CSE 391/591:

Computational Photography and Intro. to Computer Vision

www.cs.sunysb.edu/~cse591

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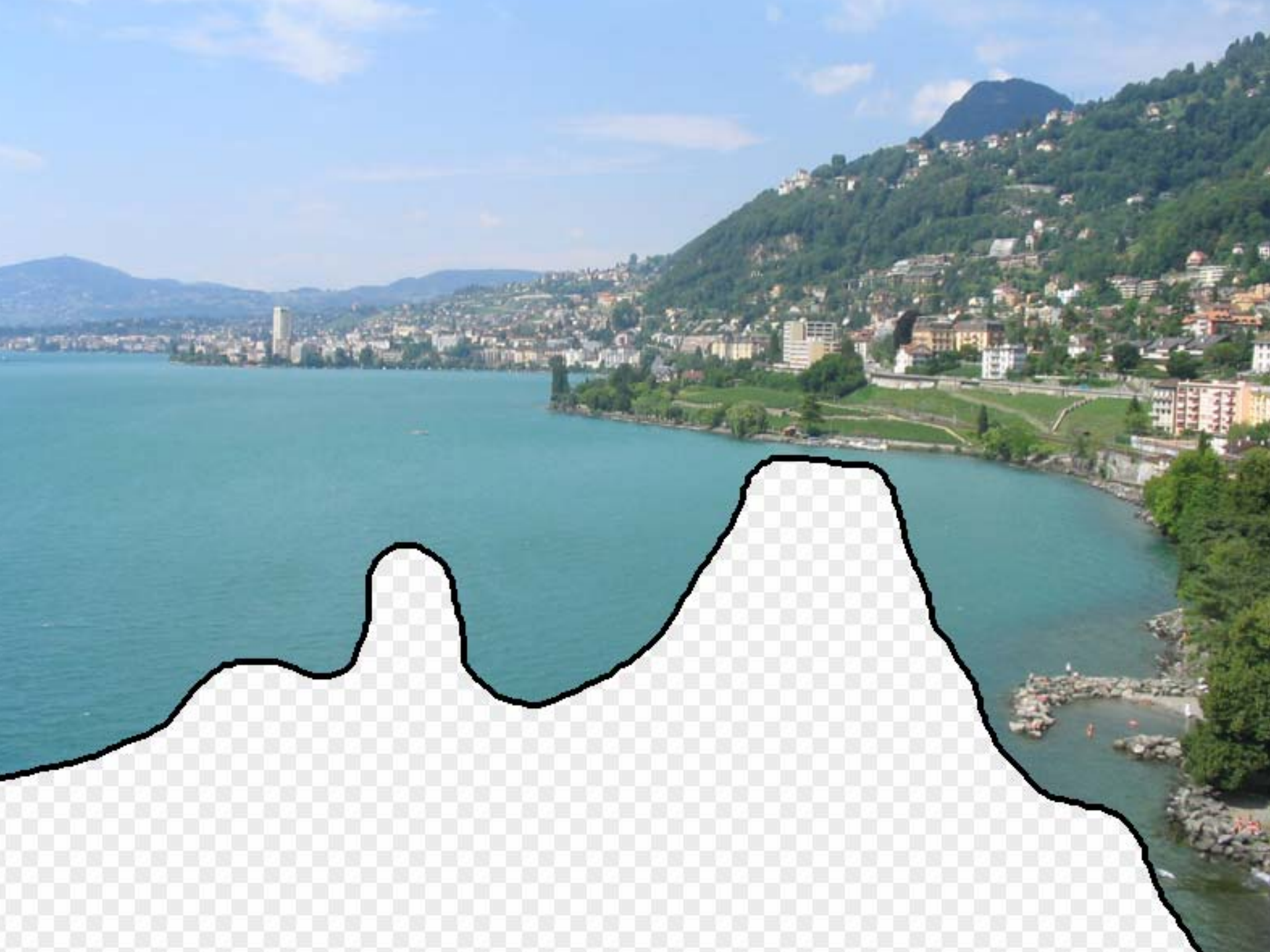
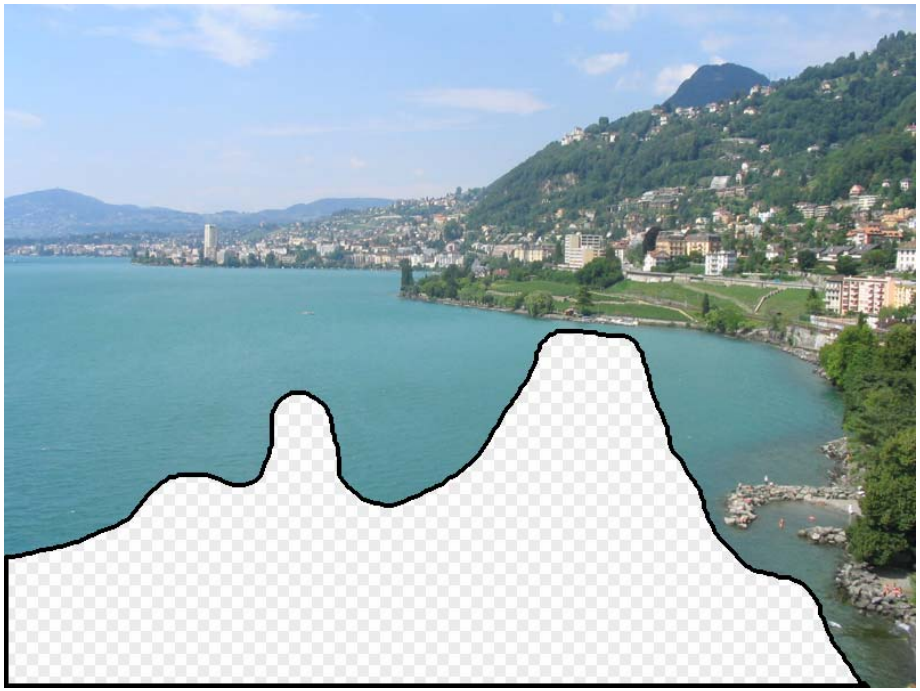
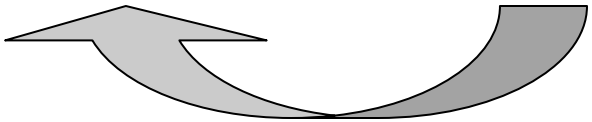
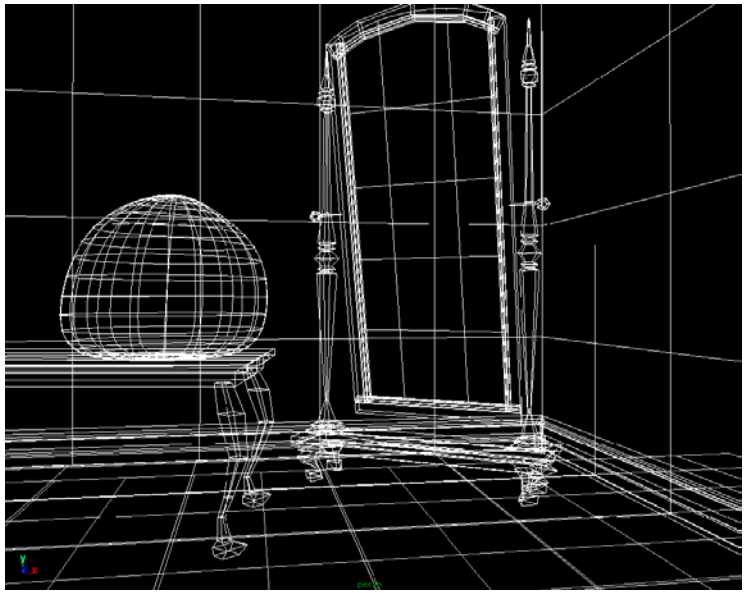


