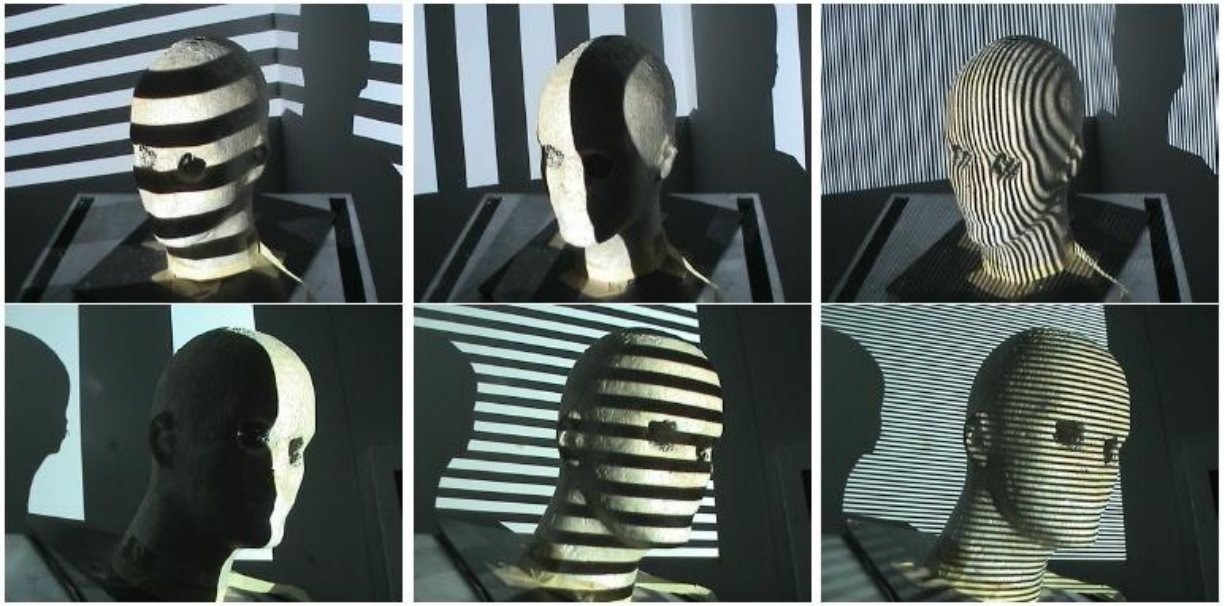


Project Ideas

Guido Gerig

CS 6320, 3D Computer Vision

Spring 2012

Final Project 3D CV

- Yourself or groups of two.
- Select a 3D vision method (examples given in slides).
- Develop a project that goes from input data to a 3D solution.
- Develop/use code, generate images (or make use of existing test images), show some substantial effort towards your own solution.
- Write a final report (min 6 pages) describing your project, approach, algorithms, input data, results, limitations, problems, critical discussion.
- Short presentation (5-10Min, ev. demo) and discussion in the last class.
- Report and presentation clearly need to reflect contributions from each partner.

3D from Stereo

Disparity map

image I(x,y)

Disparity map D(x,y)

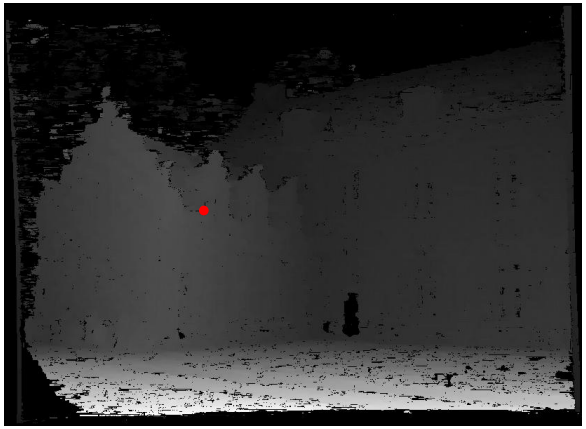
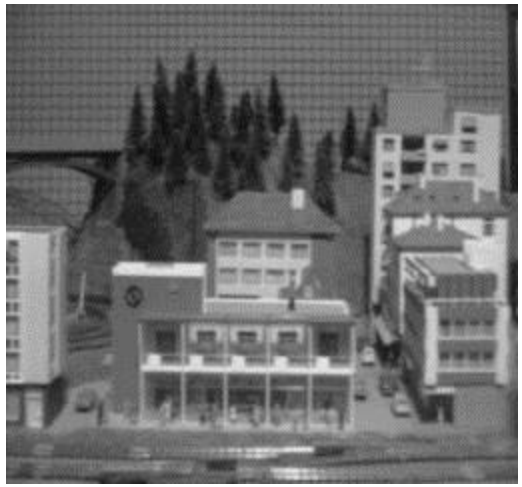


image I´(x´,y´)

