



# Shape Analysis: An Introduction

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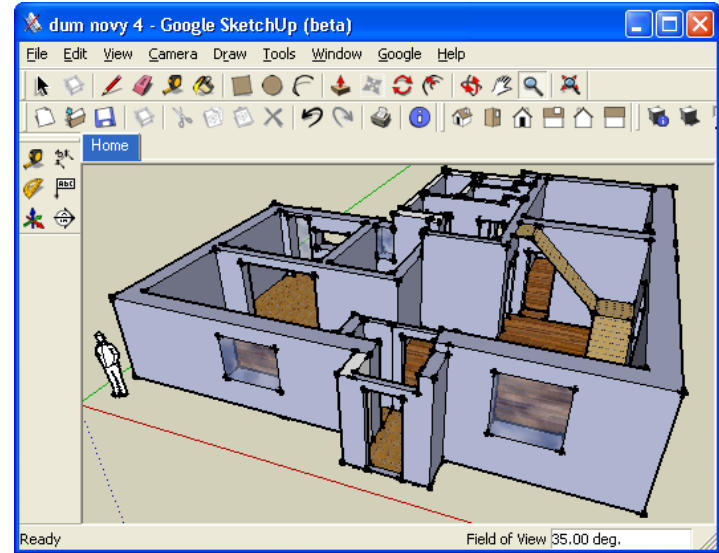
# 3D Content Creation

- 3D modeling software
- Algorithmic creation
- 3D data acquisition systems
- ...