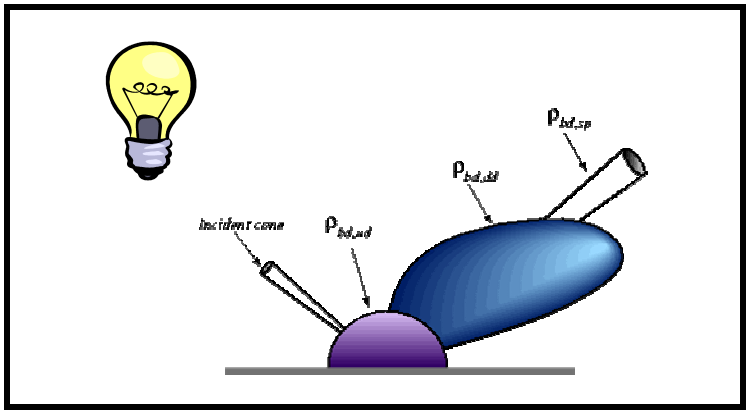




Traditional Computer Graphics



3D geometry



physics

projection

Simulation

GRAPHICS

State of the Art

- Amazingly real
- But so sterile, lifeless, *futuristic (why?)*

The richness of our everyday world

Photo by Svetlana Lazebnik

People

From “Final Fantasy”

