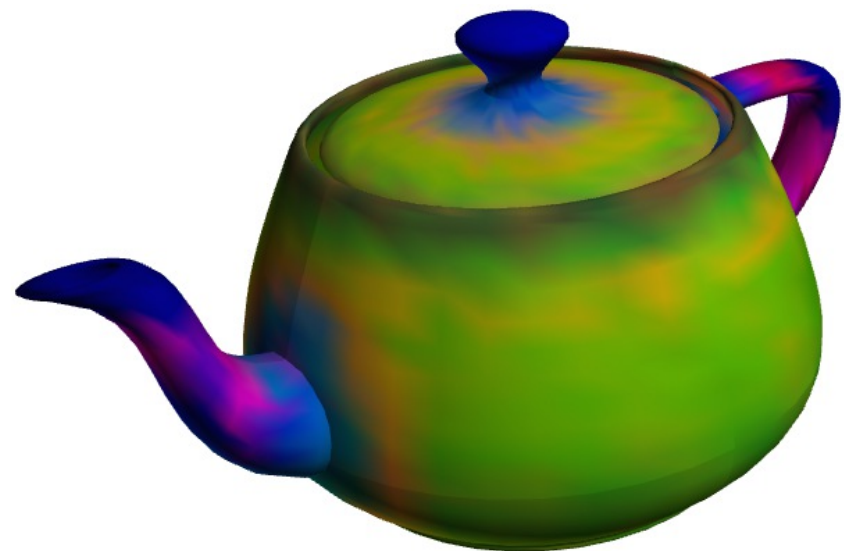
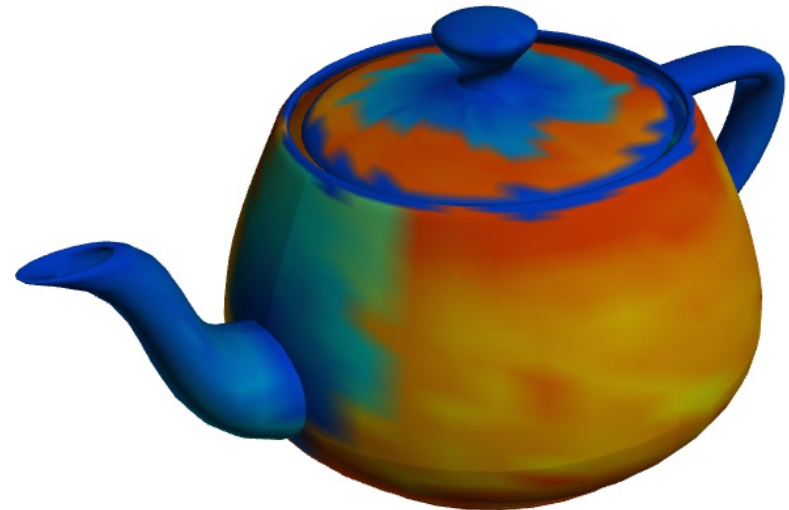
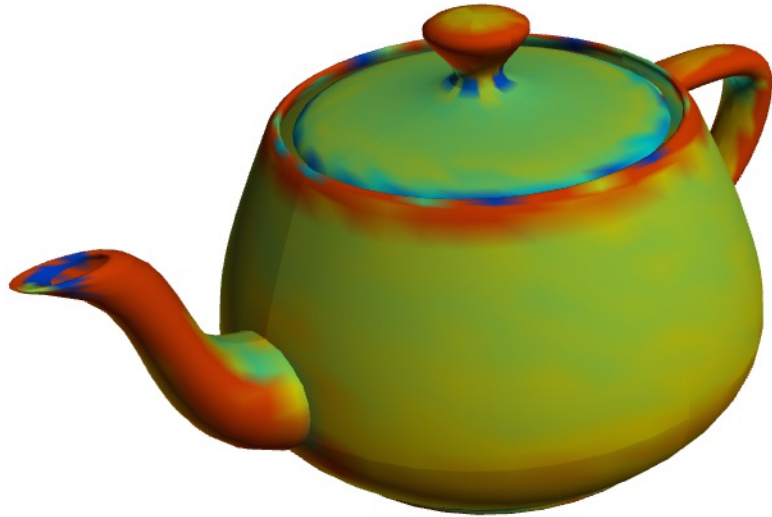


