CS 4487/9587
Algorithms for Image Analysis

- ## Web page: www.csd.uwo.ca/courses/CS4487a/

  - announcements, assignments, code samples/libraries, syllabus
  - lecture notes

- ## Text-books:

  - Recommended text:
    - Richard Szeliski (Microsoft Research). **Computer Vision: Algorithms and Applications** *szeliski.org/Book* (hard copy can be bought)
  - Other readings:
    - Sonka, Hlavac, Boyle. **Image Processing, Analysis, and Machine Vision**. Thomson Learning; 3d edition (2007)
    - Gonzalez and Woods. **Digital Image Processing**, Prentice Hall, 2002
    - Stan Z. Li. **Markov Random Field Modeling in Image Analysis**, Springer, 2009
    - Cormen et al. **Introduction to Algorithms**, The MIT Press, 3d edition, 2009
    - Kleinberg and Tardos. **Algorithm Design**, Addison Wesley, 2006
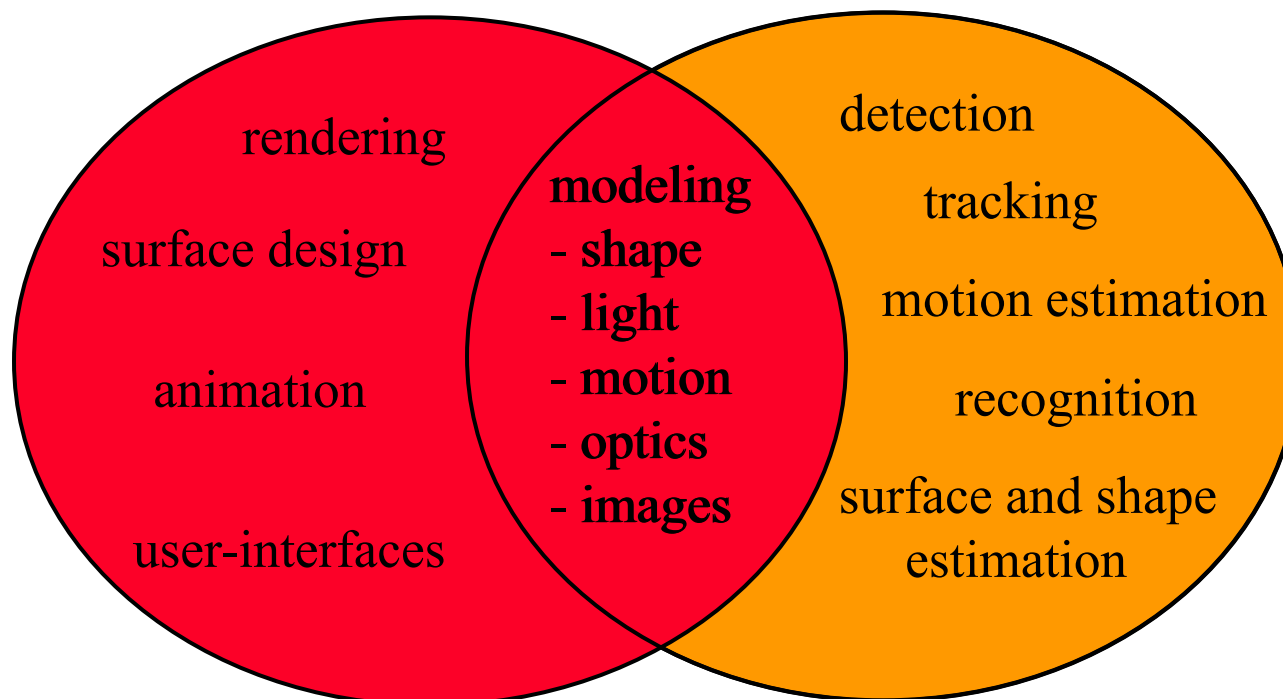
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■ Today

- Topic 1. Overview of computer vision applications
  - recommended reading: Szeliski, Ch.1

- Topic 2. Image modalities

Slide from Steve Seitz

Overview of Image Analysis

rendering

surface design

animation

user-interfaces

modeling
- shape
- light
- motion
- optics
- images

detection

tracking

motion estimation

recognition

surface and shape estimation

Computer Graphics

**Image Analysis
(Computer Vision)**

≠ Image Processing
(pre-processing, filtering)