On the Tube, London

Faces / Hair

From “Final Fantasy”

Photo by Joaquin Rosales Gomez

Urban Scenes

Virtual LA (SGI)

Photo of l LA

Nature

River Cherwell, Oxford

The Realism Spectrum

Computer Graphics

- + easy to create new worlds
- + easy to manipulate objects/viewpoint
- - Very hard to look realistic

Computational Photography

Realism
Manipulation
Ease of capture

Photography

- + instantly realistic
- + easy to aquire
- - very hard to manipulate objects/viewpoint

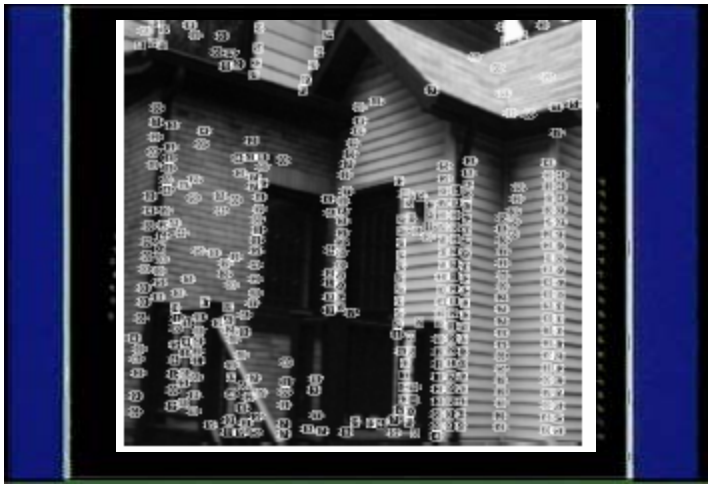
Automatic Photo Pop-Up

Structure from Motion

(Tomasi and Kanade 1992)