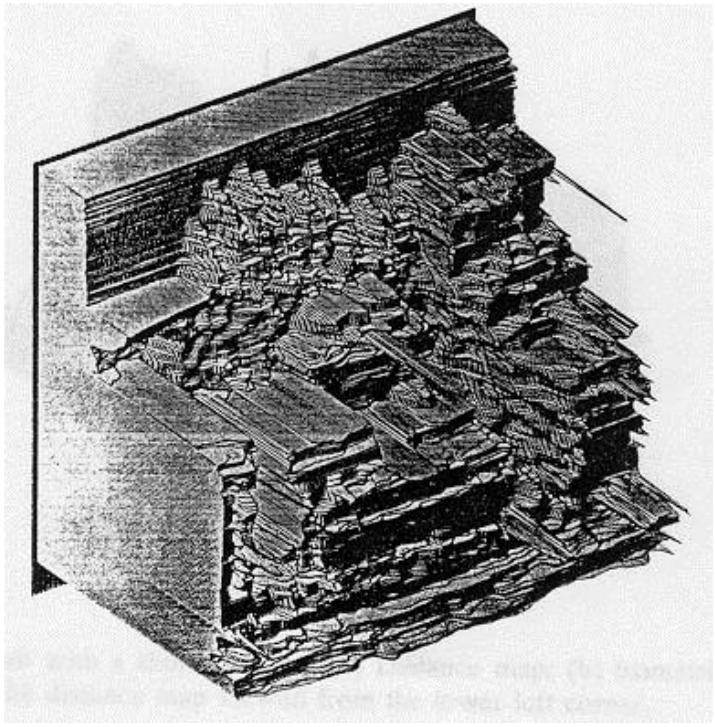
$(x´,y´)=(x+D(x,y),y)$

I1



I2

I10

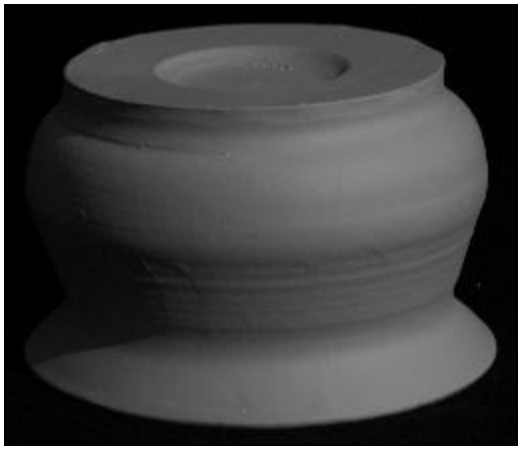


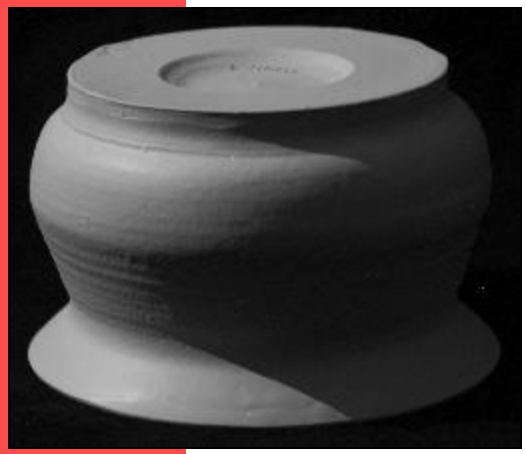
Reprinted from "A Multiple-Baseline Stereo System," by M. Okutami and T. Kanade, IEEE Trans. on Pattern Analysis and Machine Intelligence, 15(4):353-363 (1993). \copyright 1993 IEEE.

