Information Visualization

Week 12, Fri Apr 1

http://www.ugrad.cs.ubc.ca/~cs314/Vjan2005
Review: Volume Graphics

- for some data, difficult to create polygonal mesh
- **voxels**: discrete representation of 3D object
  - **volume rendering**: create 2D image from 3D object
- translate raw densities into colors and transparencies
  - different aspects of the dataset can be emphasized via changes in transfer functions
Review: Volume Graphics

- **pros**
  - formidable technique for data exploration

- **cons**
  - rendering algorithm has high complexity!
  - special purpose hardware costly (~$3K-$10K)

volumetric human head (CT scan)
Review: Isosurfaces

- 2D scalar fields: isolines
  - contour plots, level sets
  - topographic maps
- 3D scalar fields: isosurfaces
Review: Isosurface Extraction

- array of discrete point samples at grid points
  - 3D array: voxels
- find contours
  - closed, continuous
  - determined by iso-value
- several methods
  - marching cubes is most common

Iso-value = 5
Review: Marching Cubes

- create cube
- classify each voxel
- binary labeling of each voxel to create index
- use in array storing edge list
  - all 256 cases can be derived from 15 base cases
- interpolate triangle vertex
- calculate the normal at each cube vertex
- render by standard methods
Review: Direct Volume Rendering Pipeline

- do not compute surface
Review: Transfer Functions To Classify

- map data value to color and opacity
  - can be difficult, unintuitive, and slow

Gordon Kindlmann
Review: Volume Rendering Algorithms

- ray casting
  - image order, forward viewing

- splatting
  - object order, backward viewing

- texture mapping
  - object order
  - back-to-front compositing
Review: Ray Casting Traversal Schemes

Intensity
Max

Average

Accumulate

First

Depth