Overview of Image Analysis

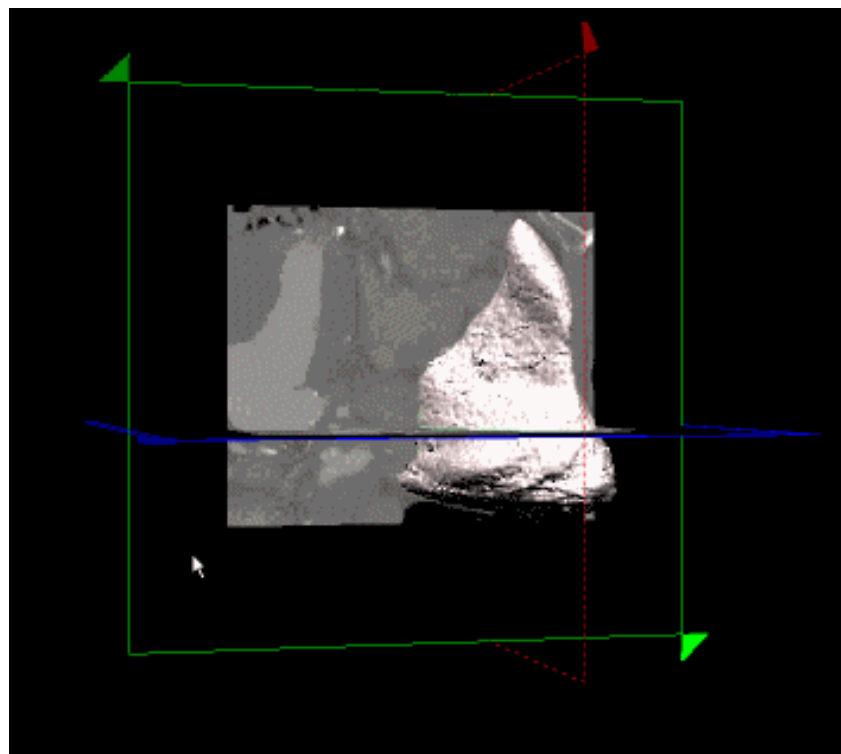## Segmentation in Medical Imaging:

2D segmentation
(snakes)

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Overview of Image Analysis

Segmentation in Medical Imaging:

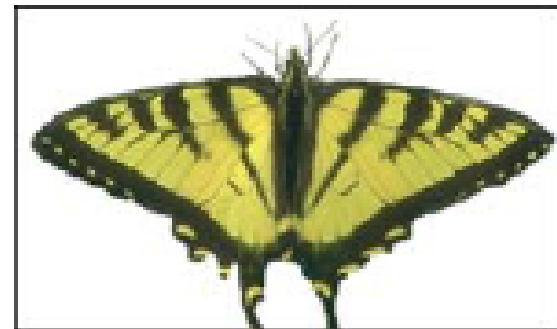2D model

3D Model of a liver from Medical Data

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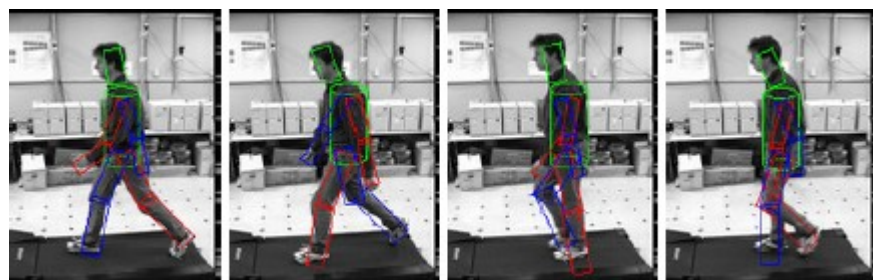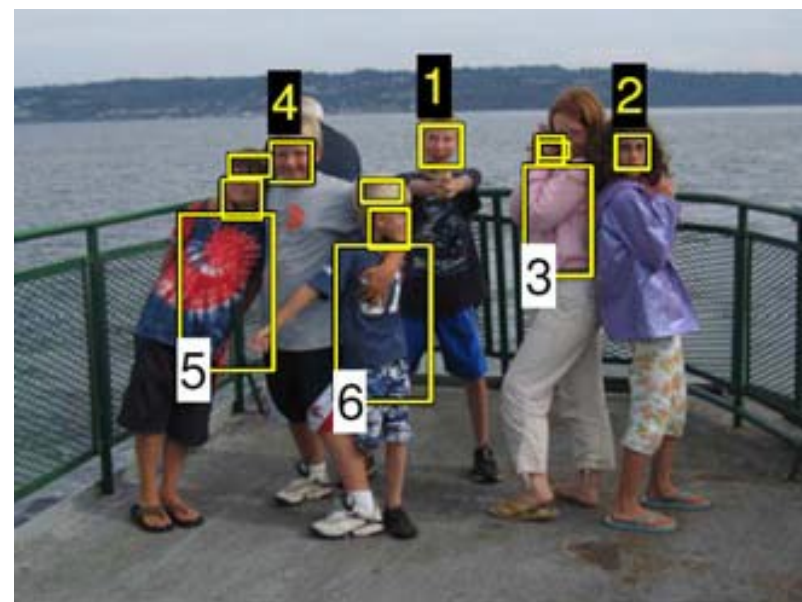
Segmentation in photo editing:

livewire

"Grab cuts"

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Object Detection and tracking:

pictorial structures

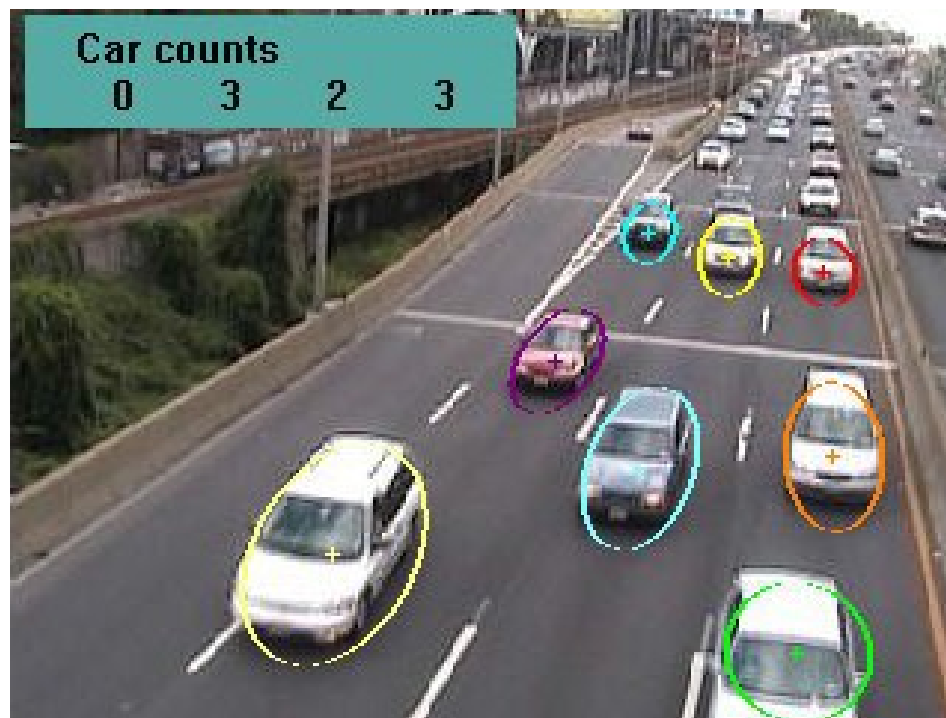tracking pictorial structures

face detection ++

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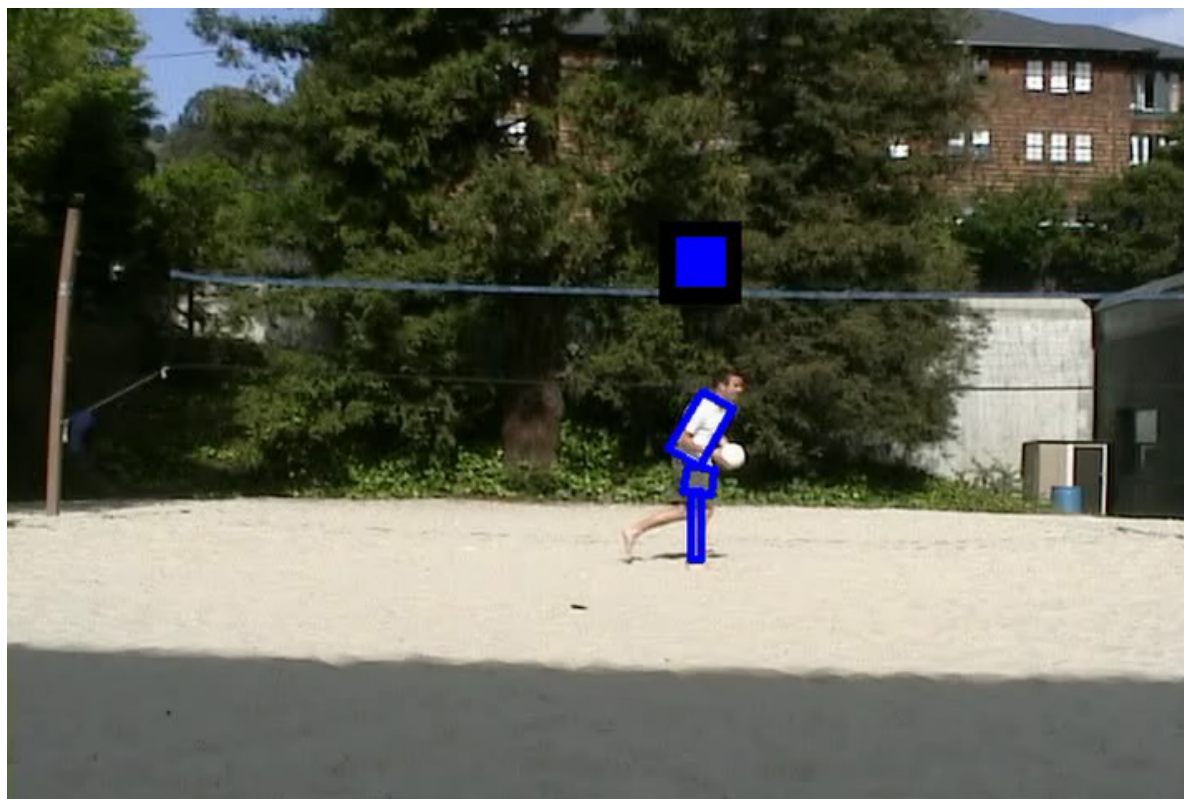
Object Detection and tracking:

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Object Recognition and tracking:

Bottom-up tracker
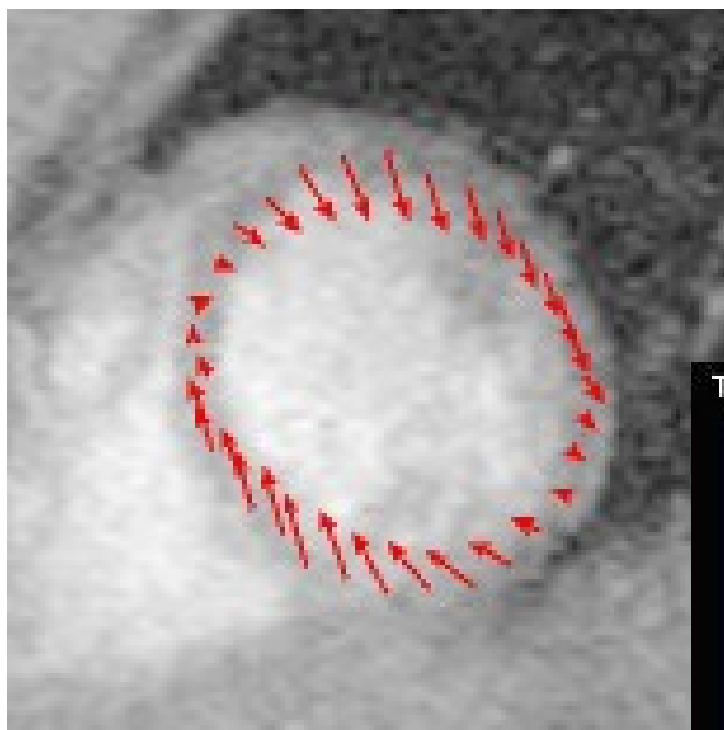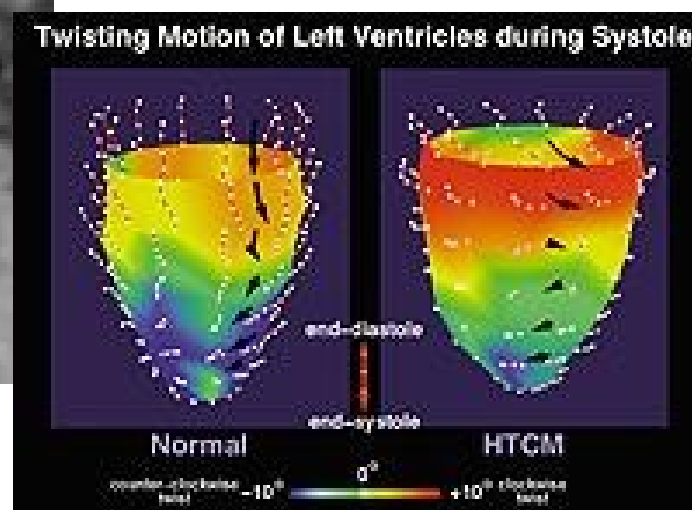
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The University of