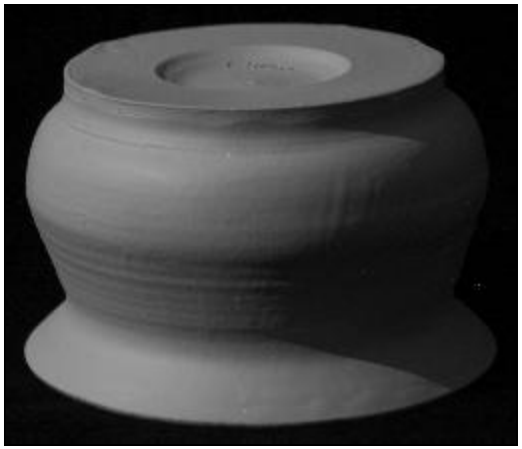
Shape from Shading

Ceramic Pot Data

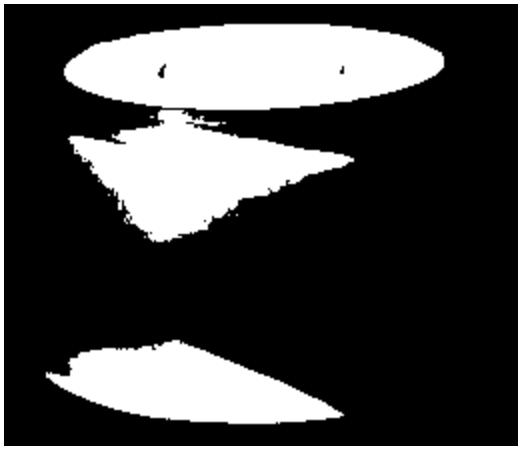
Input images





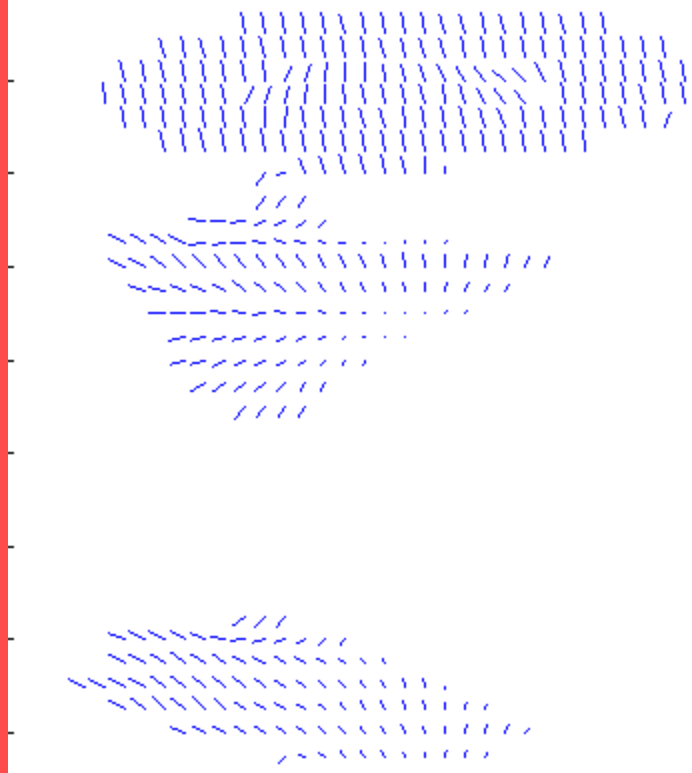


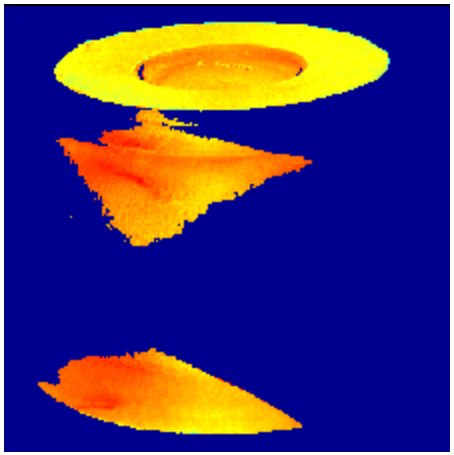
Usable Data Mask



Ceramic Pot Results

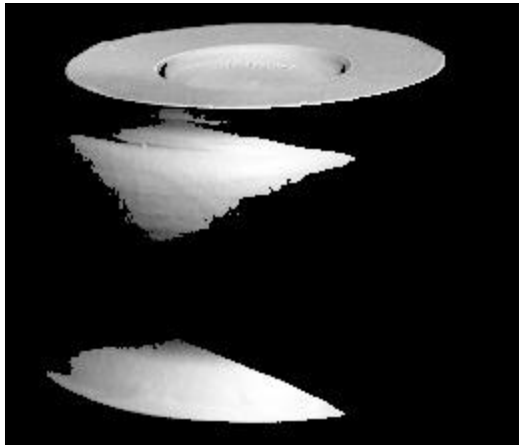
Needle Diagram:





Albedo

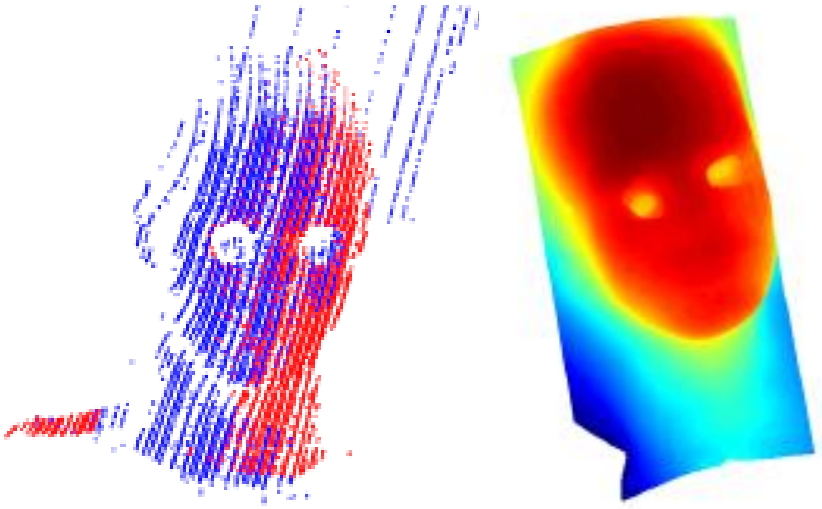
Re-lit:



