

## Computer Vision (CSE 455)

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### Web Page

- <http://www.cs.washington.edu/education/courses/cse455/06wi/>

### Handouts

- signup sheet
- intro slides
- image filtering slides

## Today

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

### Readings for this week

- Forsyth & Ponce, chapter 7 (in reader, available at Comm building copy center)
- [Mortensen, Intelligent Scissors](#) (online)

## Every picture tells a story

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

## Can computers match human perception?

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Yes and no (but mostly no!)

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

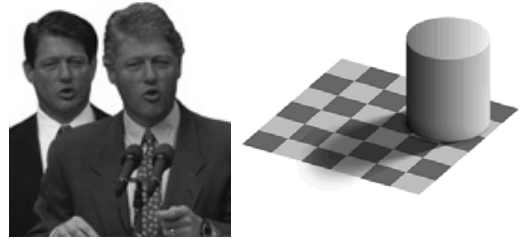
## Perception

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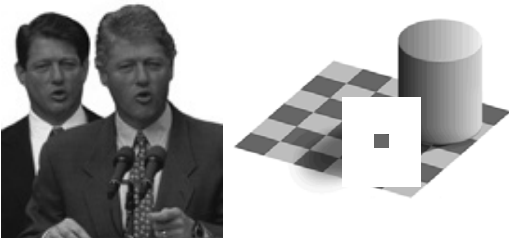
## Perception

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## Perception

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## Low level processing

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### Low level operations

- Image enhancement, feature detection, region segmentation

## Mid level processing

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### Mid level operations

- 3D shape reconstruction, motion estimation

## High level processing

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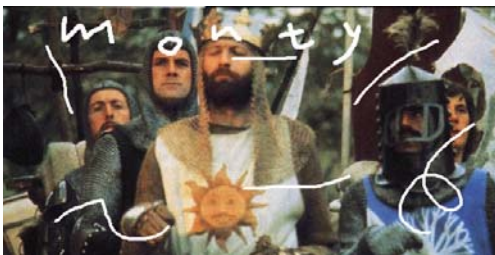


### High level operations

- Recognition of people, places, events

## Image Enhancement

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*Image Inpainting*, M. Bertalmio et al.  
<http://www.iaa.upf.es/~mbertalmio/restoration.html>

## Image Enhancement

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## Image Enhancement



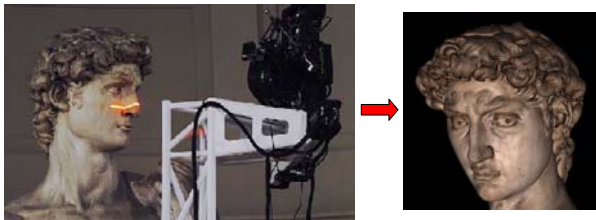
*Image Inpainting*, M. Bertalmio et al.  
<http://www.iaa.upf.es/~mbertalmio/restoration.html>

## Application: Document Analysis



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

## Applications: 3D Scanning

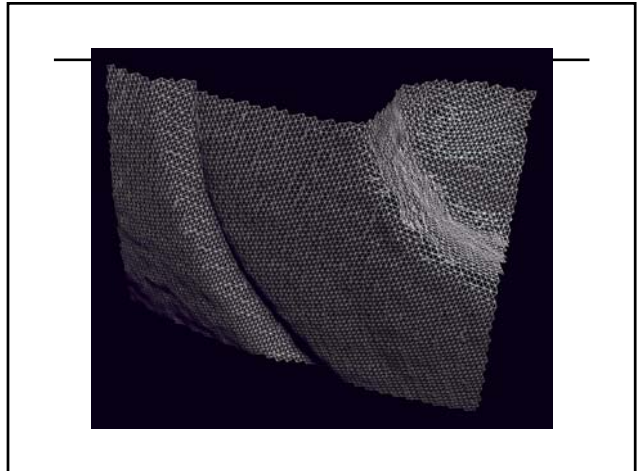
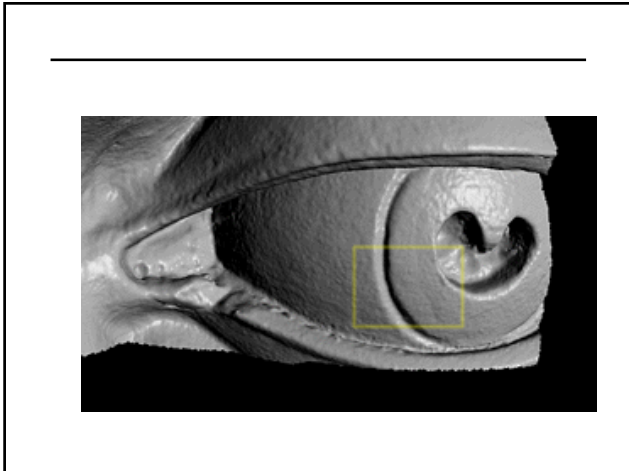
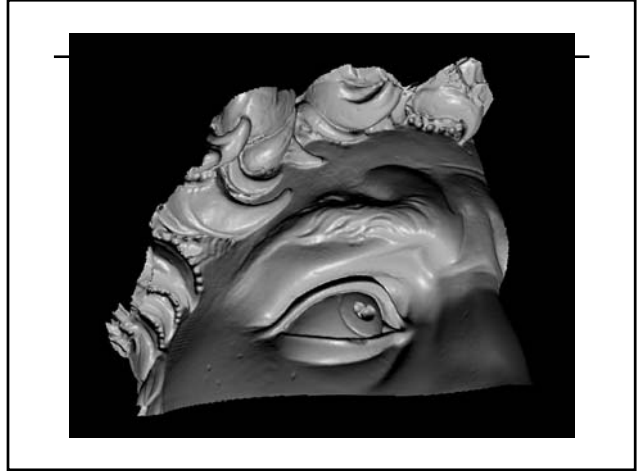


