

The Keck Laboratory

is designed for research in 3D multi-perspective computer vision.

Current Research

- Volumetric Reconstruction
- Shape Analysis
- Motion Capture
- Detection and Tracking
- Gesture Recognition

Capabilities

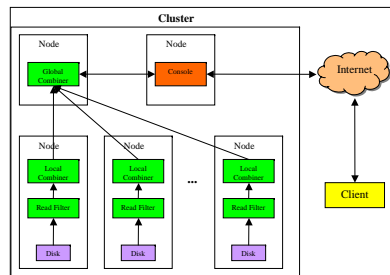
- 64 digital, progressive-scan cameras organized as sixteen quadrangular rigs each with three grayscale and one color camera
- 16+1 Dell 610 Precision Workstations (Pentium II Xeon 450 MHz with 1 GB SDRAM)
- Gigabit Ethernet network
- Data Translation DT340 Digital I/O Board for synchronization signals

Image Capture

• per node

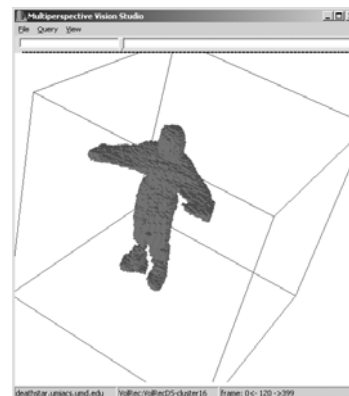
# of cameras	1	4	4	4
Frames per second	30	30	60	85
Max Duration (sec)	99.8	24.9	12.5	8.8

• cumulative: with 64 cameras shooting at 85 fps and full image resolution, 1 minute of video generates 95 GB



Vision Studio

- Independent of data acquisition facilities
- Generic multi-view sequence management
- Extensible multi-view application framework via [DataCutter](#) middleware for building parallel/distributed data analysis applications on multi-dimensional datasets
- Designed to answer [range queries](#)
- Large datasets (currently terabytes)
- [ADR](#) for single cluster/parallel machine
- [DataCutter](#) for data distributed/processed at multiple sites on the Grid



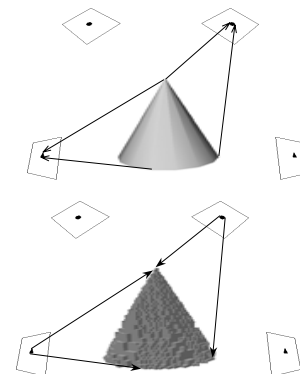
Volumetric Reconstruction

Largely based on Szeliski's rapid volume reconstruction technique.

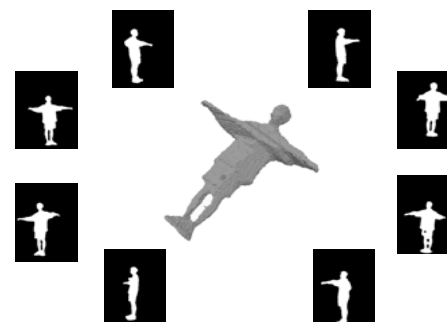
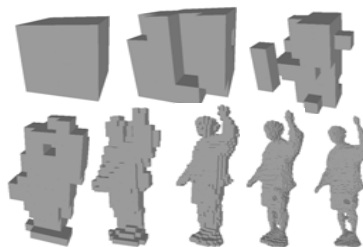
Multi-view Silhouette Intersection

Starting with a multi-perspective view of an object, for each view,

- compute the silhouette
- build object's visual cone as a 3D occupancy map
- represent visual cone as an octree
- intersect octant's projection bounding square with object's silhouette to decide octant's occupancy

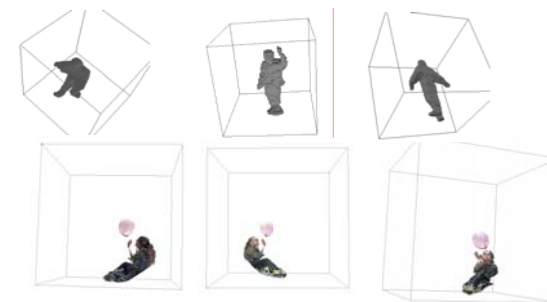


Reconstructions



Client GUI

- a database inquiry involves specifying a 3D region, a time range and a volumetric reconstruction resolution
- query result is a multi-resolution reconstruction of the foreground object region lying within the query region
- result can be used for 3D shape analysis and 3D tracking
- Support colorized mesh output in the near future



Voxel Projection Strategy

is the fundamental query execution performance factor

- naïve 8 vertex projection
- vertex caching
- [approximate projection](#)