Computer Vision (CSE 455)

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Web Page

- http://www.cs.washington.edu/education/courses/cse455/08wi/

Handouts

- signup sheet
- intro slides
- image filtering slides

Today

- Intros
- Computer vision overview
- Course overview
- Image processing

Readings for this week

- Forsyth & Ponce, chapter 7 (in reader, available at UW Bookstore in the CSE textbook area)
- Mortensen, Intelligent Scissors (online)

What is computer vision?

What is computer vision?


Terminator 2

Every picture tells a story

Goal of computer vision is to write computer programs that can interpret images

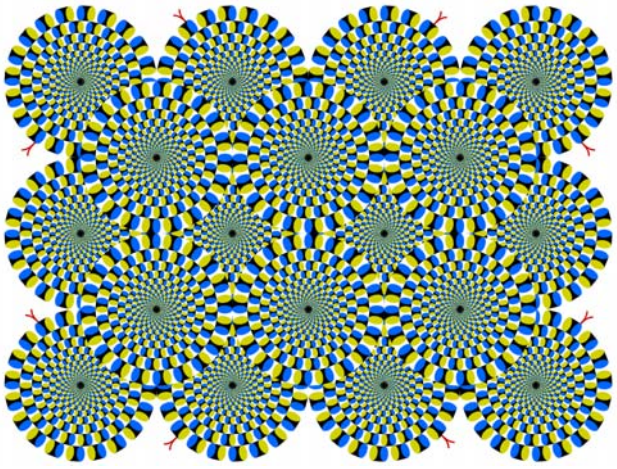
Can computers match (or beat) human vision?

Yes and no (but mostly no!)

- humans are much better at "hard" things
- computers can be better at "easy" things

Human perception has its shortcomings…

Sinha and Poggio, *Nature*, 1996



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Current state of the art

The next slides show some examples of what current vision systems can do

Earth viewers (3D modeling)

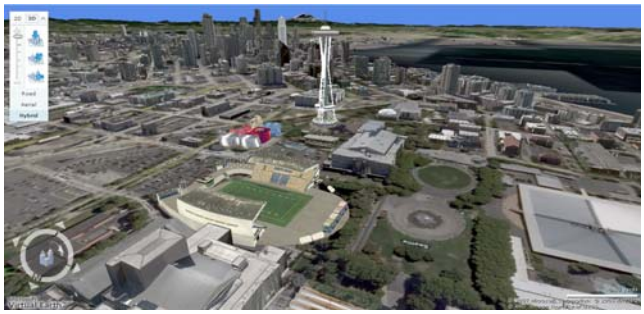


Image from Microsoft's Virtual Earth
(see also: Google Earth)

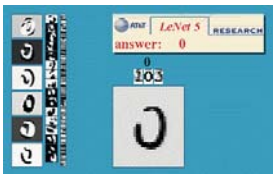
http://labs.live.com/photosynth/

Based on Photo Tourism technology developed here in CSE!
by Noah Snavely, Steve Seitz, and Rick Szeliski

Optical character recognition (OCR)

Technology to convert scanned docs to text

- If you have a scanner, it probably came with OCR software



Digit recognition, AT&T labs
http://www.research.att.com/~yann/

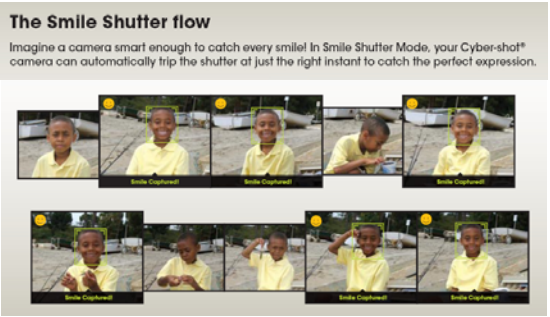
License plate readers
http://en.wikipedia.org/wiki/Automatic_number_plate_recognition

Face detection

Many new digital cameras now detect faces

- Canon, Sony, Fuji, …

Smile detection?