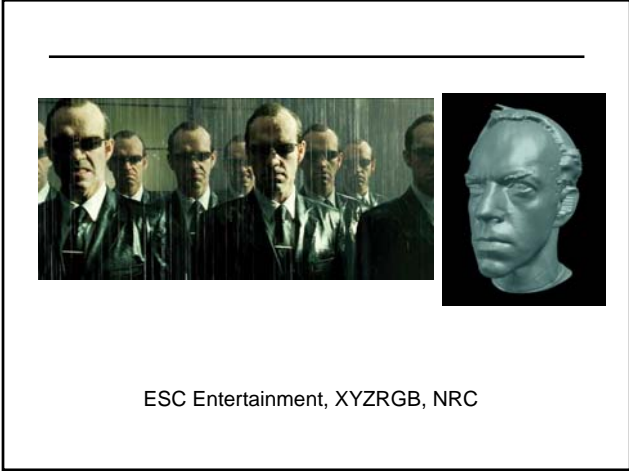
Scanning Michelangelo's "The David"

- [The Digital Michelangelo Project](http://graphics.stanford.edu/projects/mich/)  
- <http://graphics.stanford.edu/projects/mich/>
- UW Prof. [Brian Curless](#), collaborator
- 2 BILLION polygons, accuracy to .29mm

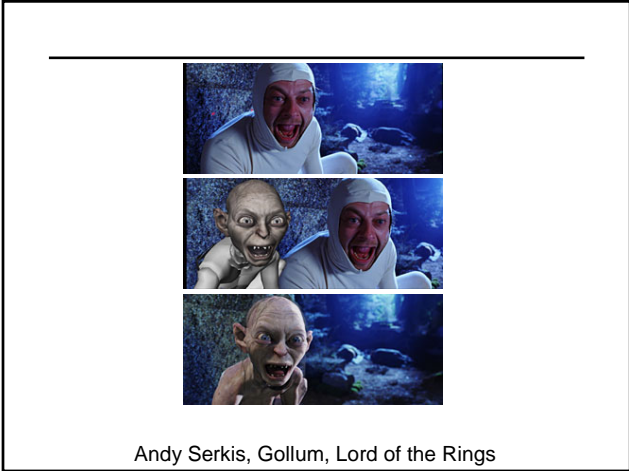


*The Digital Michelangelo Project*, Levoy et al.





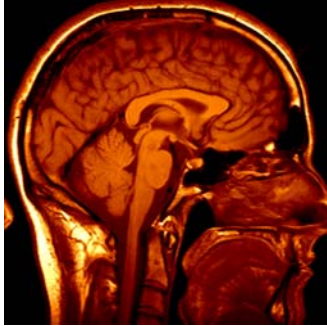
ESC Entertainment, XYZRGB, NRC



Andy Serkis, Gollum, Lord of the Rings

## Application: Medical Imaging

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## Applications: Robotics

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## Syllabus

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### 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

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### 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

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### Project 2: Panorama Stitching

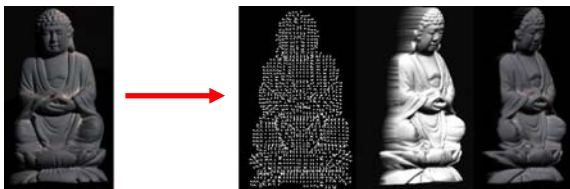
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<http://www.cs.washington.edu/education/courses/455/03wi/projects/project2/artifacts/crosetti/index.shtml>



### Project 3: 3D Shape Reconstruction

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### Project 4: Face Recognition

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## Class Webpage

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<http://www.cs.washington.edu/education/courses/cse455/06wi/>

## Grading

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### Programming Projects (70%)

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

Midterm (15%)

Final (15%)

## General Comments

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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.