Western
Ontario

Motion and tracking in medical imaging:

beating heart

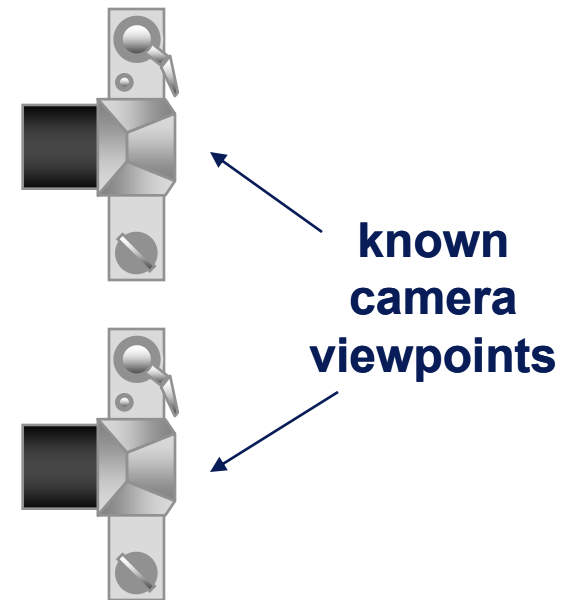Twisting Motion of Left Ventricles during Systole

Normal   HTCM

Slide by Aleosha Effros

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■ Stereo Reconstruction from Photo Images

  • Shape from two (or more) images

  • Biological motivation

known camera viewpoints

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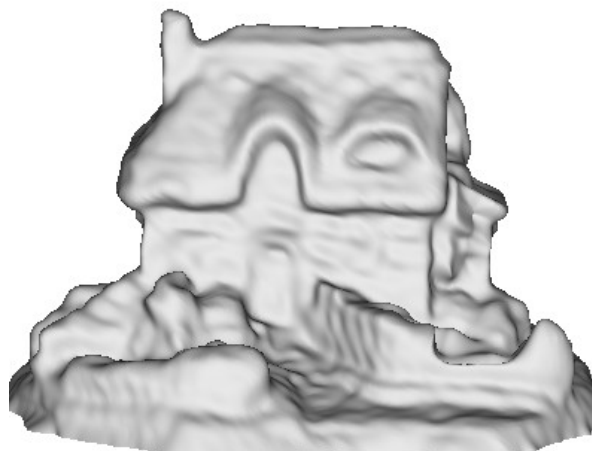(state of the art) stereo depth map