Structured Light

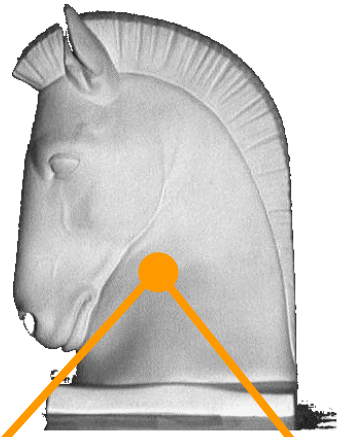
Active Vision: Structured Light

Segmentation: Binarization and coding of stripes

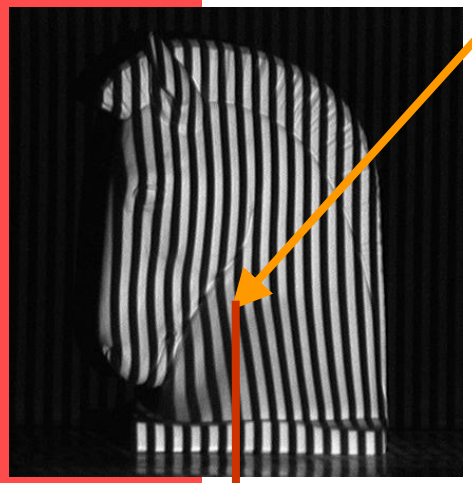


3D model extracted from stripe pattern

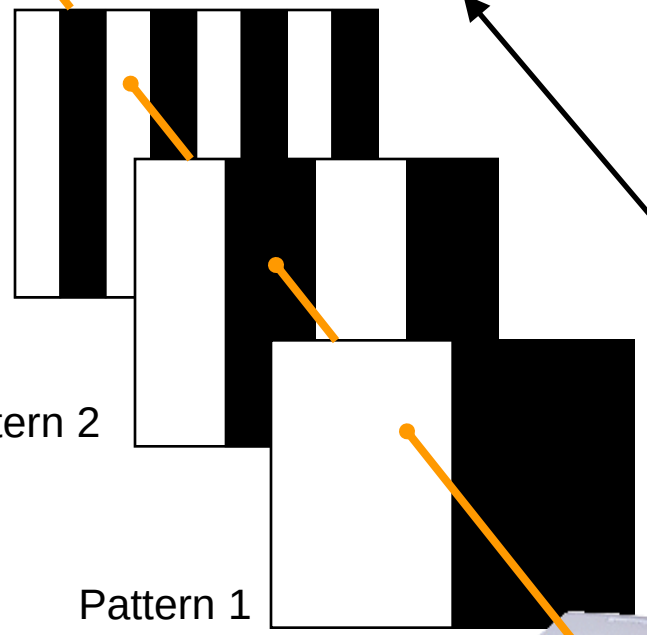
Binary Coding



Example: 7 binary patterns proposed by Posdamer & Altschuler



...