Video

Features



3D Reconstruction

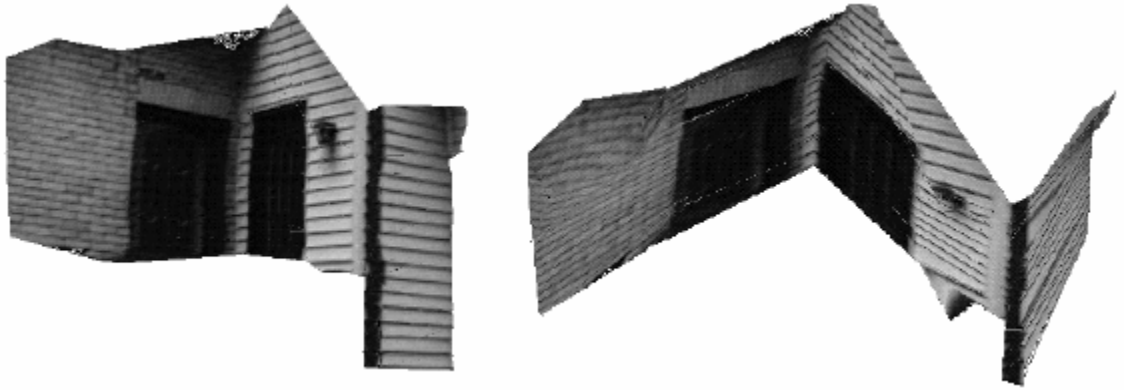
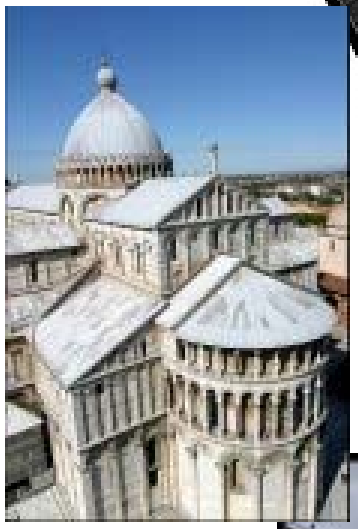
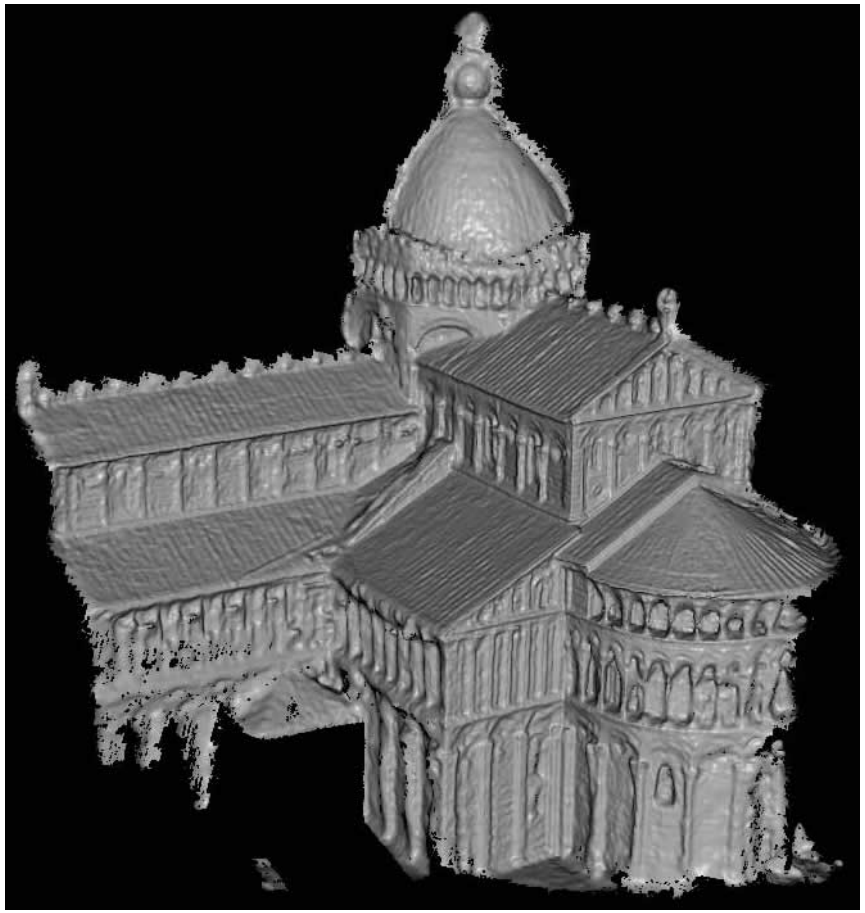
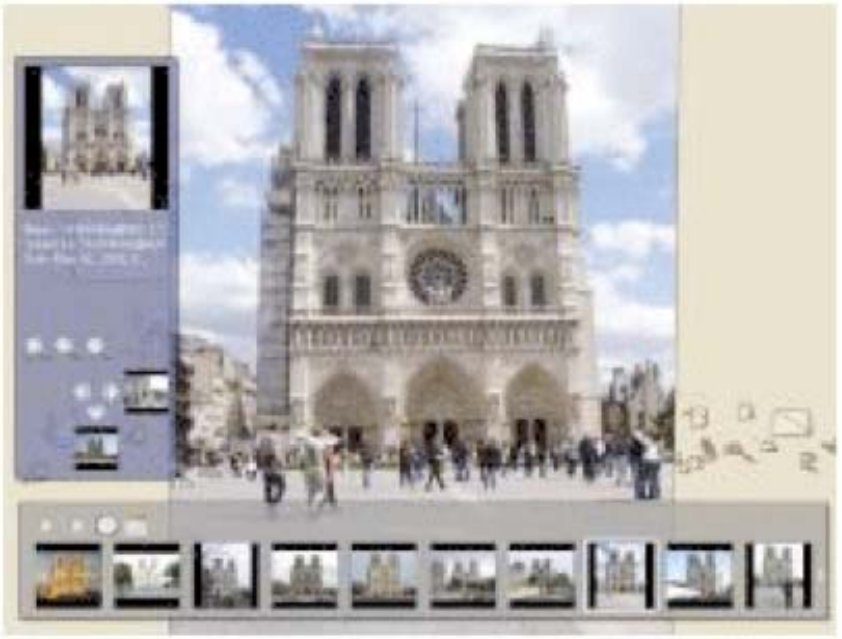