Medial Axis Transform

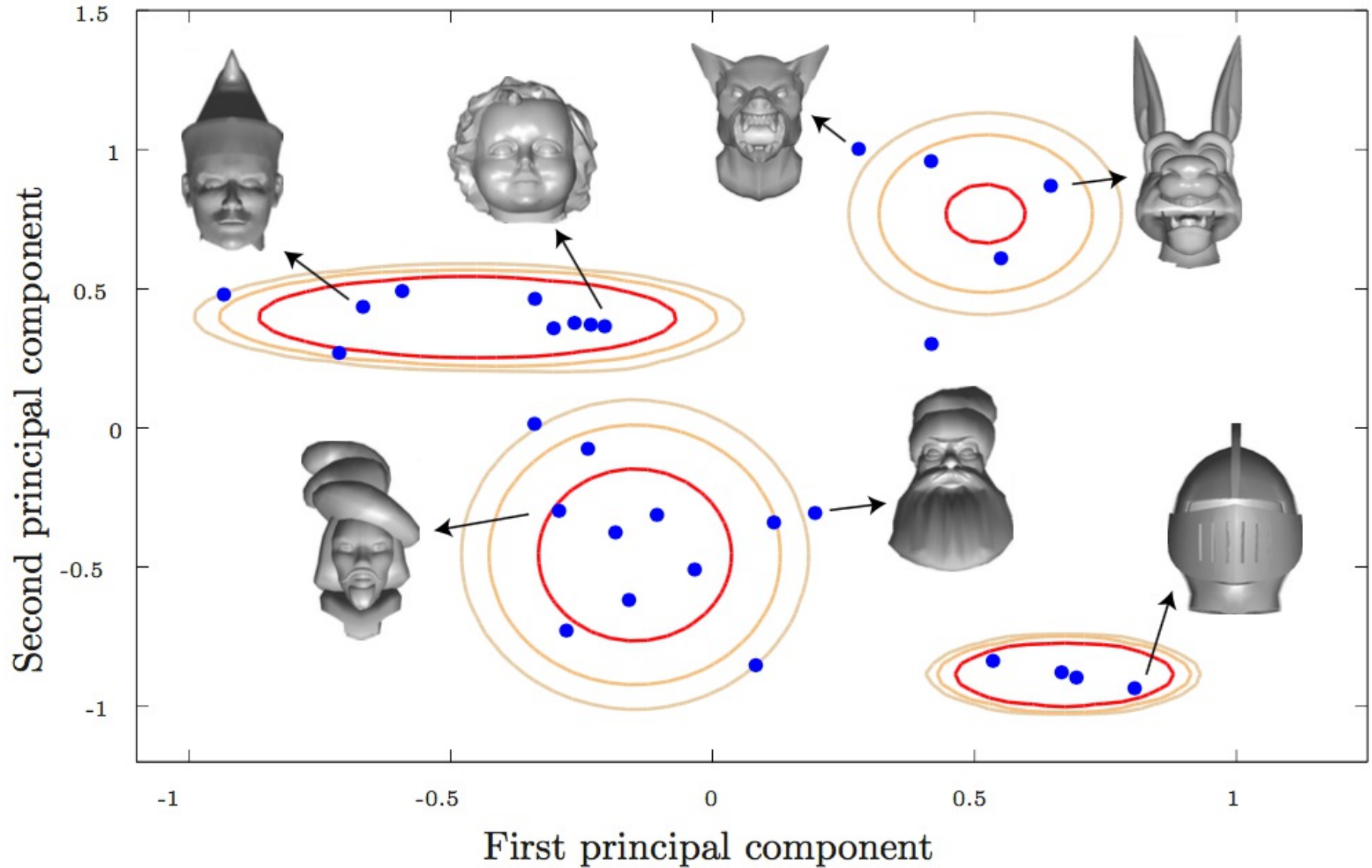


Spectral Decomposition

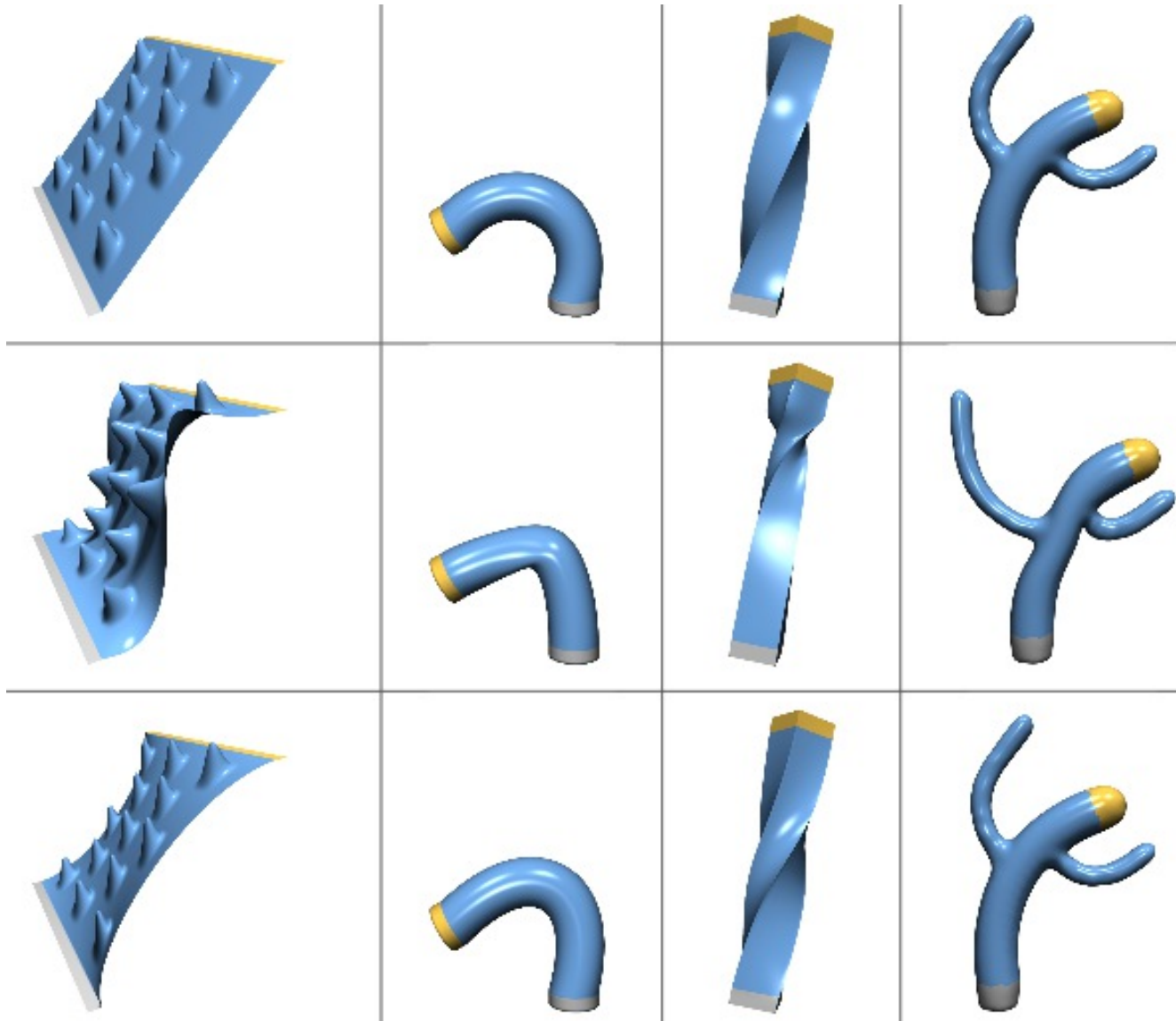