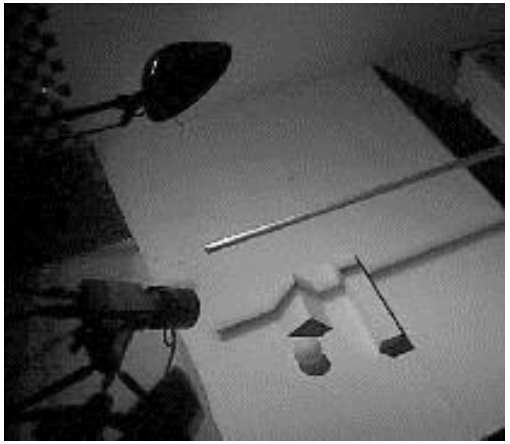


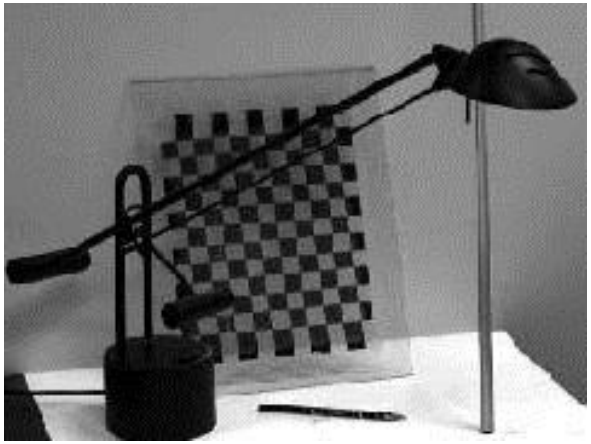
Projected over time

Codeword of this píxel: 1010010 → identifies the corresponding pattern stripe

“Cheap and smart” Solution

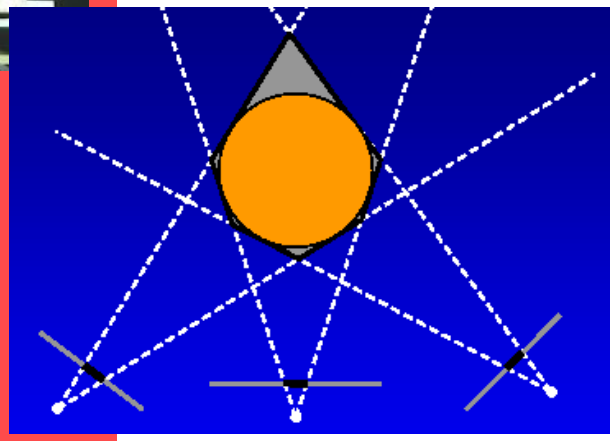
Example: Bouguet and Perona, ICCV’98

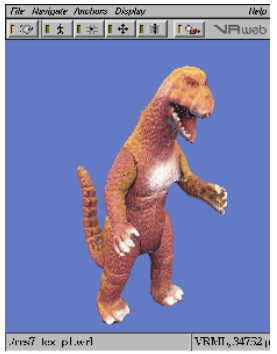


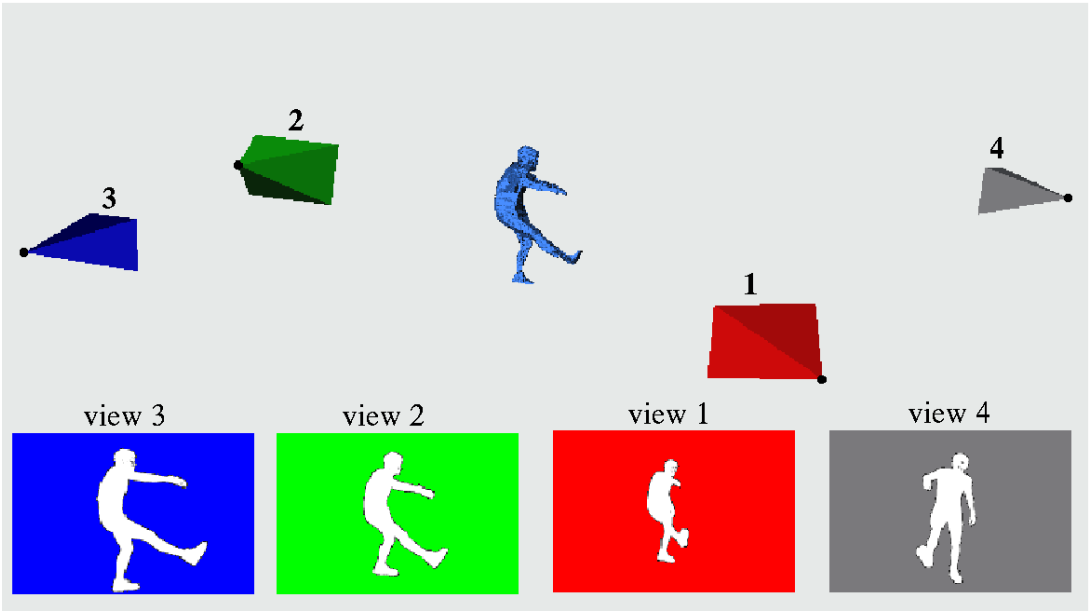


Shape from Silhouettes

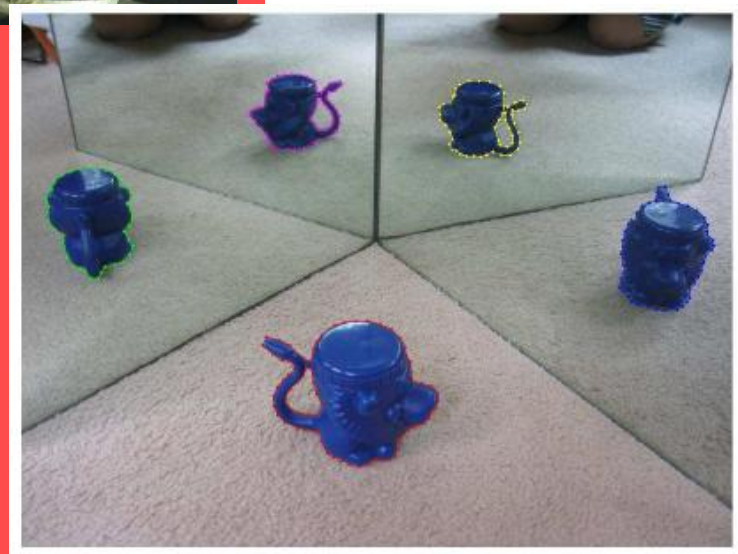
3D Shape from Silhouettes

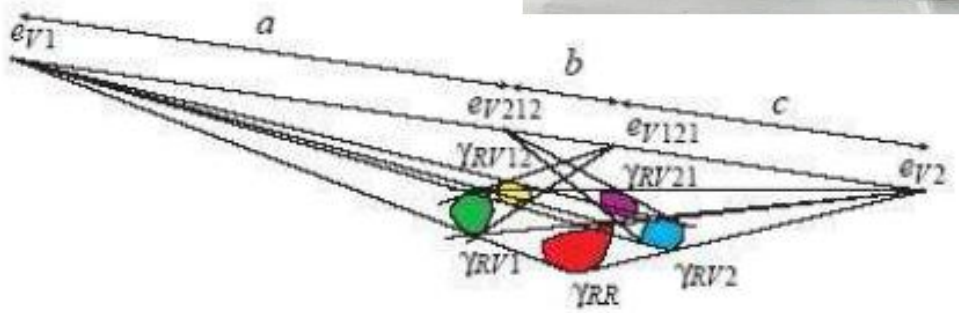






3D shape from silhouettes



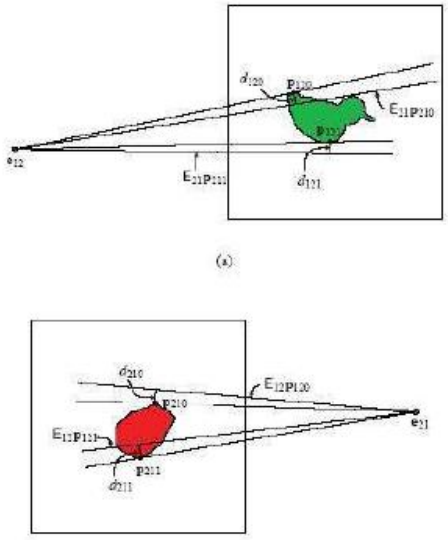


Forbes et al., ICCV2005

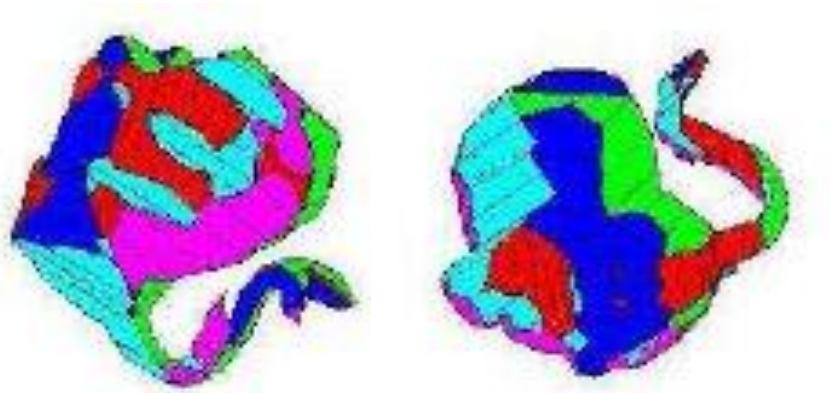
Christine Xu, Computer Vision Student Project