Photo Collections





Organize Photos



Panoramic imaging

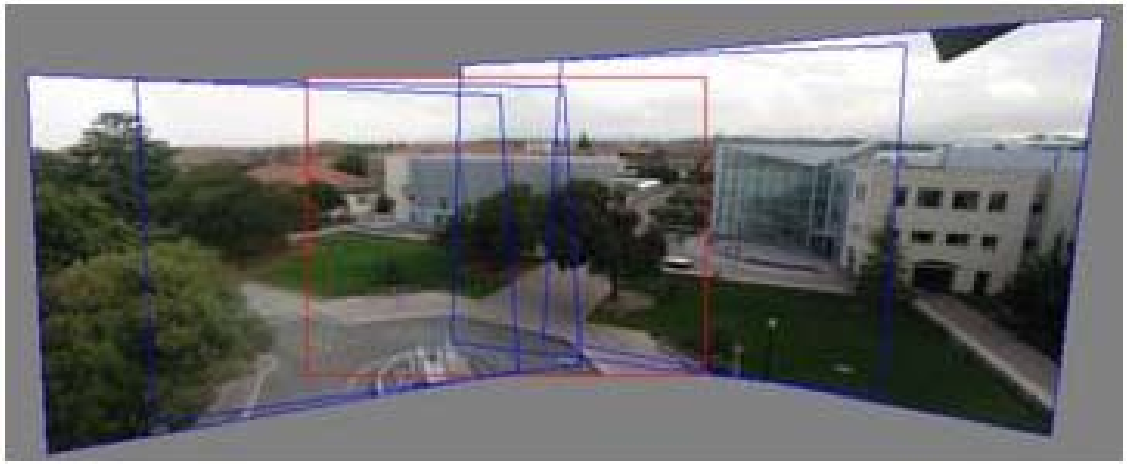
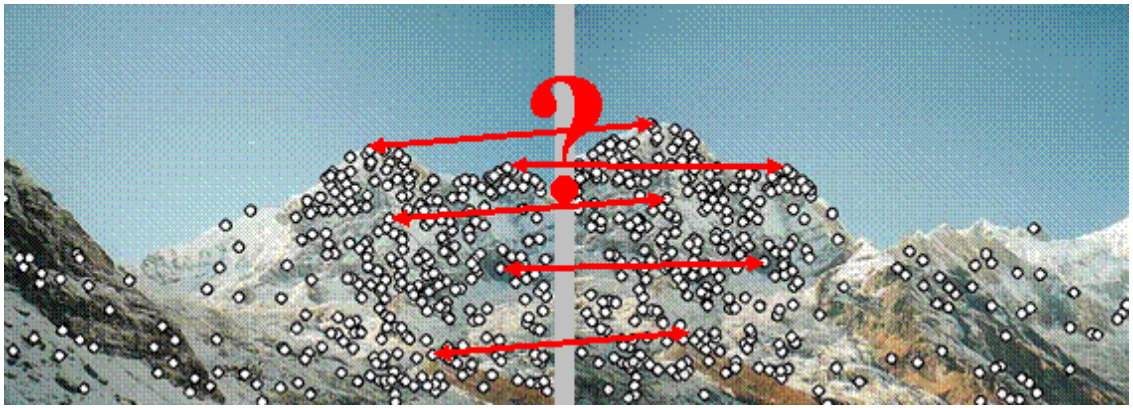
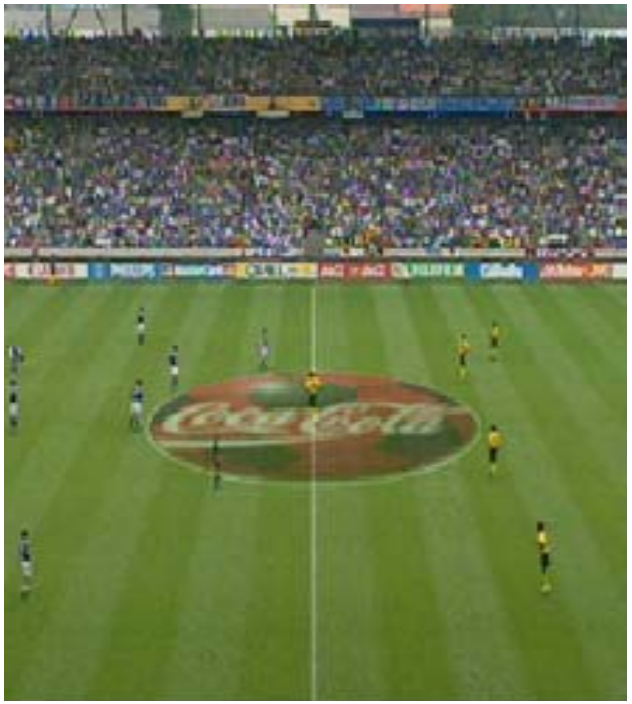