Ground truth

Ontario

The University of

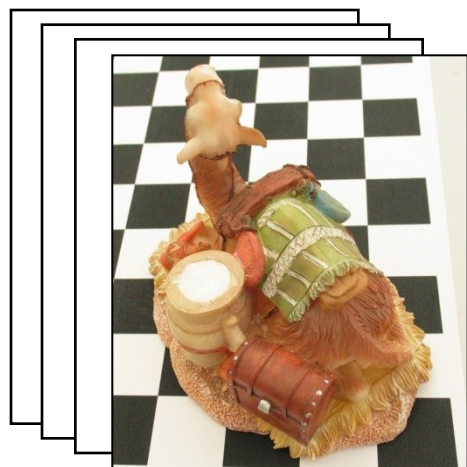CS 4487/9587
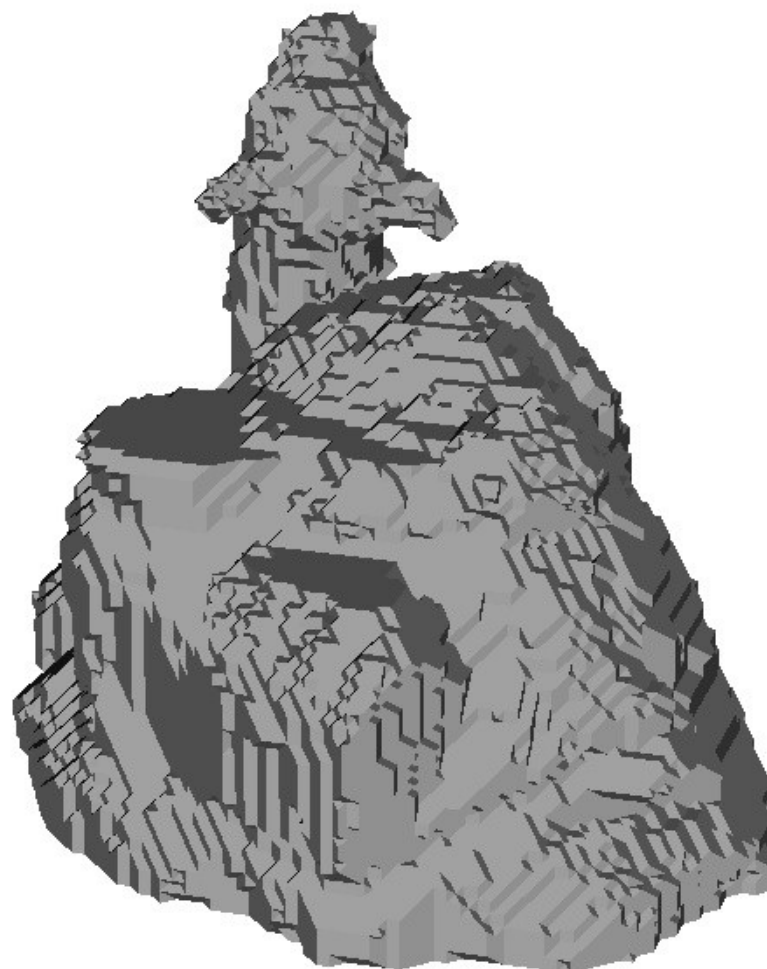# Algorithms for Image Analysis

More then
2 images

Vogiatis et al. CVPR'05

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images from a **cheap**
consumer-grade digital camera

Automatic 3D model reconstruction

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multi-view reconstruction set up

Furukawa&Ponce ECCV'06

3D model   (texture mapped)