Think about the geometry
-> calculate relationship between silhouettes

3D shape from silhouettes



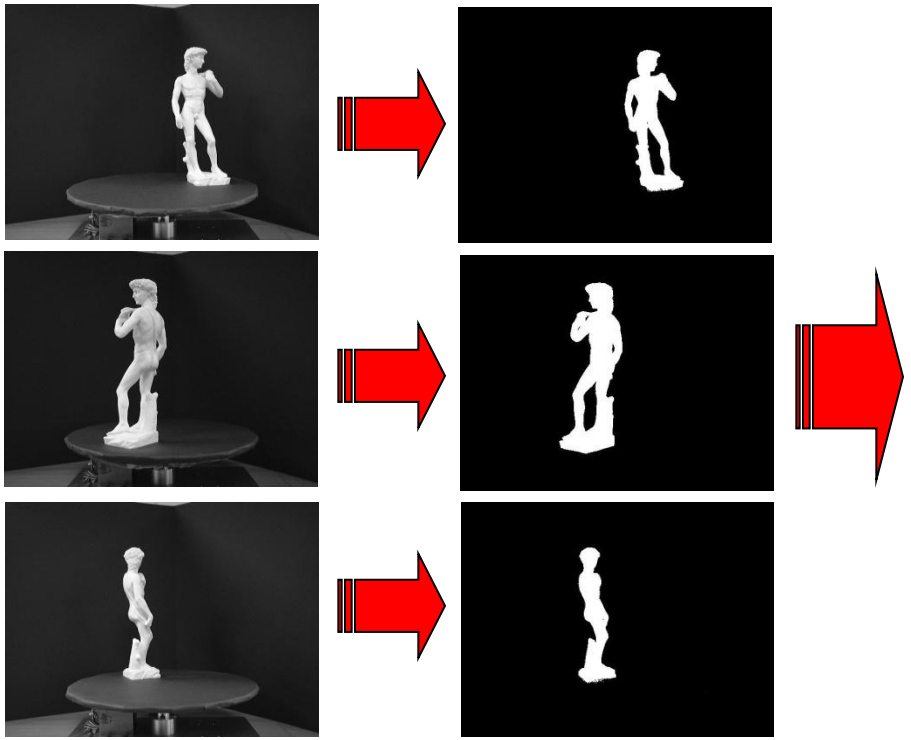
Build 3D model

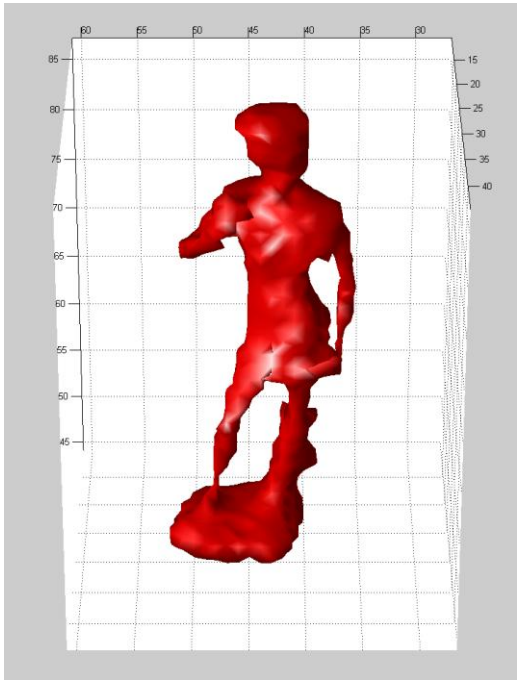


Visualize 3D model from arbitrary viewing angles

Example

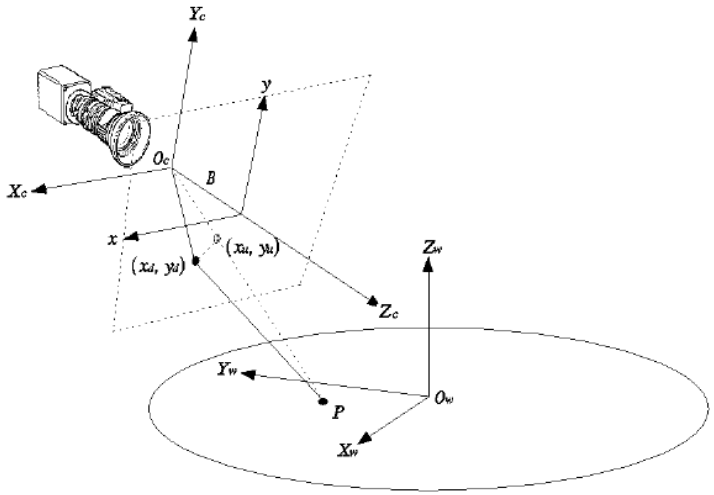
- Compute visual hull with silhouette images from multiple calibrated cameras
- Compute Silhouette Image
- Volumetric visual hull computation
- Display the result