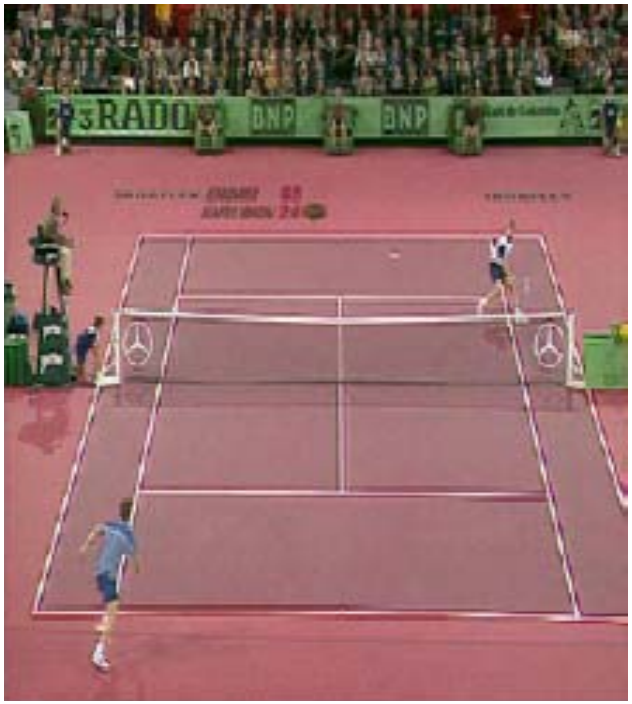
Image and video registration



Spatial warping operations

Detect ground plane in video and introduce pictures on them