Local Shape Features



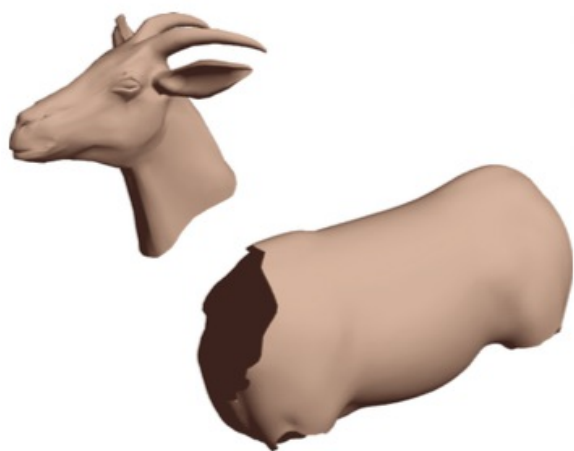
Global Shape Features



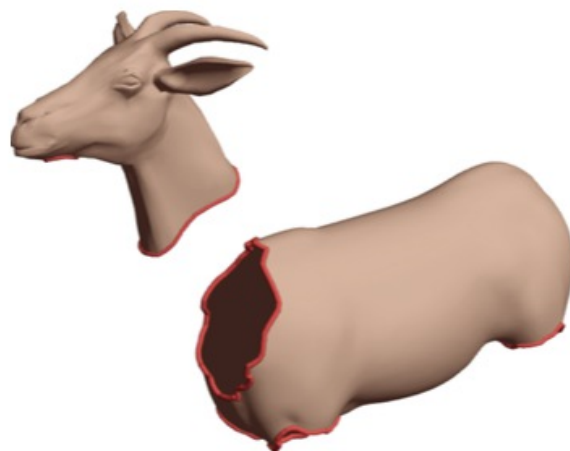
Shape Deformation



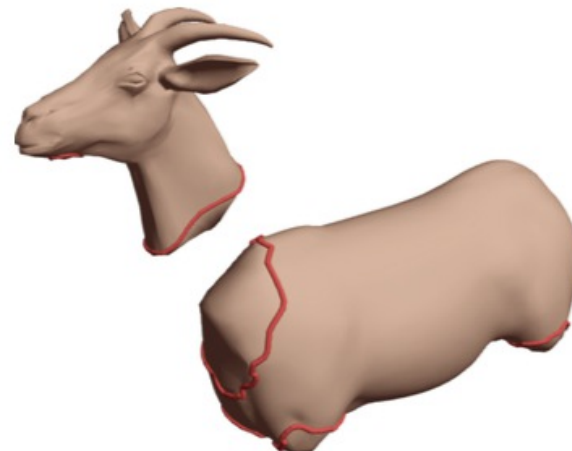
Shape Editing



(a)



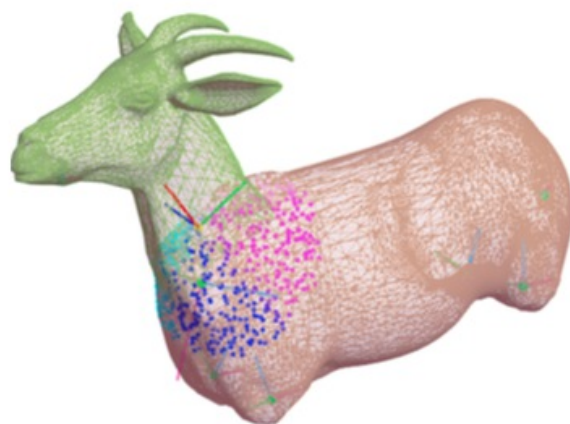
(b)



(c)



(d)