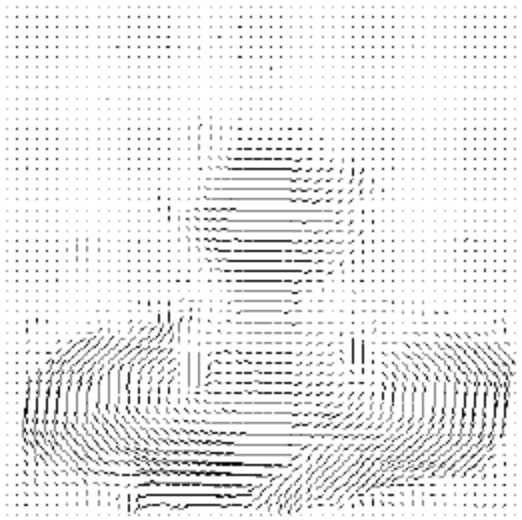




Shape from Rotation

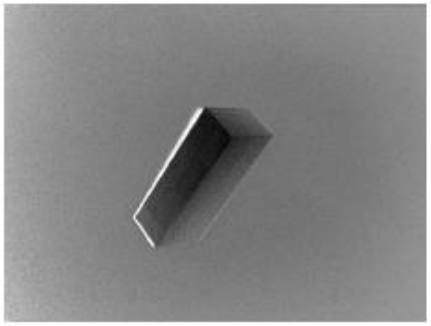
Turntable Approach

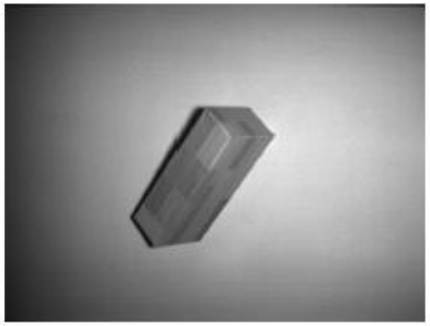




Range Sensor Data Processing to get 3D Shapes

Input Data: Depth Maps

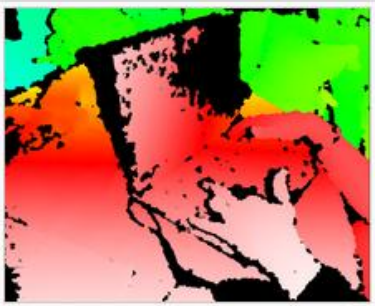




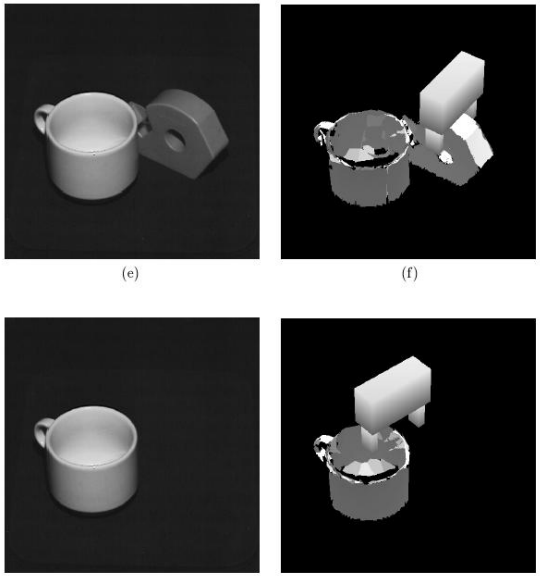
Range Image (left) and gray level image (right)

A slide from Microsoft's E3 Conference showing a diagram of the technologies in Kinect

This infrared image shows the laser grid Kinect uses to calculate depth



The depth map is visualized here using color gradients from white (near) to blue

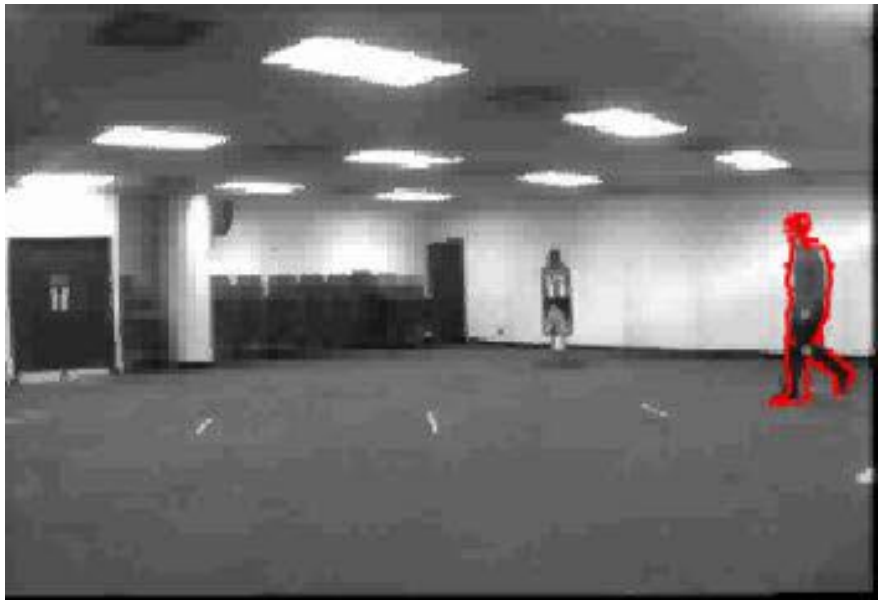


(e) (f) (g) (h)

Figure 9: Continuation of the example scene consisting of four objects. (e) and (f) grasping the Scotch tape roller, and (g) and (h) grasping the coffee cup.

Object Tracking

Object Tracking



Spatiotemporal Volumes

Figure 3.3: Visualization of a spatio-temporal volume and a spatio-temporal cut plane. On the left, a 10 second video is presented as a spatio-temporal volume. The front of the volume shows the first frame, the right side shows the right-most vertical line through time, and the top shows the top-most scanline through time. On the right, the volume has been rotated and been cut using two planar cuts. The first, parallel to the front face, has shortened the video. The second has revealed a different scanline which shows the motion of people walking during the duration of the video.