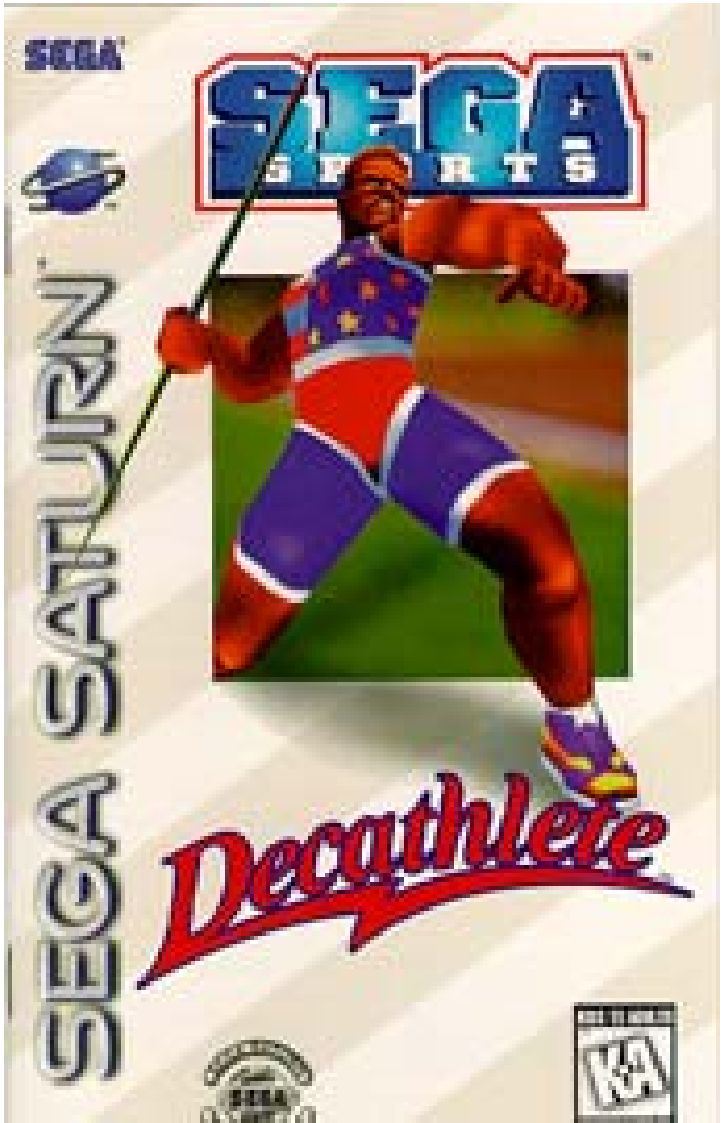


Insert new objects

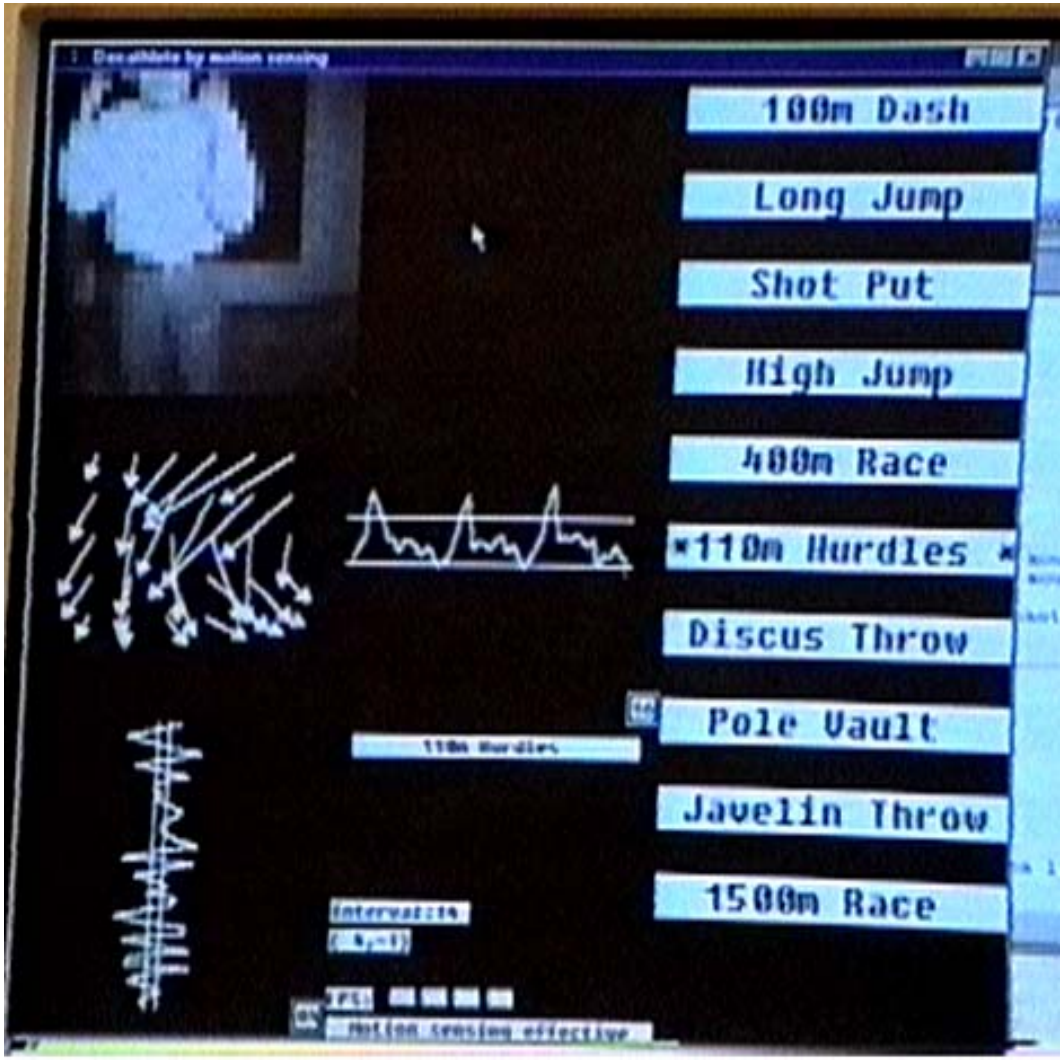
Video example: **http://break.com/index/ufo-lands-on-guys-desk.html**

