Computer Vision (CSE P576)

Staff

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Web Page

- http://www.cs.washington.edu/education/courses/csep576/05wi/

Handouts

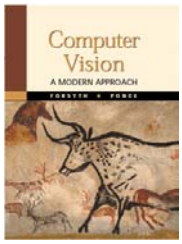
- signup sheet
- intro slides
- image filtering slides
- image sampling slides

Today

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

Readings for this week

- Forsyth & Ponce textbook, chapter 7



Every picture tells a story

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

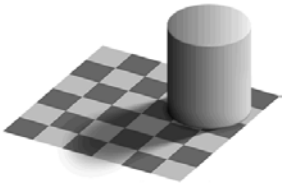
Can computers match human perception?

Yes and no (but mostly no!)

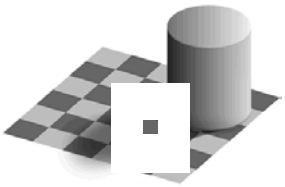
- humans are much better at "hard" things
- computers can be better at "easy" things

Perception

Perception



Perception



Low level processing

Low level operations

- Image enhancement, feature detection, region segmentation

Mid level processing

Mid level operations
- 3D shape reconstruction, motion estimation

High level processing

High level operations
- Recognition of people, places, events

Image Enhancement

Image Inpainting, M. Bertalmío et al.
http://www.iua.upf.es/~mbertalmio//restoration.html

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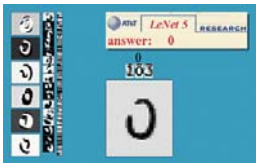
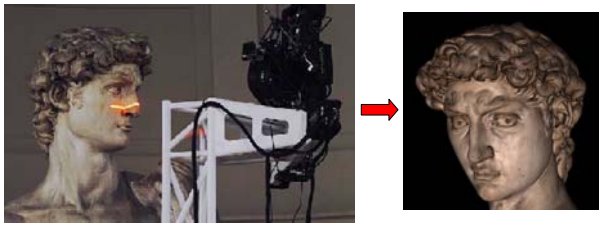
Application: Document Analysis



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

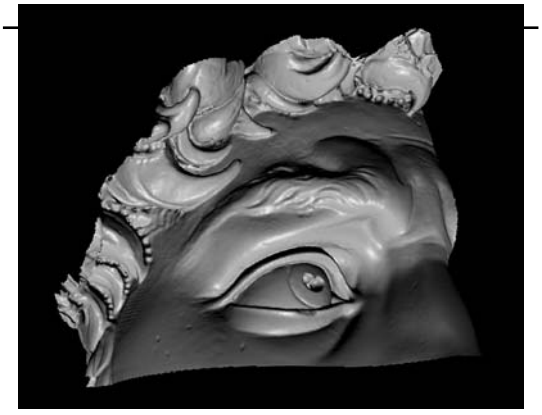
Applications: 3D Scanning

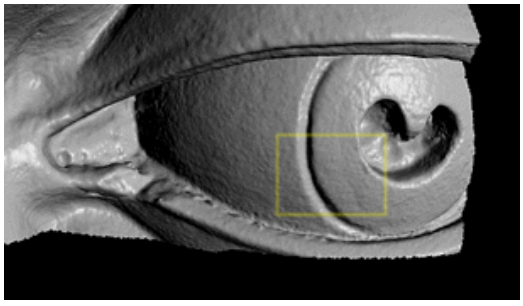


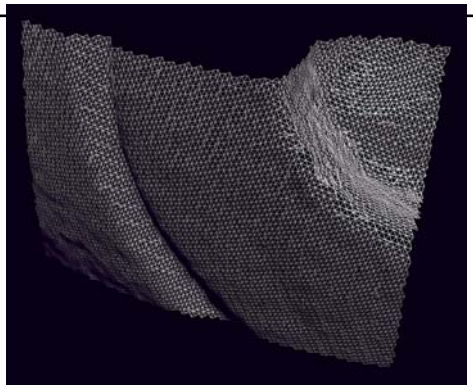
Scanning Michelangelo's *"The David"*

- The Digital Michelangelo Project
  - http://graphics.stanford.edu/projects/mich/
- UW Prof. Brian Curless, collaborator
- 2 BILLION polygons, accuracy to .29mm

The Digital Michelangelo Project, Levoy et al.





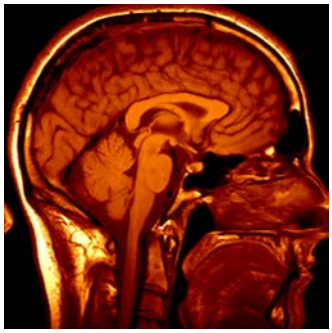


ESC Entertainment, XYZRGB, NRC

Applications: Motion Capture, Games

Andy Serkis, Gollum, Lord of the Rings

Application: Medical Imaging



Applications: Robotics

Syllabus

Image Processing (2 weeks)
- filtering, convolution
- image pyramids
- edge detection
- feature detection (corners, lines)
- hough transform

Image Transformation (2 weeks)
- image warping (parametric transformations, texture mapping)
- image compositing (alpha blending, color mosaics)
- segmentation and matting (snakes, scissors)

Motion Estimation (1 week)
- optical flow
- image alignment
- image mosaics
- feature tracking

Syllabus

Light (1 week)
- physics of light
- color
- reflection
- shading
- shape from shading
- photometric stereo

3D Modeling (3 weeks)
- projective geometry
- camera modeling
- single view metrology
- camera calibration
- stereo

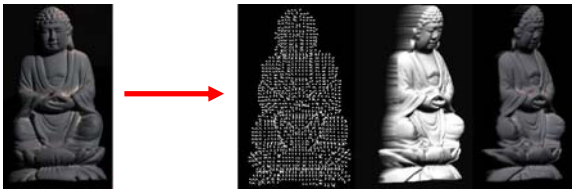
Object Recognition and Applications (1 week)
- eigenfaces
- applications (graphics, robotics)

Project 1: Intelligent Scissors

Project 2: Panorama Stitching

http://www.cs.washington.edu/education/courses/455/03wi/projects/project2/artifacts/crosetti/index.shtml

Project 3: 3D Shape Reconstruction



Project 4: Face Recognition

Class Webpage

http://www.cs.washington.edu/education/courses/csep576/05wi/

Grading

Programming Projects (100%)

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

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.