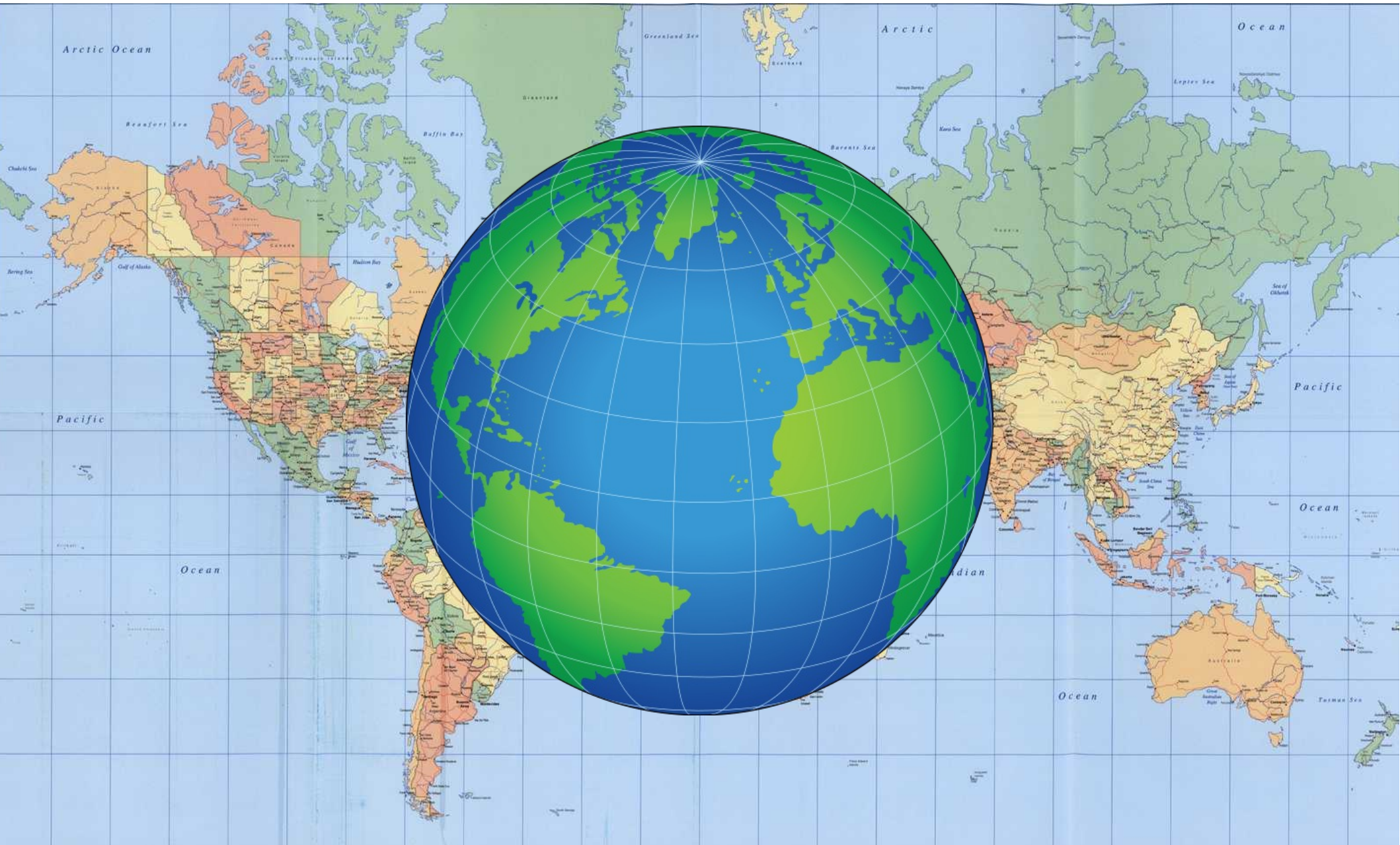


(e)