Video Summary

Game: Decathlete



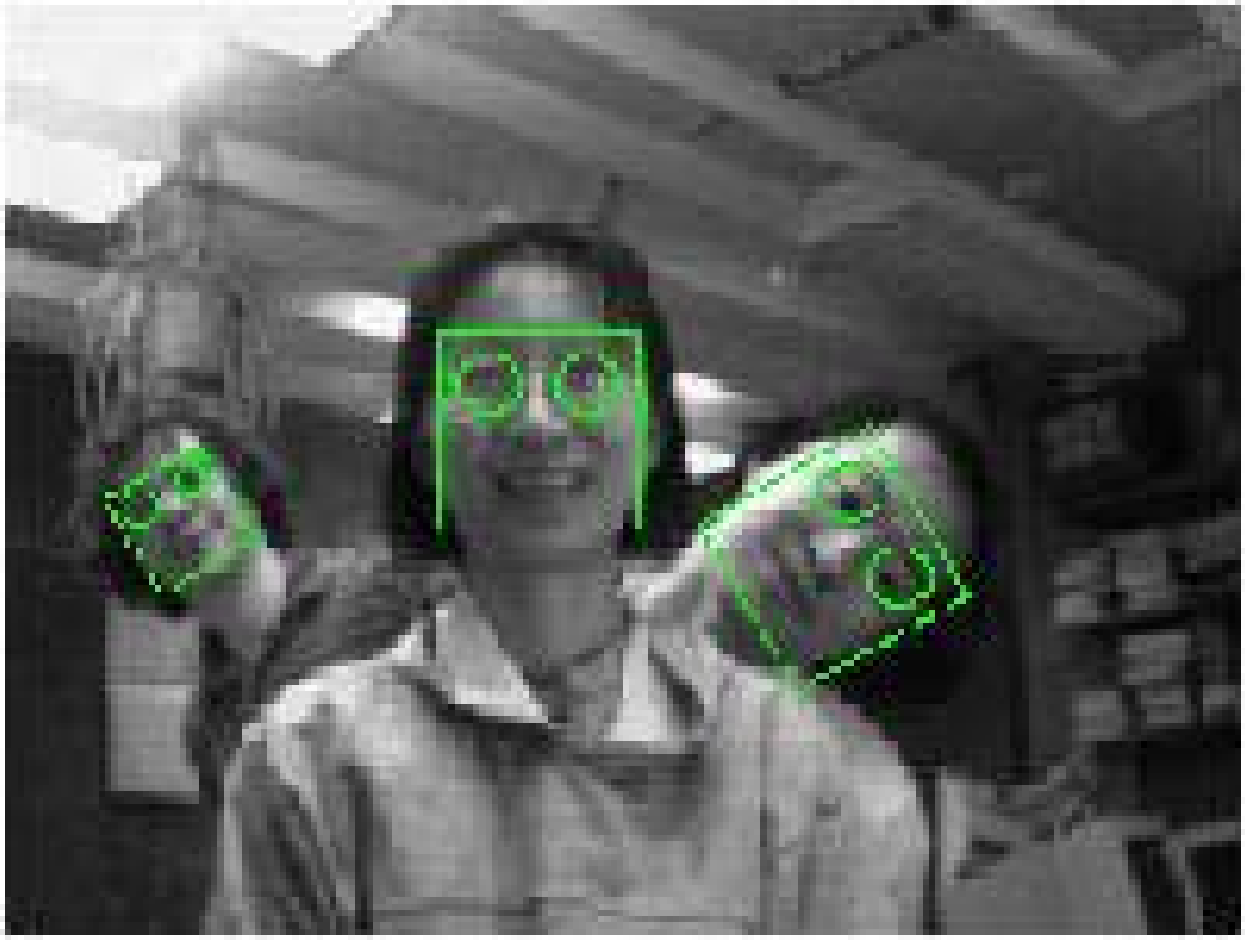
Optical-flow-based Decathlete figure motion analysis



Decathlete javelin throw

Decathlete javelin throw

Decathlete 100m hurdles



http://www.ri.cmu.edu/projects/project_271.html

Black or White

- **Face Detection**
- **Face Localization**
- **Segmentation**
- **Face Tracking**
- **Facial features localization**
- **Facial features tracking**
- **Morphing**

www.youtube.com/watch?v=Zl9OYMRwN1Q

General Comments

- **Prerequisites**

  Linear algebra!!!

  Some computer graphics, vision, or image processing is useful, but not required.

- **Emphasis on programming projects!**

  Building something from scratch (Matlab!)

References

- **There is no required text. Various course notes and papers will be made available. Furthermore, there is an optional textbook that you might find helpful. It will be placed on reserve at the Wean Hall library:**
  - ***Computer Vision: The Modern Approach, Forsyth and Ponce***
- **There is a number of other fine texts that you can use for general reference:**
  - ***Photography (9th edition), London and Upton,***
  - ***Vision Science: Photons to Phenomenology, Stephen Palmer***
  - ***Digital Image Processing, 2nd edition, Gonzalez and Woods***
  - ***Multiple View Geometry in Computer Vision, Hartley & Zisserman***
  - ***The Computer Image, Watt and Policarpo***
  - ***Linear Algebra and its Applications, Gilbert Strang***

Grading

	A	B
Problem Sets (~6) with lab exercises in Matlab. **Problem sets may be discussed, but all written work and coding must be done individually.**	**30%**	**50%**
One take-home exams. **(Take-home exams may not be discussed.)**	**30%**	**0%**
Class Participation	**10%**	**10%**
Final Project: –An original implementation of a new or published idea –A detailed empirical evaluation of an existing implementation of one or more methods **Project proposal** **not longer than two pages must be submitted and approved before the end of October.**	**30%**	**40%**

Administrative Stuff

- **Late Policy**

  Seven late days total, to be spent wisely
- **Cheating**

  Let's not embarrass ourselves
- **Software**

  MATLAB!!!

Internet Resources

- **Matlab:**

  University of Colorado Matlab Tutorials

  - A decent collection of Matlab tutorials, including one focusing on image processing.

  Matlab Image Processing Tutorial

  - A short introduction to the manipulation of images in Matlab, including an introduction to principal components analysis via eigenfaces.

- **Computer Vision:**

  Computer Vision Homepage

  Face Recognition Homepage

  Face Detection Homepage

Introductions

- **Name, year, supervisor**
- **Why do you want to take this class?**
- **What are you hoping to learn?**