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Furukawa&Ponce ECCV'06

multi-view reconstruction set up
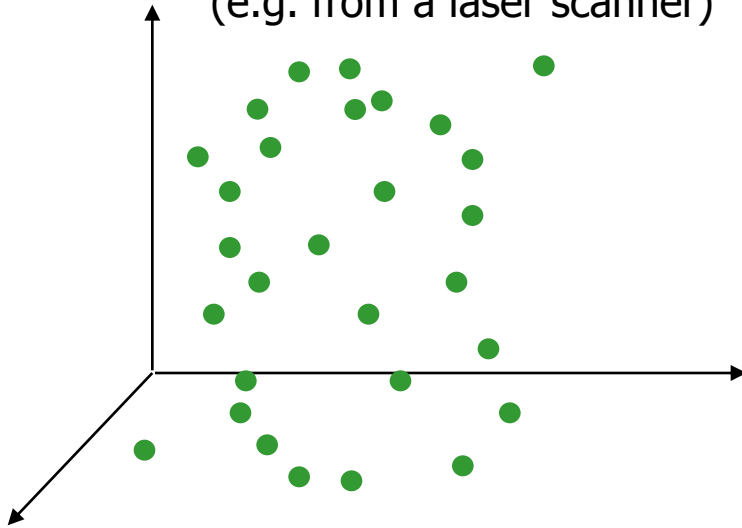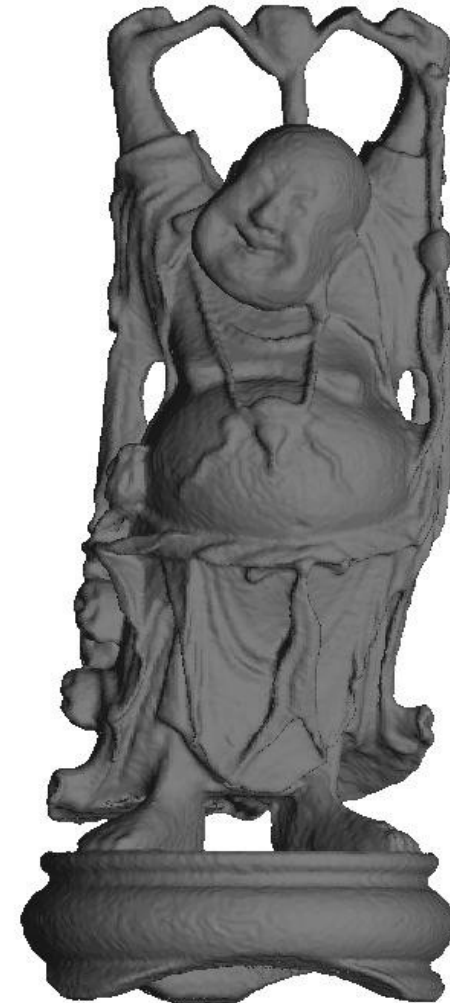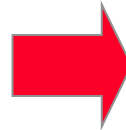
3D model   (texture mapped)

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a cloud of 3D points
(e.g. from a laser scanner)

surface fitting:

3D model:

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2 photos

features detection (SIFT) and
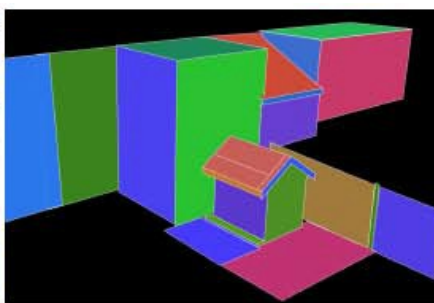model fitting (planes, homographies)

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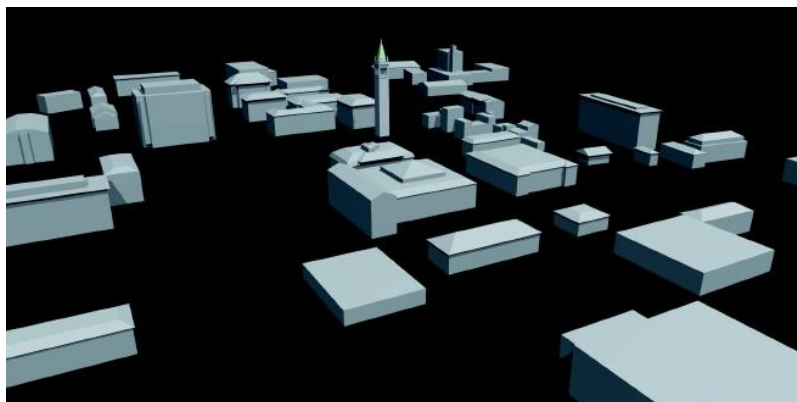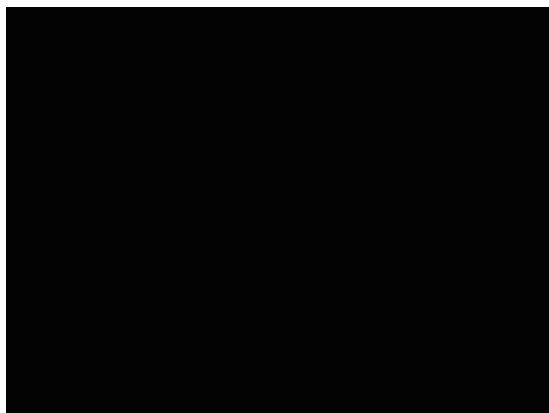Input Photographs   2D Sketching Interface   Geometric Model   Texture-mapped model

