ArtiSketch: A System for Articulated Sketch Modeling

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Eurographics 2013
Sketch-Based Modeling

• Previous work:
  – 2D interaction (Teddy [Igarashi et al. 1999])
  – Predetermined views (orthographic)
  – Rigid object
Objective

• Exploit 2D articulated content (e.g. cartoon animations and sprites)
• Assumptions:
  – Articulated content (piecewise rigid)
  – The animation “imitates real-life”
• What is missing?
The Skeleton

- **Missing information:** camera transforms
- **Can the user supply somehow the missing info?** 3D skeleton!
A New Problem

• Input:
  – A set of $F$ sketches
  – A skeleton in $F$ (initial) poses
  – Correspondence

• Output:
  – Triangle mesh
  – Silhouettes of LBS fit sketch
System Outline

• Camera calibration
• Surface reconstruction
• Volume reduction
• Parts consolidation
Camera Calibration

• The user can’t be trusted!
• Objective: Maximize consistency between shape silhouette and sketch contour
• Voxel grid for visual hull carving (discretize camera rays)
• Camera transform = joint inverse transform
ICP-Based Approach

- Previous algorithms: texture, epipolar geometry
- Objective: Minimize Hausdorff distance between rays
- ICP iteration
  - Find correspondences between A-rays and B-rays
  - Optimize camera transformation
• Generalize: full skeleton, multiple cameras
• Perspective camera: camera dolly step

Camera B view
Surface Reconstruction

• LSM:
  – Chan-Vese, GAC, GVF, OMG...
Volume Reduction

• The visual hull = maximal volume
• The user meant something else...

Before

Circle

After

Heart
• Find rim paths (dynamic programming)
  – Silhouette cost
  – Proximity cost
  – Geodesic cost
  – Barycenter cost
  – Normal cost
• Bi-Laplacian equation
  – Anchors: rim points
Parts Consolidation

- Place a sphere at each joint
- Boolean union
- Bi-Laplacian equation
  - Variables: vertices inside spheres