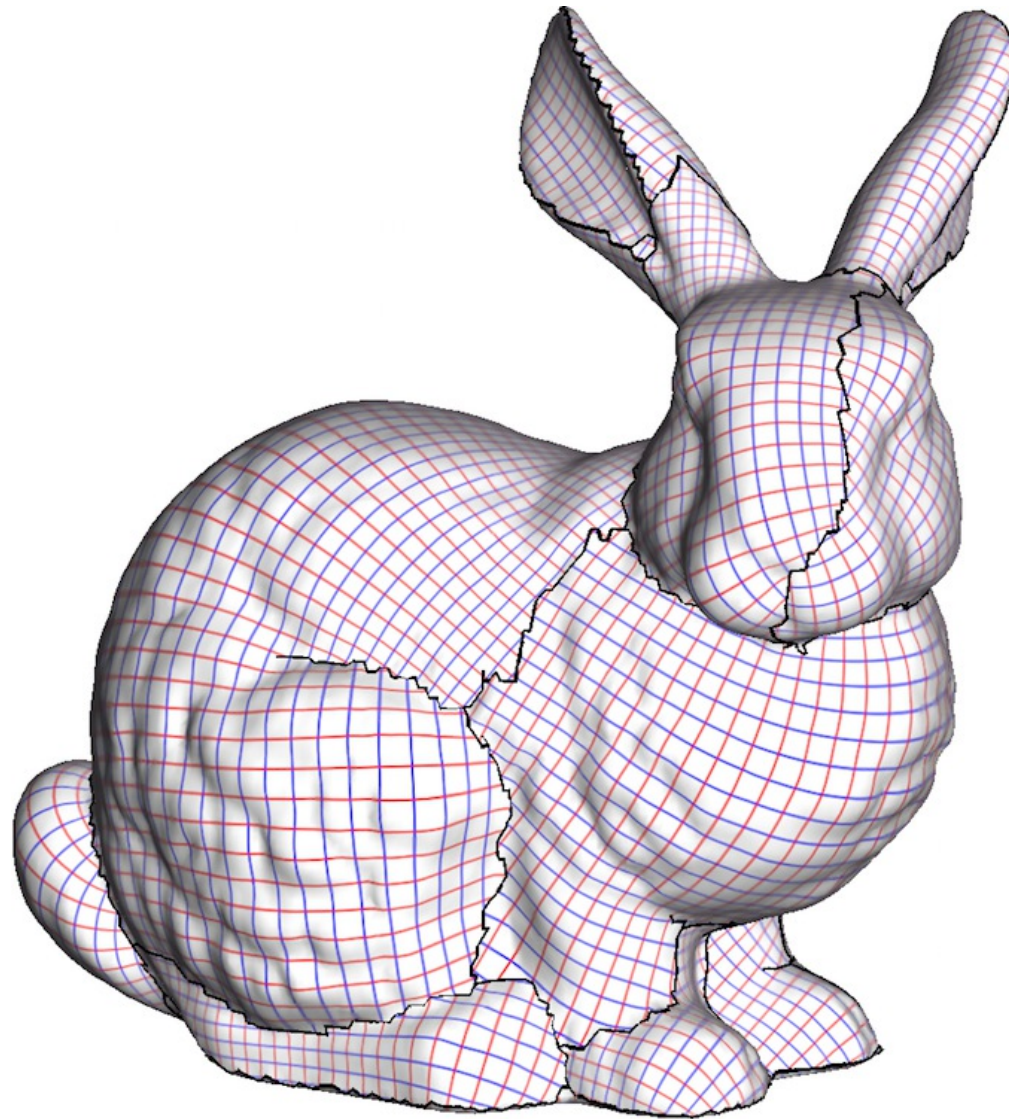


(f)

Shape Parametrization



Shape Parametrization



Shape Parametrization



(a)



(b)