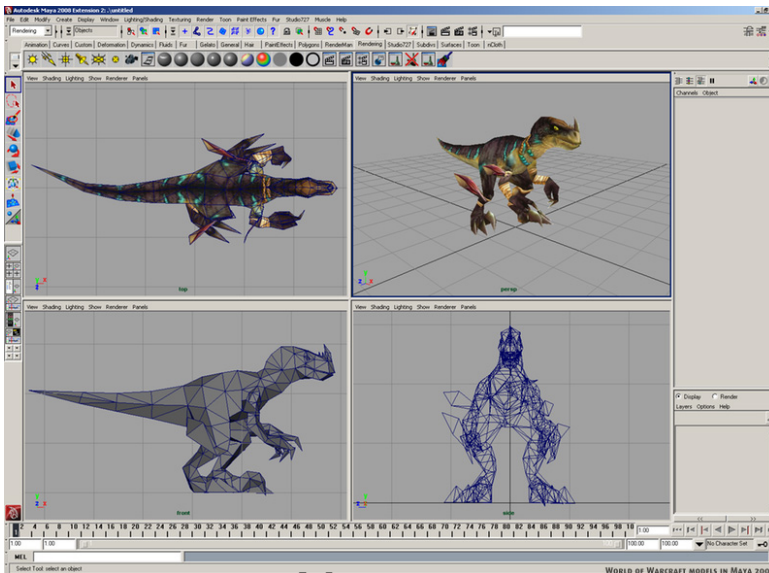
# 3D Modeling Software



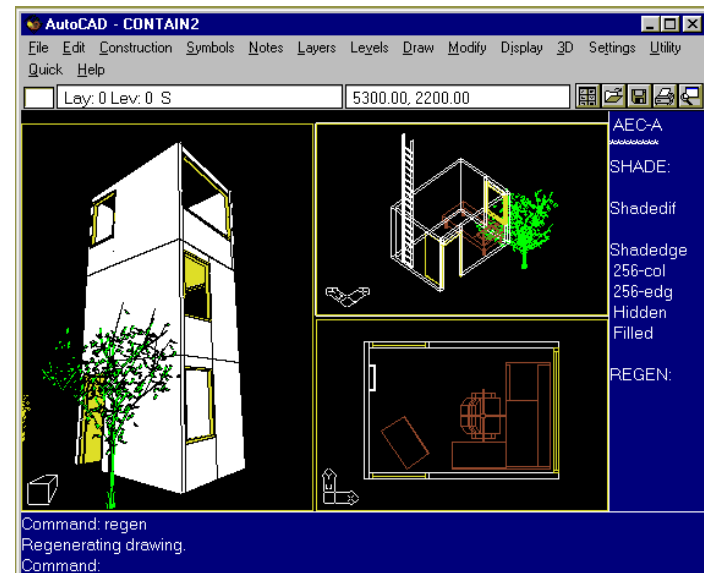
3D Max



Google Sketchup

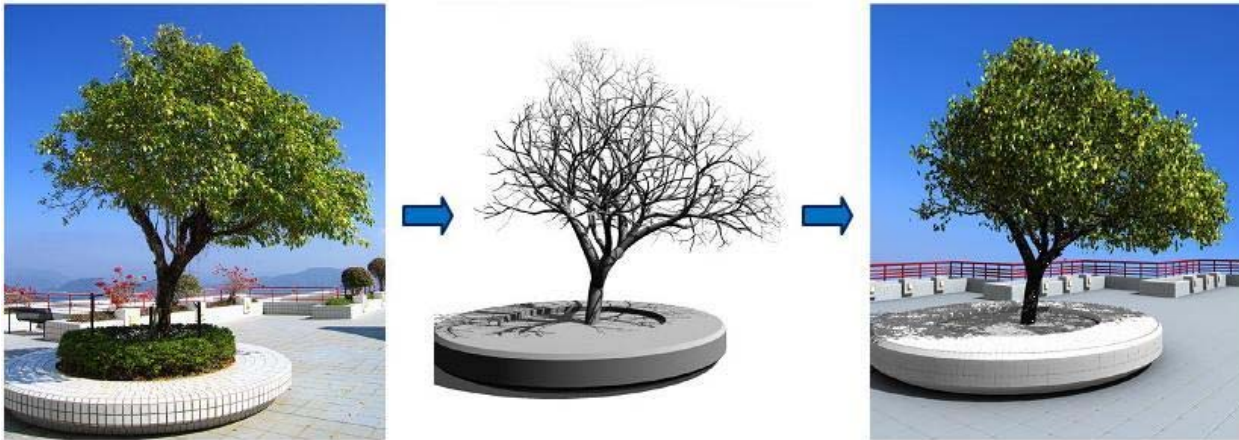


Maya

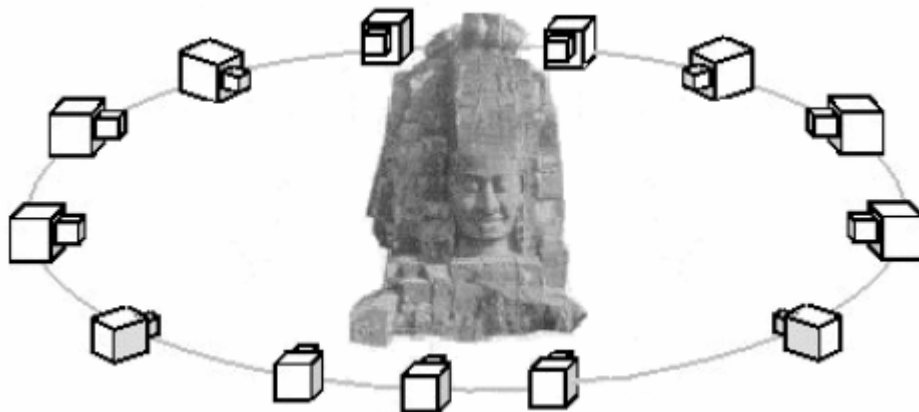
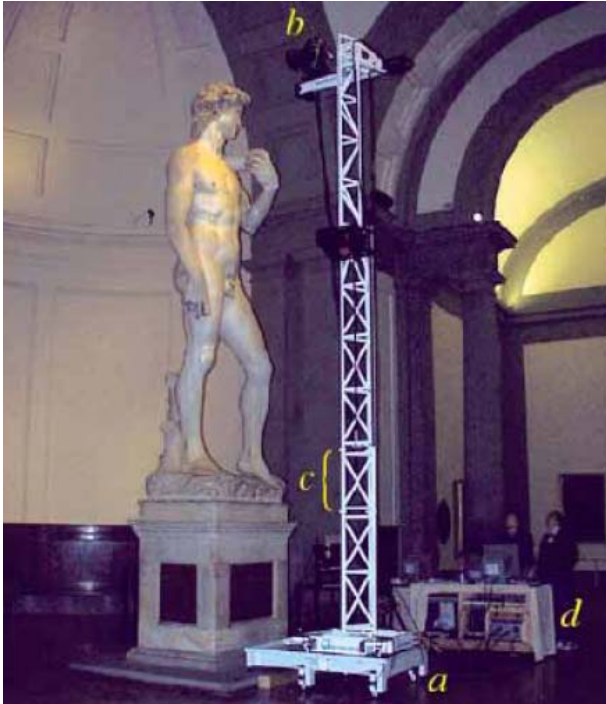


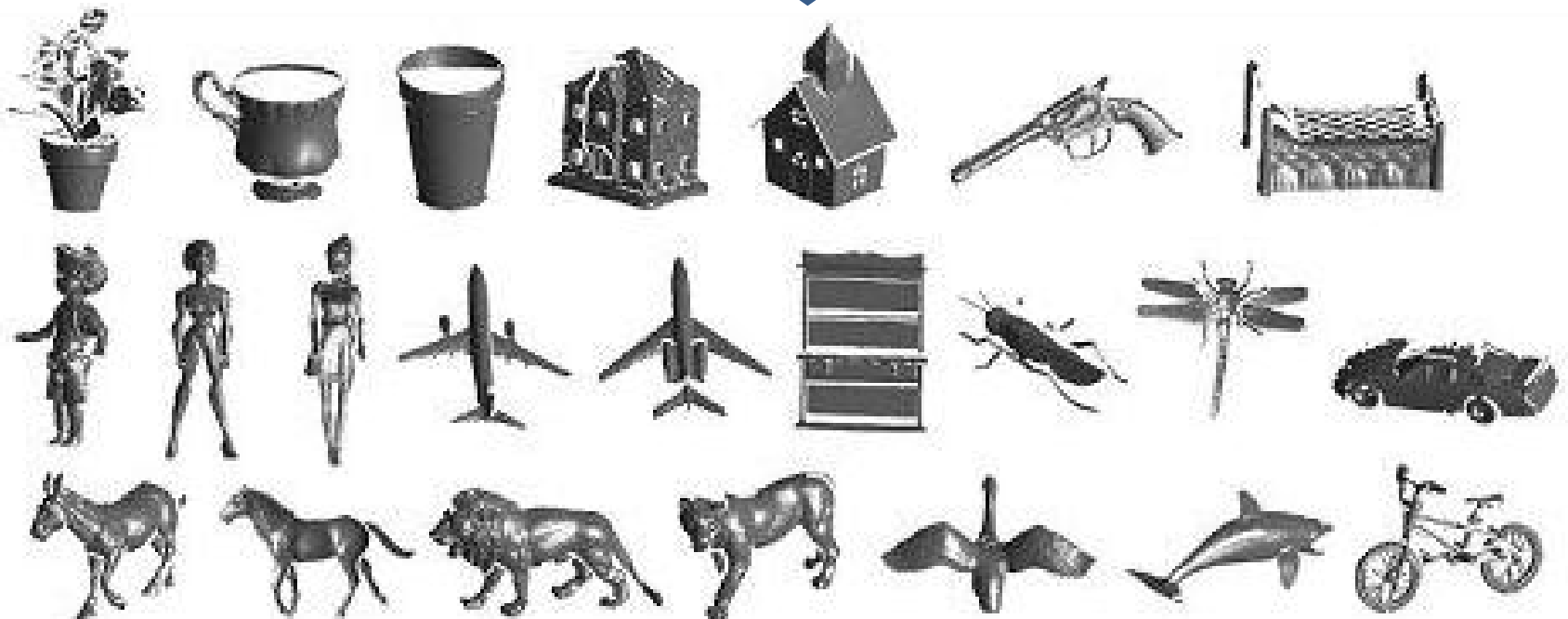
AutoCAD

# Modeling from X

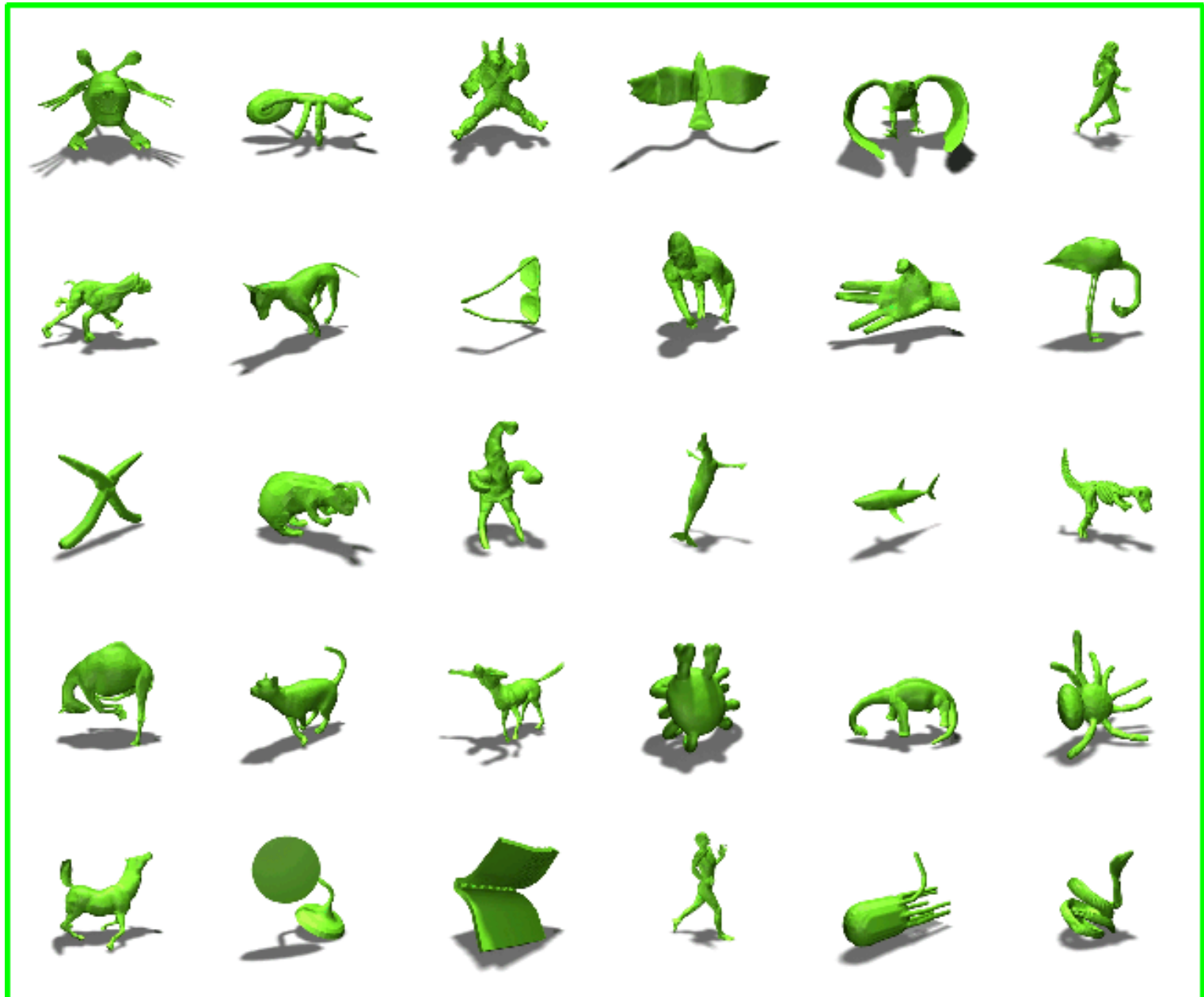


# 3D Data Acquisition Systems





# A number of 3D shapes...



# Princeton Shape Benchmark

- 900+ models, 90 classes



14 biplanes



50 human bipeds



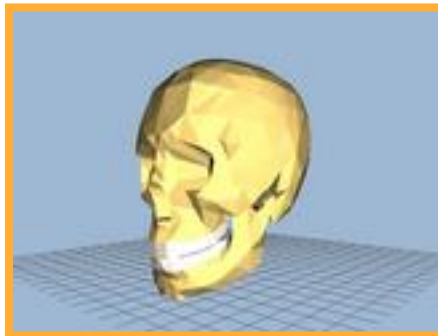
7 dogs



17 fish



16 swords



6 skulls



15 desk chairs



13 electric guitars

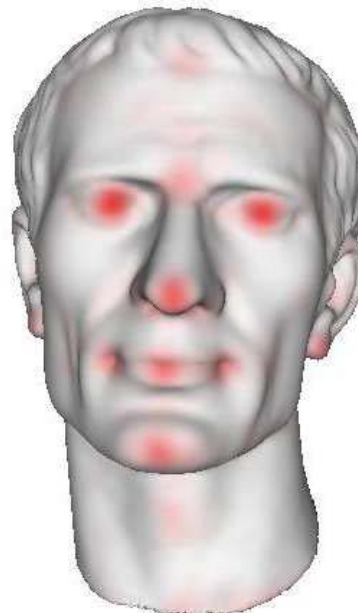
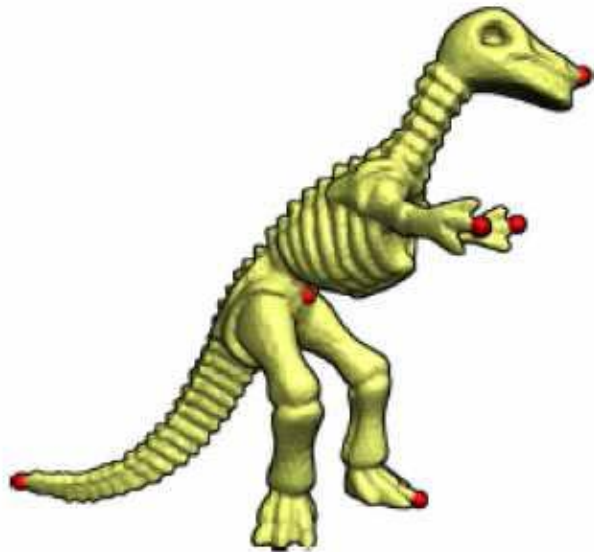
<http://www.shape.cs.princeton.edu/benchmark/>



# Understanding 3D Contents

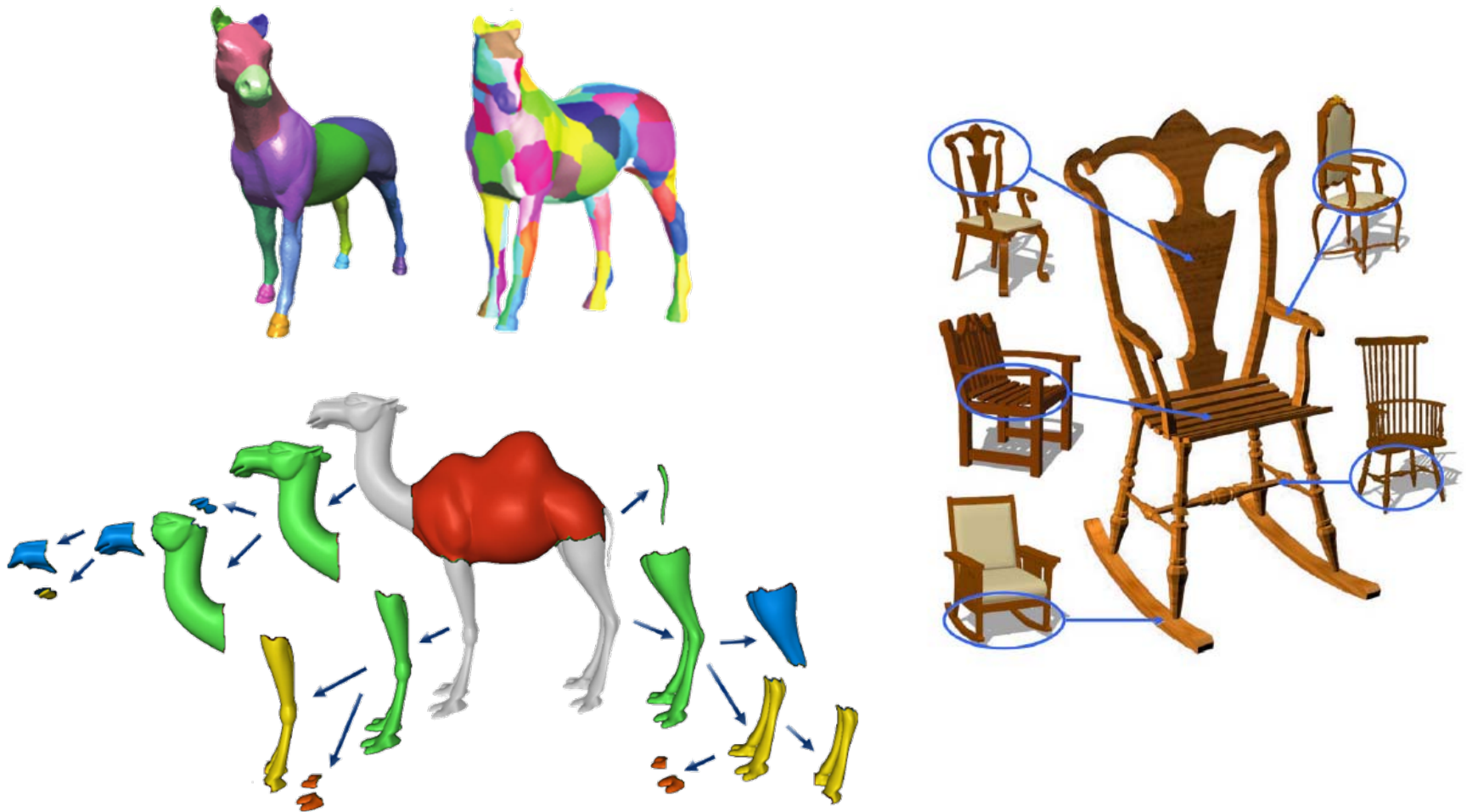
# Understanding Shapes

- Shape features
  - Feature points
  - Feature lines
  - Saliency



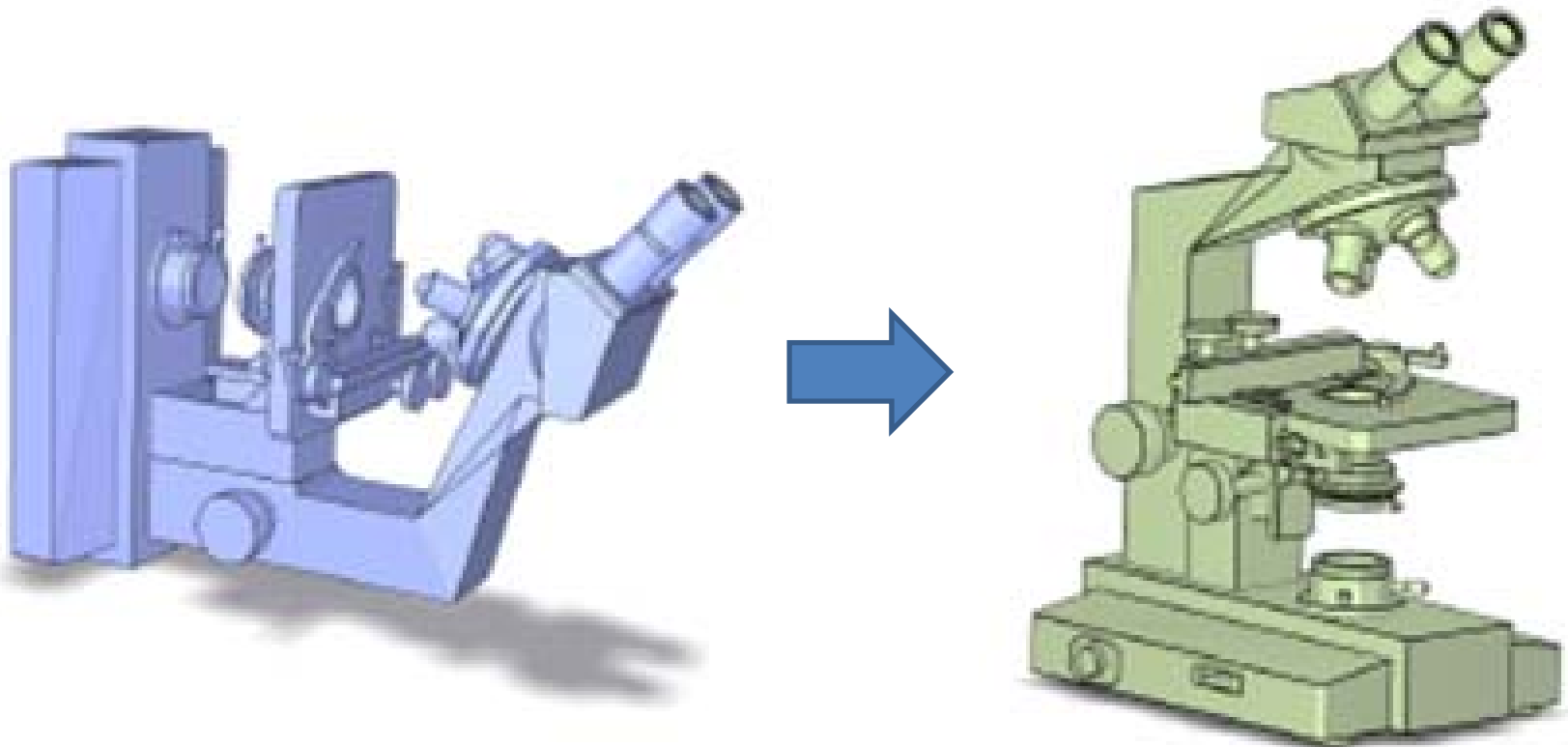
# Understanding Shapes

- Shape components (semantics)



# Understanding Shapes

- Alignment (upright)



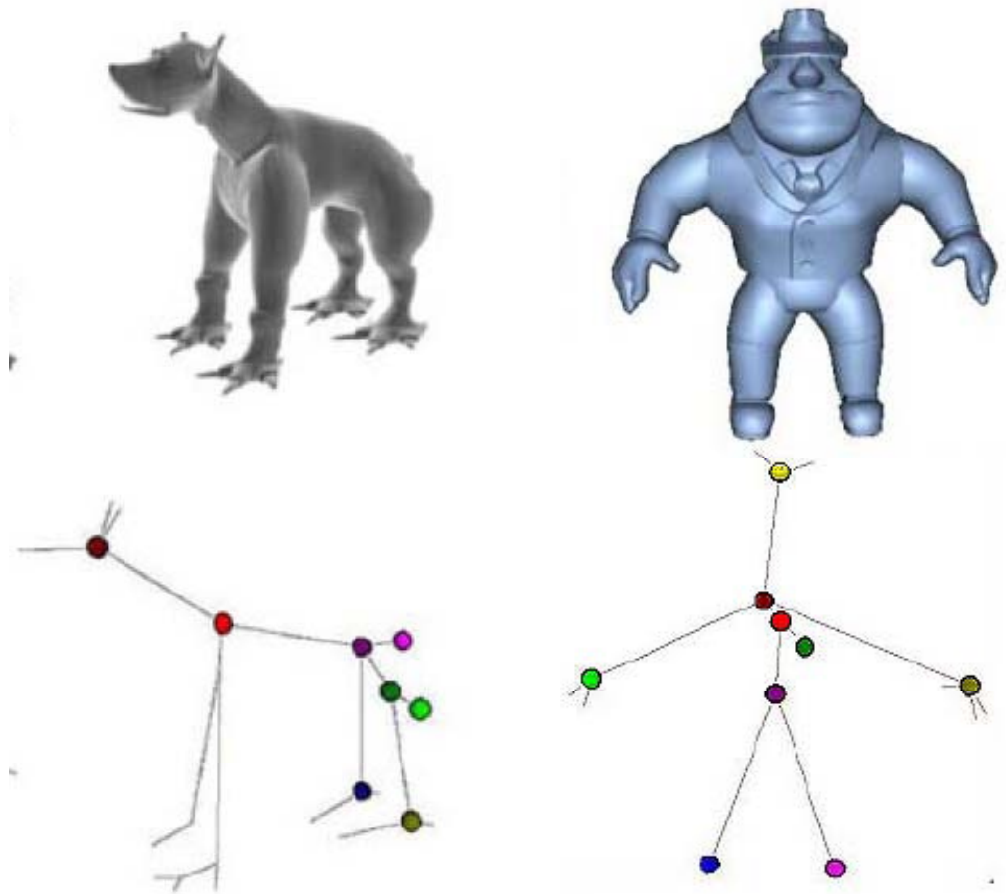
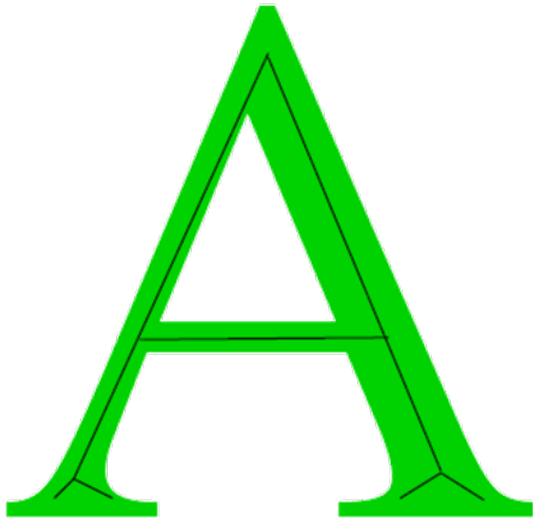
# Understanding Shapes