Motion Tails

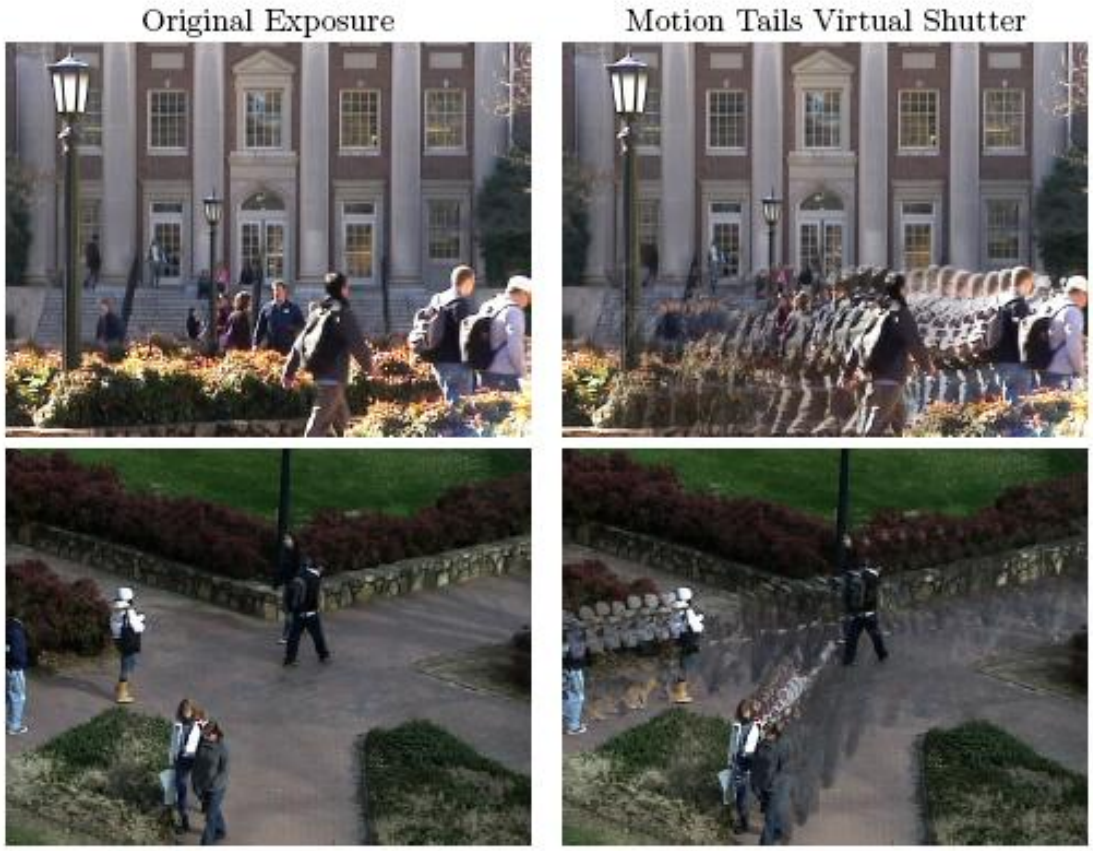
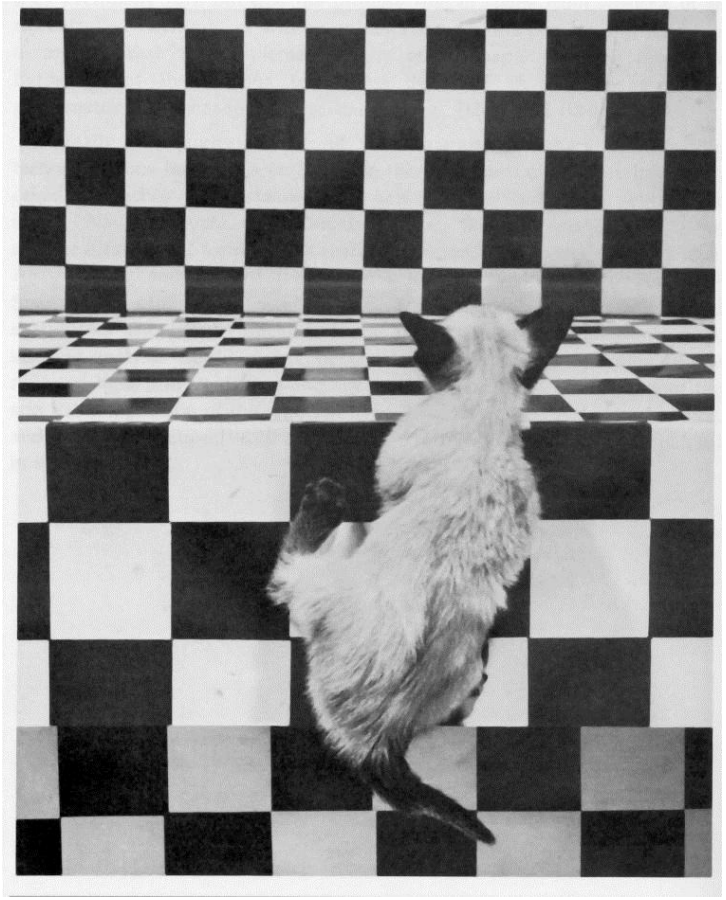


Figure 5.9: Two examples of using motion tails to depict dense motion paths between sampled time-lapse frames. The building front result (above) uses uniform sampling, while the crowded sidewalk (below) is non-uniformly sampled.

3D from Texture

Shape from Texture



Shape from Texture

Images from: http://www.betterphoto.com/gallery/dynoGall2.asp?catID=355, and google images

3D from Optical Flow

Results

Optical Flow

- Motion of brightness pattern in the image
- **Ideally** Optical flow = Motion field