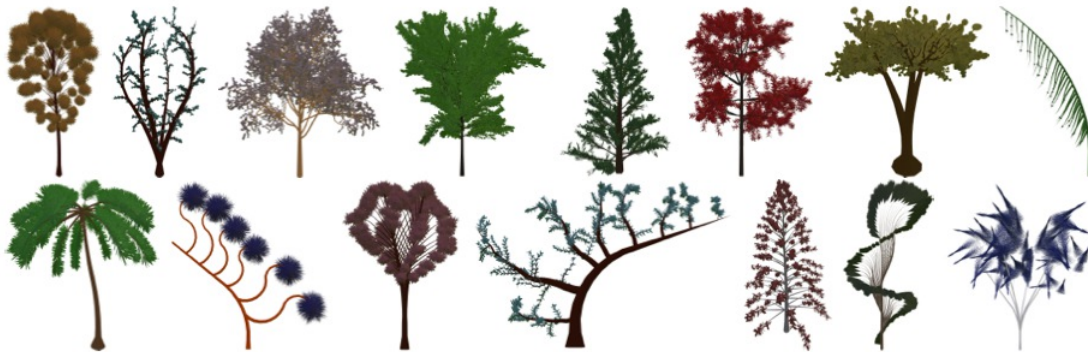
Statistical Shape Models



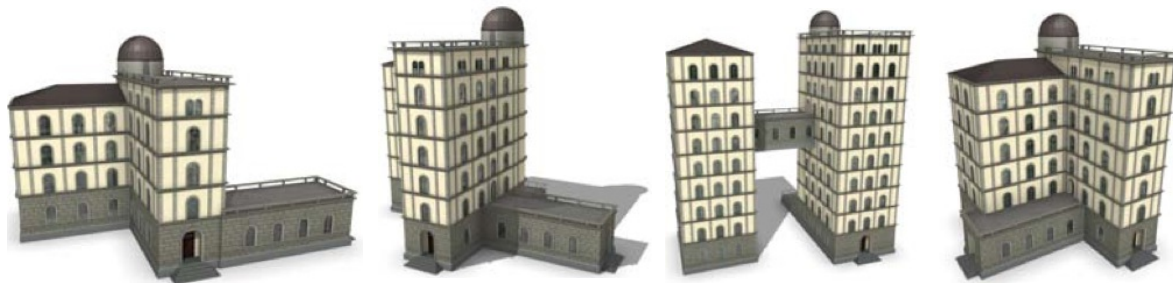
Template



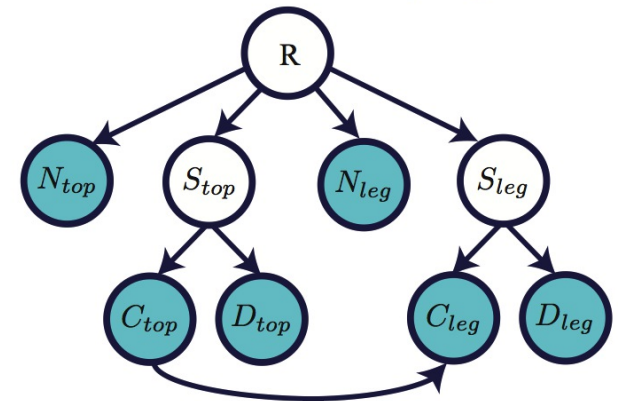
Exemplars



Procedure



Grammar



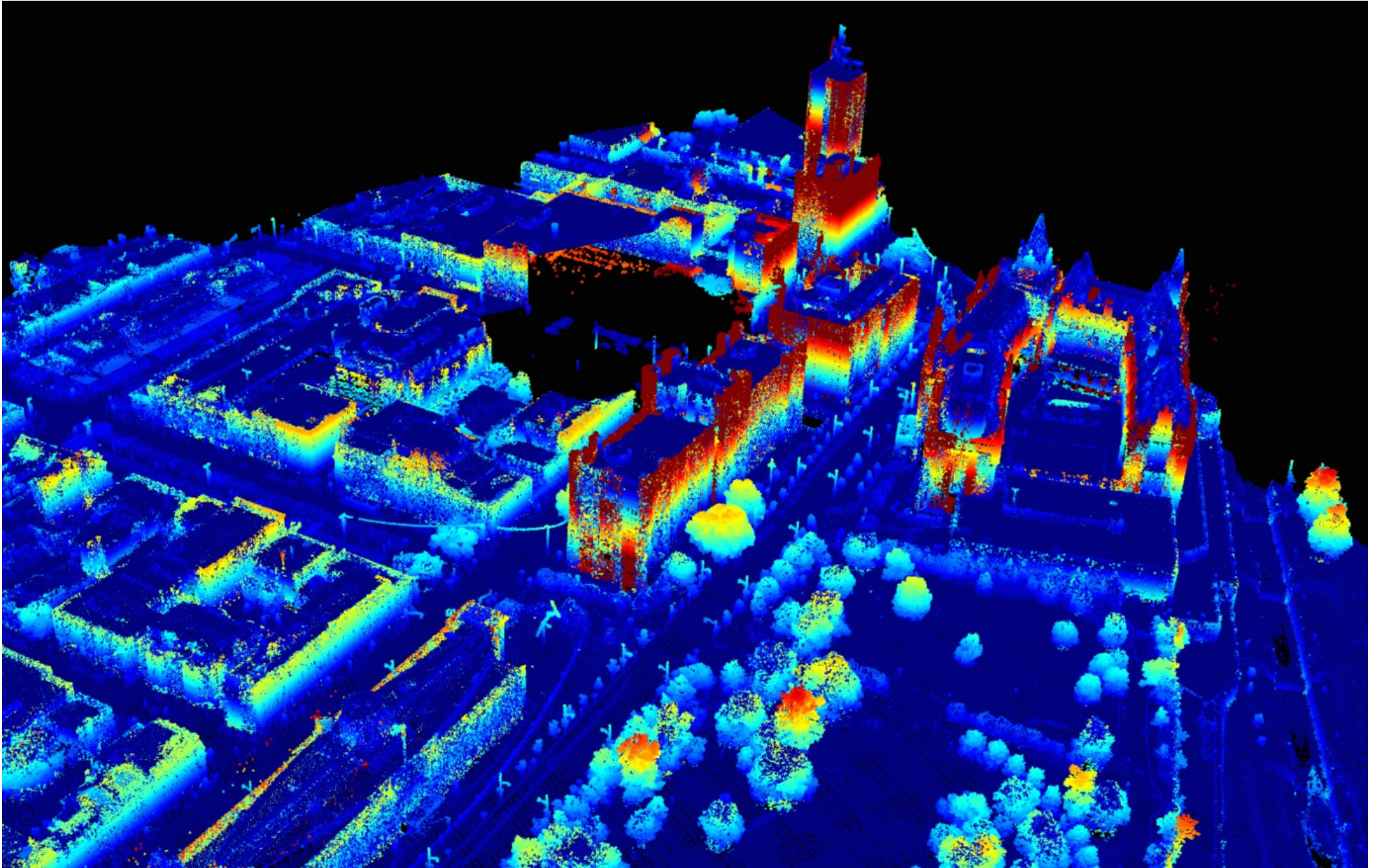
Probabilistic Graphical Model

Research Topics: High-level shape understanding

