CMPUT 428: 3D Modeling

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Contents

1 Lecture - Mar 12

Structure from Silhouette

Get cone ray from silhouette

1.1 Incremental Free Space Carving

Triangulate sparse point cloud: remove tetrahedrons/triangles + remake w/ points

1.2 3D modeling system

online, incremental handling of new info events
works with sparse point clouds (good for vision/feature based methods)
models coarse

1.3 3 Tier Model

Macro, Meso, Micro model
refine geometry w/ coarse model as prior Multi Tiered Models:

- Commonly:
  - 2 Tiers: 3D geom and appearance (texture mapping)
  - Used in graphics applications, recovered from vision applications
- 3 Tier:
  - Macro - scene geometry (triangulation map)
  - Meso - fine scale geometric detail (displacement map)
    - Micro - fine scale geometry/reflectance (texture map)
- Captured via sequential refinement

1.4 Multiscale Model

Geometry alone doesnt solve modeling, need multiscale model
Need

1. Geometry
2. Depth
3. Dynamic Texture

$\rightarrow$ Rendering
Use image derivatives (know lighting changes, position of view, etc.) in forward way to render a diff. img (helps get photorealism)

1.5 Capgui

Step 1 - Calibration

Step 2 - Segmentation

Get rid of background

Step 3 - Shape From Silhouette

8-60 imgs
multiple views of same object → intersect **gneeralized cones** generated by each img to build a volume (guaranteed to contain object)
limiting smallest vol. obtainable in this way is known as the **visual hull** of the object

1.5.1 SFS methods

Voxel based (use voxel grid rep.)

inaccurate

triangulate w/ marching cubes algo

Image ray based (use image rays)

accurate

Axis aligned (use rectlinear rays (instead of camera rays), mark 'cut' points of image rays)

moderately accurate

fast

marching intersections algo

(mix of img ray and voxel based)

Step 4 - Phototextures + Texture Mapping

For each triangle in model, establish corresponding region in the phototextures
Difficulties:

- Tedious to sepcify texture coords. for every triangle

1.5.2 Common Text. Coord. Mappings

Orthogonal
Cylindrical
Spherical
Perspective Projection
Texture Chart (ie. text. split + flatten; cut object into pieces and map textures to each piece (piecwise planner))

1.5.3 Advanced Texture Splitting and Mapping

Floating Planes Method

- split into dozen - several dozen perspective mappings
- union of persp. planes accurately represent obj

LCSM (Least Squares Conformal Mapping)

- least square (locally) preserve orthogonality

Step 6 - Texture Basis Computation

1.6 Dyntex Theory