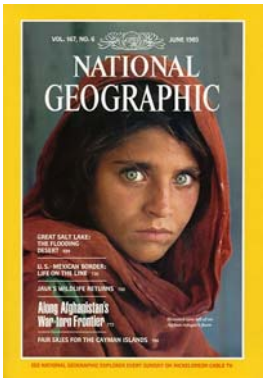


Sony Cyber-shot® T70 Digital Still Camera

Object recognition (in supermarkets)

LaneHawk by EvolutionRobotics
"A smart camera is flush-mounted in the checkout lane, continuously watching for items. When an item is detected and recognized, the cashier verifies the quantity of items that were found under the basket, and continues to close the transaction. The item can remain under the basket, and with LaneHawk,you are assured to get paid for it… "

Face recognition



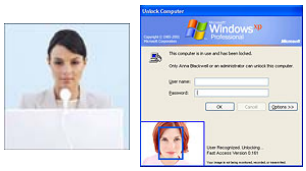
Who is she?

Vision-based biometrics

"*How the Afghan Girl was Identified by Her Iris Patterns*" Read the story

Login without a password…

Fingerprint scanners on many new laptops, other devices



Face recognition systems now beginning to appear more widely
http://www.sensiblevision.com/

Object recognition (in mobile phones)

This is becoming real:

- Lincoln Microsoft Research
- Point & Find, Nokia

Special effects: shape capture

The Matrix movies, ESC Entertainment, XYZRGB, NRC

Special effects: motion capture

Pirates of the Carribean, Industrial Light and Magic
Click here for interactive demo

Sports

Sportvision first down line
Nice explanation on www.howstuffworks.com

Smart cars

Slide content courtesy of Amnon Shashua

Mobileye

- Vision systems currently in high-end BMW, GM, Volvo models
- By 2010: 70% of car manufacturers.
- Video demo

Vision-based interaction (and games)

Nintendo Wii has camera-based IR tracking built in. See Lee's work at CMU on clever tricks on using it to create a multi-touch display!

Digimask: put your face on a 3D avatar.

"Game turns moviegoers into Human Joysticks", CNET
Camera tracking a crowd, based on this work.

Vision in space

NASA'S Mars Exploration Rover Spirit captured this westward view from atop a low plateau where Spirit spent the closing months of 2007.

Vision systems (JPL) used for several tasks

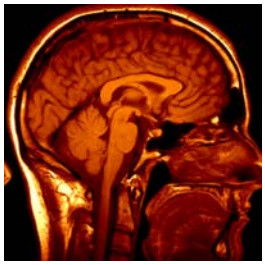
- Panorama stitching
- 3D terrain modeling
- Obstacle detection, position tracking
- For more, read "Computer Vision on Mars" by Matthies et al.

Robotics

NASA's Mars Spirit Rover
http://en.wikipedia.org/wiki/Spirit_rover

http://www.robocup.org/

Medical imaging



3D imaging
MRI, CT

Image guided surgery
Grimson et al., MIT

Current state of the art

You just saw examples of current systems.

- Many of these are less than 5 years old

This is a very active research area, and rapidly changing

- Many new apps in the next 5 years

To learn more about vision applications and companies

- David Lowe maintains an excellent overview of vision companies
  - http://www.cs.ubc.ca/spider/lowe/vision.html

This course

http://www.cs.washington.edu/education/courses/cse455/08wi/

Project 1: intelligent scissors

David Dewey, 455 02wi

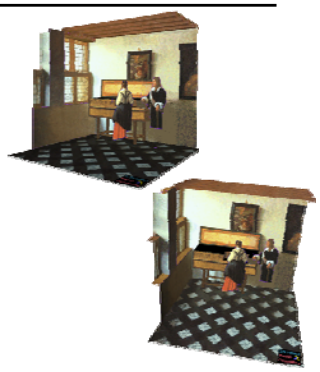
Project 2: panorama stitching

http://www.cs.washington.edu/education/courses/455/06wi/projects/project2/results.html

Oscar Danielsson, 455 06wi

Project 3: 3D shape reconstruction

Vermeer's *Music Lesson*



Reconstructions by Criminisi et al.

Project 4: Face Recognition

Grading

Programming Projects (70%)

- image scissors
- panoramas
- 3D shape modeling
- face recognition

Midterm (15%)

Final (15%)

General Comments

Prerequisites—*these are essential*!

- Data structures
- A good working knowledge of C and C++ programming
  - (or willingness/time to pick it up quickly!)
- Linear algebra
- Vector calculus

Course does ***not*** assume prior imaging experience

- computer vision, image processing, graphics, etc.