3D Scans

September 27, 2004

Today’s Short Film

Arnold
by
Daniel M. Lara
Announcement

• Class cancellation: 10/4

from last class:
• Occlusion compatible order
• Artifacts of 3D warping
• Layered depth image (LDI)
Scanning 3D Objects

• UNC Laser Scanner
• Digital Michelangeo (Stanford)
• Cyberware Scanner
• ITRI Scanner and 3D Camera
• Structured Light Scanner (Intel, Light Field Mapping)

Available for Reading

• Cyberware homepage: http://www.cyberware.com
UNC Laser Scanner

• Reading room of UNC CS department
  – The depths are obtained from a laser range finder.

How to Get the Depths?

• Laser Rangefinder
• Cyberware scanner
  – used in Stanford’s Digital Michelangelo project
• Stereo matching
  – e.g. structure from motion
Structured Light

3D Geometry acquisition

Problems

• Merging multiple scans
• Black objects
• Shiny objects
• Public perception of the danger of laser
Capturing the complete object geometry

For complete coverage, need of multiple scans (16-20)

The corner markers are used for 3D alignment

Computing a unique surface mesh

Different approaches:
- Generate a surface mesh from a set of unorganized points [Hoppe92]
- Use of a “3D wrapping” software package such as Geomagic Studio (
- “Zipper” the set of partial meshes together into unique mesh [Turk94]
- Volumetric integration using the combined signed distance function [Curless96]
Rendering

• 3D Warping
• Rendering as 3D triangle meshes
• Rendering as 3D points
  – Qsplats
  – Surfel, Surface Splatting
• Surface light field (or light field mapping)

Modeling from Handheld Cameras

• "Obtaining 3D Models With a Hand-Held Camera" by Marc Pollefeys, SG2001 Course #2.
• Similar materials in SG2001 Course #46, Session 3.
Per-Pixel Depth: Why So Hard?

• Getting per-pixel depths is hard:
  – A classic computer vision problem: automatically finding (sparse and dense) pixel correspondences between 2D images.

• Epipolar line search:
  – Color may change (e.g., specular reflection)
  – Multiple matches possible (e.g., repeating pattern)
Visual Hulls

- Let's just give up on finding the exact match along the epipolar line.
- But finding the intersection with the silhouette is easy!
Representation

An IBVH-Based 3D Scanner

- Simultaneous capture of IBVH shape and reflected radiance
- Low-cost
- Fast acquisition

CS5520 Image-Based Rendering
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