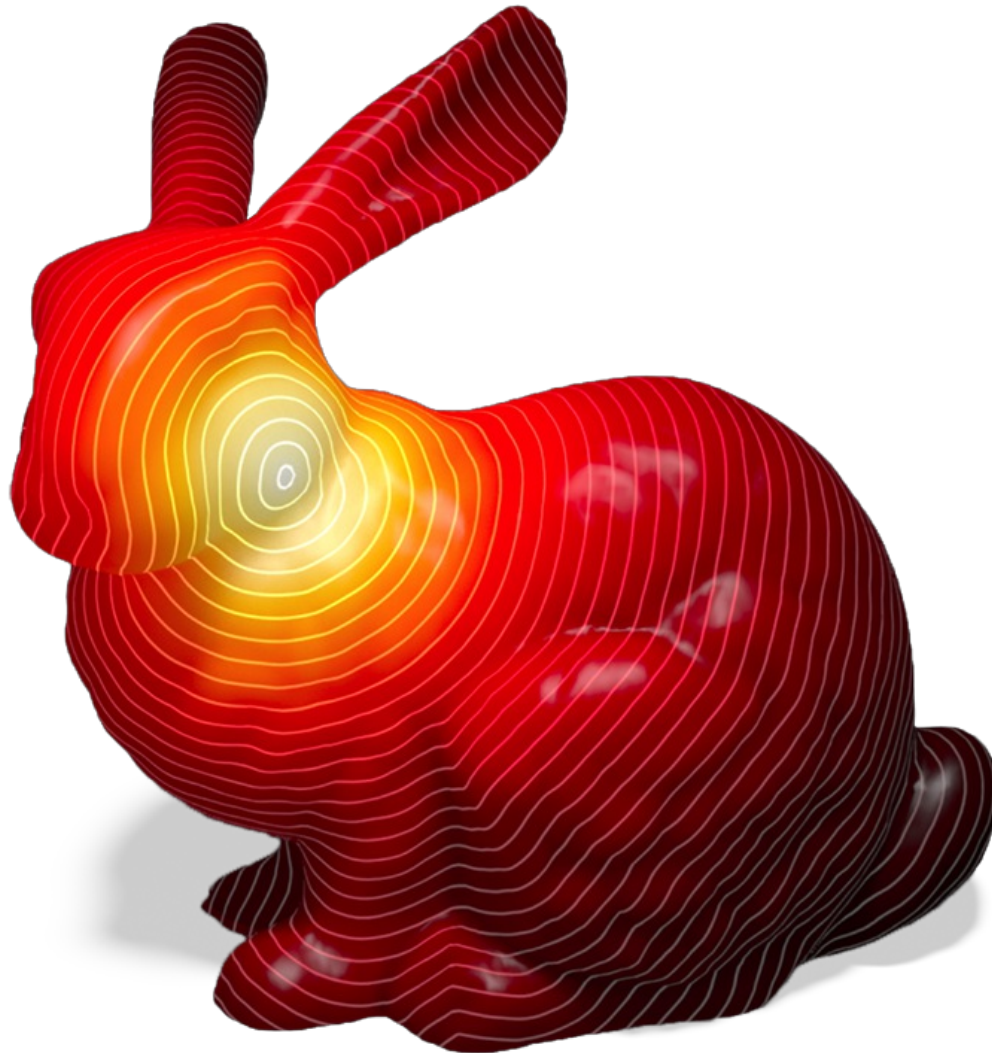
Structure, function, semantics, attributes, materials,
human and environmental impact, local context,
manufacturability, sustainability, cost...



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 (don't team up now)

Questions?

