Shape Representations

Point cloud

Polygon mesh

Volumetric mesh

Spline patches
Polygon Meshes
Basic Geometric Analysis

- Dimensions
- Curvature
- Geodesics
- Moments
Advanced Geometric Analysis

Discrete Differential Geometry

Medial Axis Transform

Spectral Decomposition
Local Shape Features
Global Shape Features
Shape Editing
Shape Parametrization
Shape Parametrization
Shape Parametrization
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

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?