- Symmetries



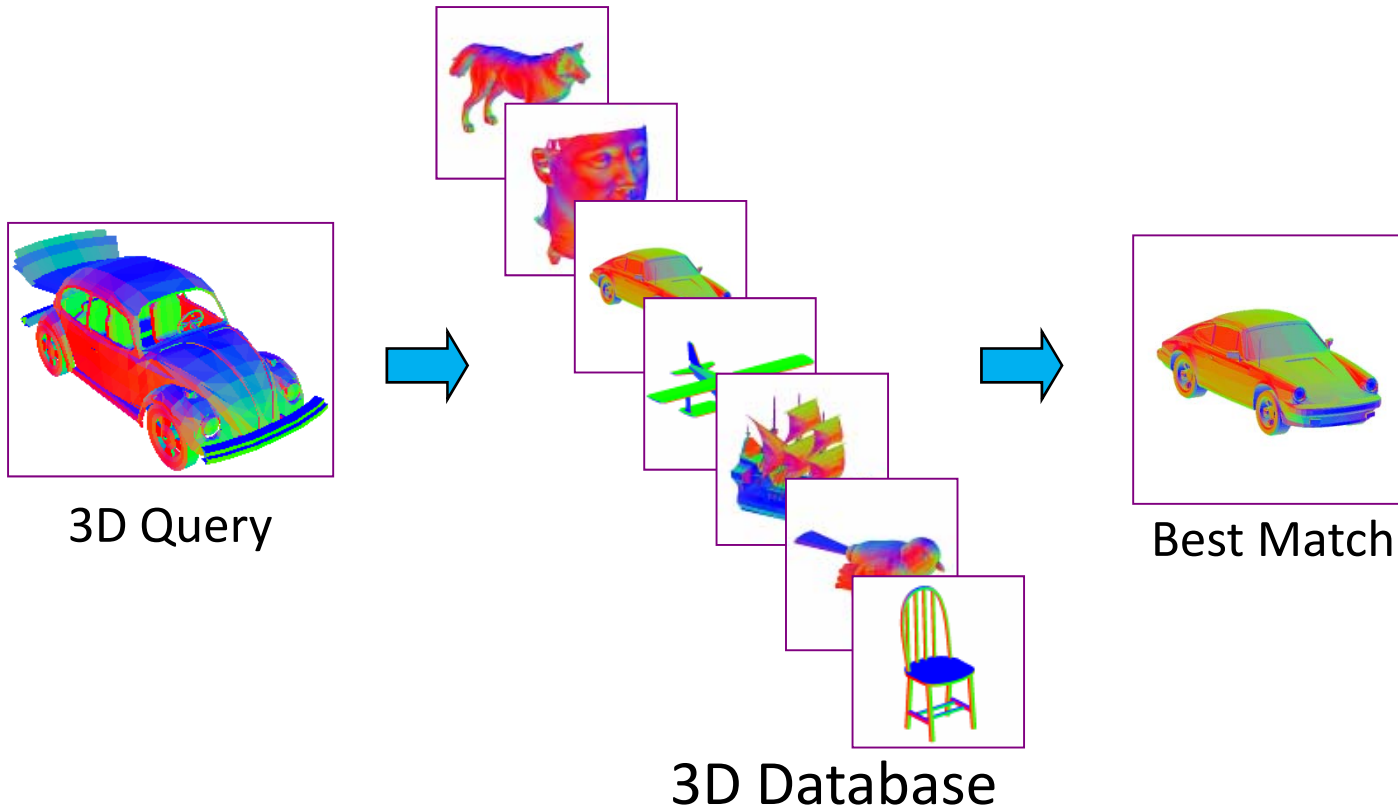
# Understanding Shapes

- Skeleton



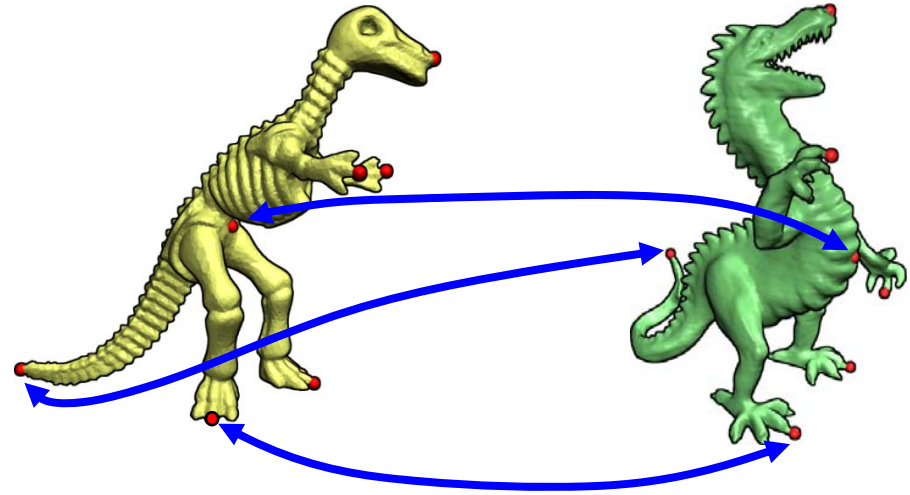
# Understanding Shapes

- Shape retrieval



# Understanding Shapes

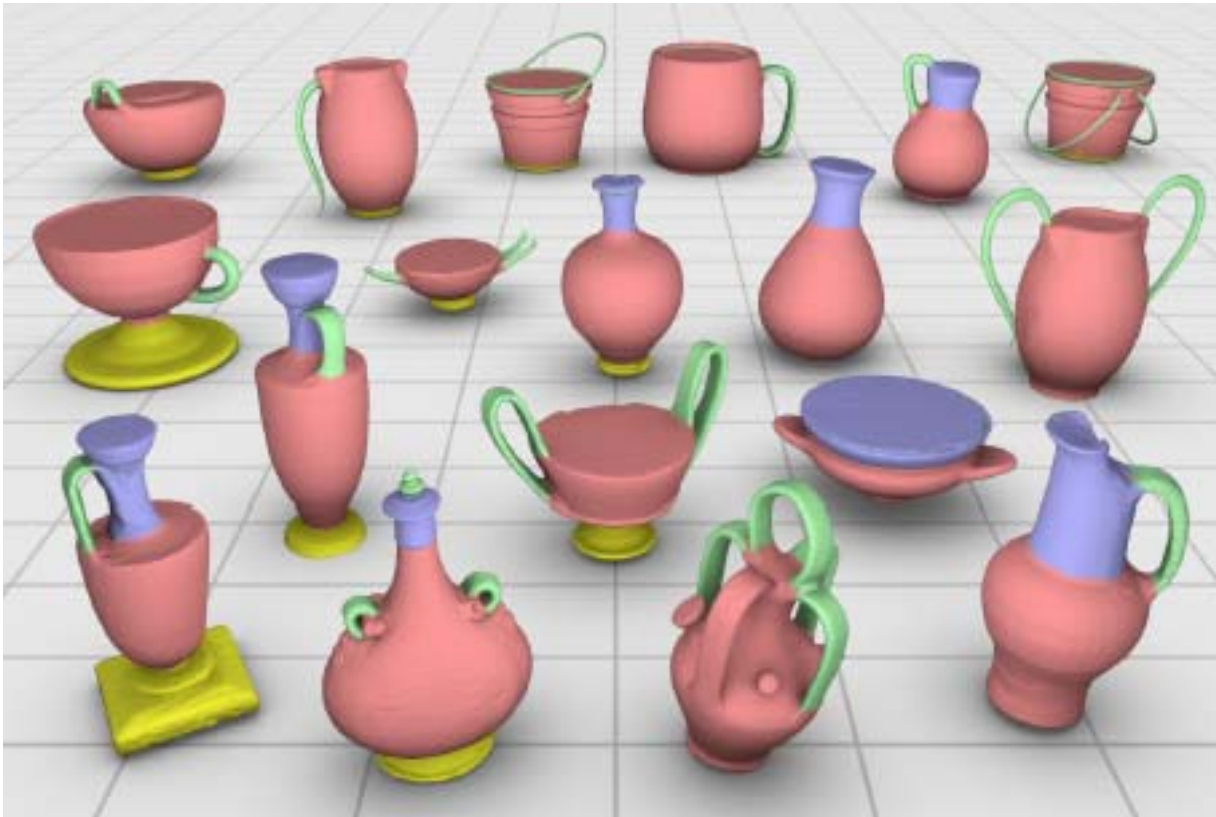
- Shape matching
  - Similarity
  - Correspondences





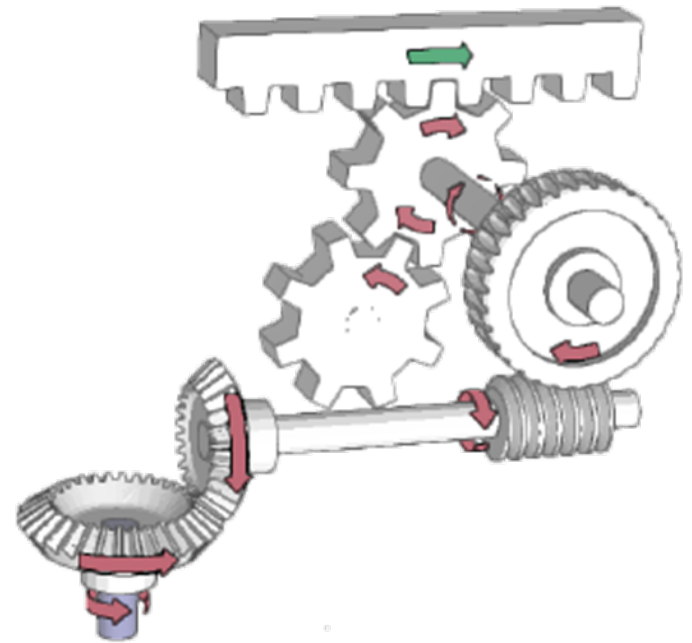
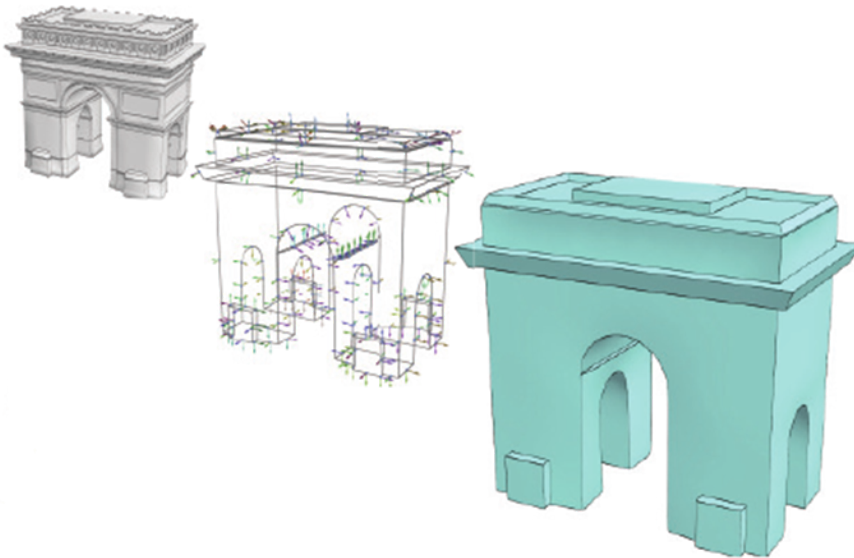
# Understanding Shapes

- Understanding a set of shapes
  - Co-segmentation



# Understanding Shapes

- Abstraction of shapes
  - [Mehra et al. SIGAsia 2009]
- Understanding assemblies
  - [Mitra et al. SIG 2010]



# Nature trend: low- to high-level

- Local level analysis
  - purely geometry/content-driven
  - mathematical formulation of objectives
  - Examples: curvature and normal estimation, mesh smoothing, simplification, remeshing, parameterization...
- High level analysis
  - non-local analysis
  - not easy to formulate objectives mathematically
  - Semantics is hard!

# Discussion