3D model constructed form 9 images

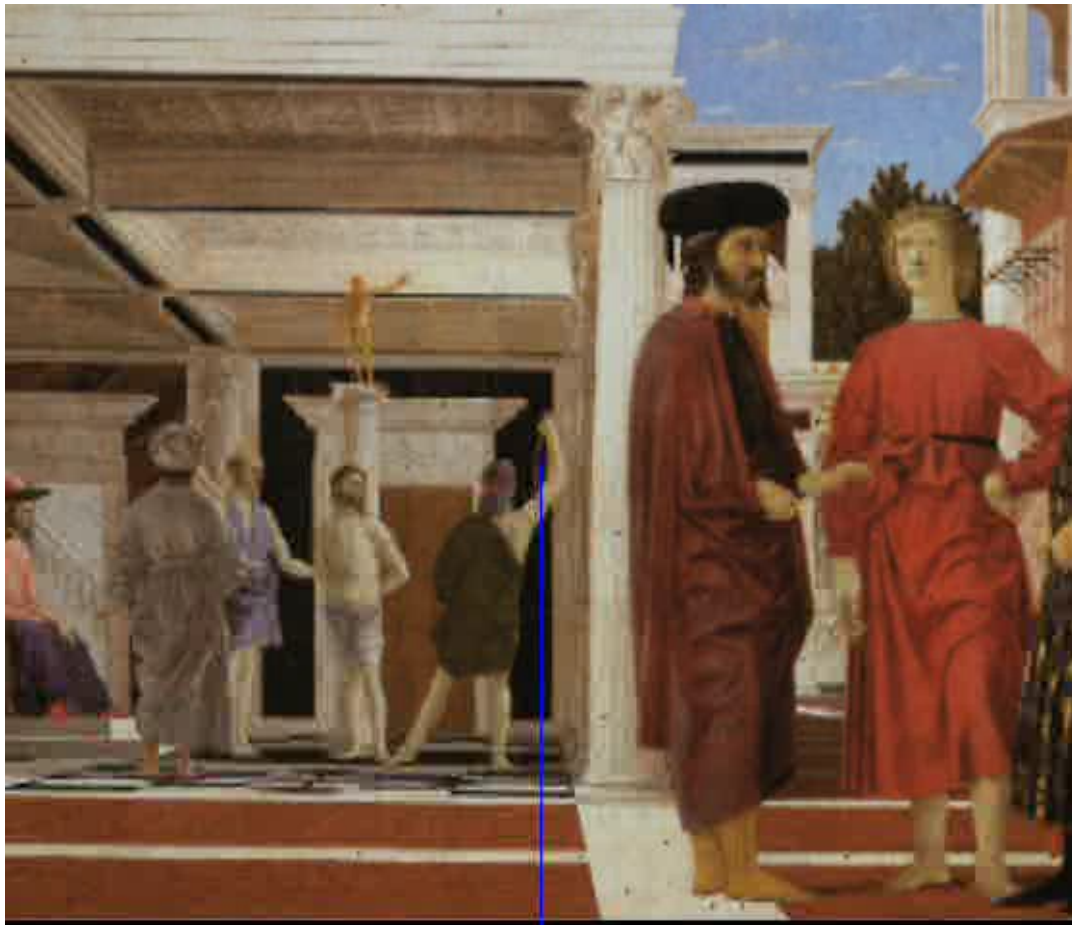# Algorithms for Image Analysis

3D Scene Reconstruction:

Debevec, Taylor, and Malik, SIGGRAPH 1996

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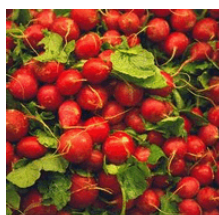
3D Scene Reconstruction:
From a single view!!!

Courtesy
Creminisi et al.

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Texture Synthesis:

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Video Texture:

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Digital scan of a slide with independent R G B acquisition of a scene (dated 1905)

After proper registration

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Medical Image Fusion:

MRI + CT

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Photo Image Morphing:

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Image Blending:

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Image Blending: