EECS 332 Digital Image Analysis

Introduction to EECS 332

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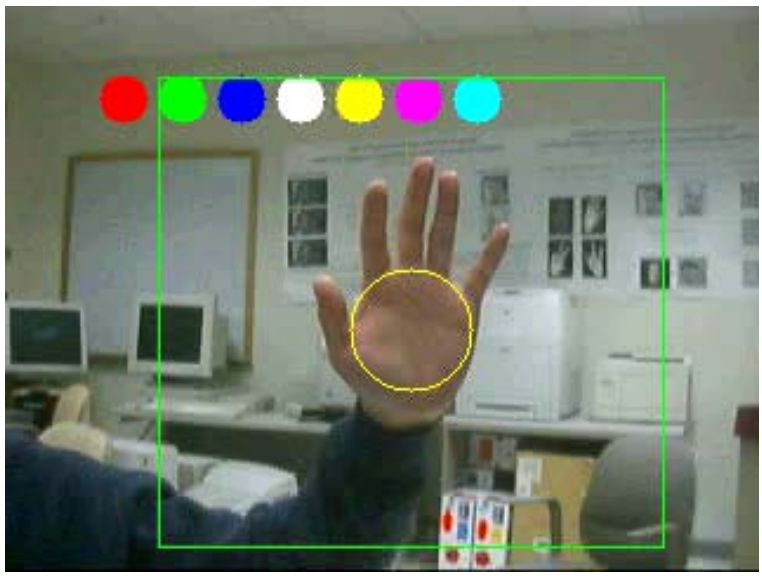
A Dream

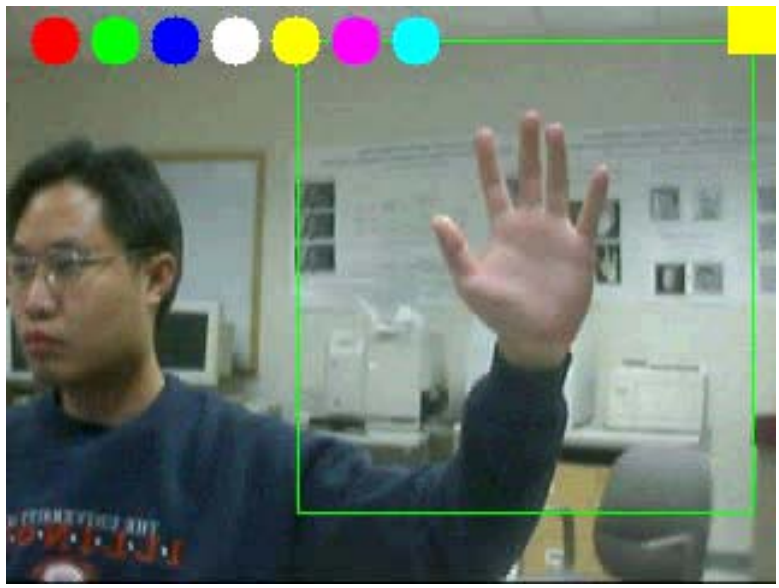
- Can the computer see?
  - Can it tell what a car is?
  - Can it recognize my face?
  - Can it perceive my gait?
  - Can it guess where I am looking?
  - Can it know what I am doing?
  - Can it summarize a movie for me?
  - …

Finger Grabber

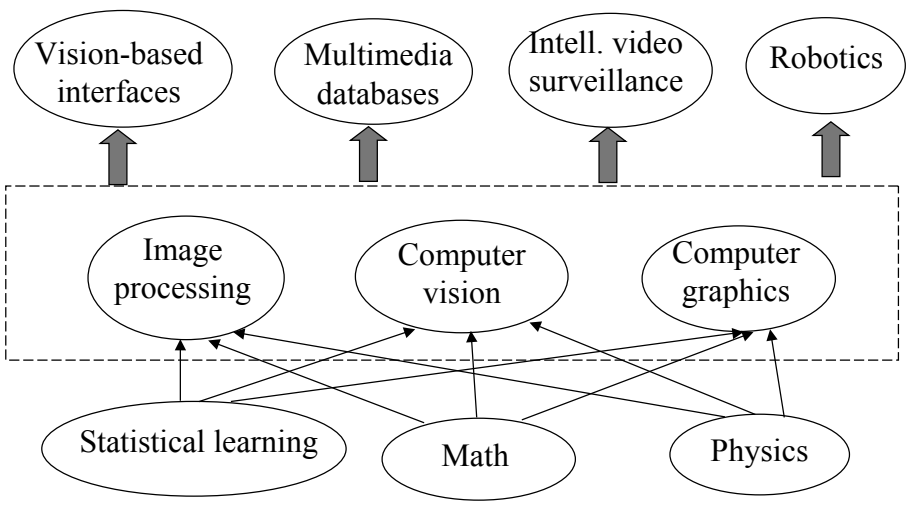


Finger Pen

Finger Painter



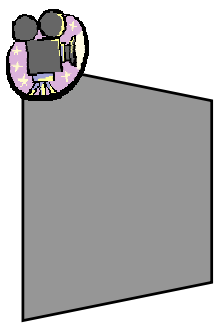
A Big Picture of the Field

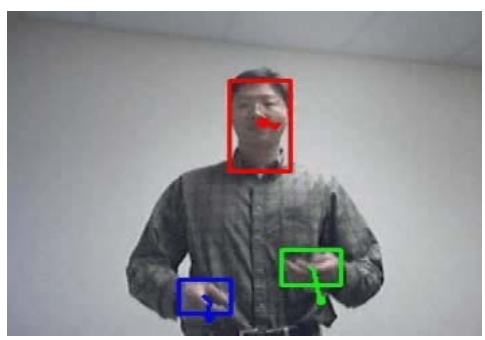


Motivation and Applications

- Intelligent video surveillance
- Multimedia databases
- Intelligent human-computer interaction
- Smart environments
- Intelligent robots
- Medical imaging
- Vision-based graphics

Perceptual PowerPoint (P^3)





Perceptual PowerPoint (P^3)

- *face/hand detection*
- *multiple object tracking*
- *motion interpretation*

click to show the video

Mobile Device and Intelligent Environment

VisualPanel: getting rid of mice and keyboards by using a piece of paper and fingers

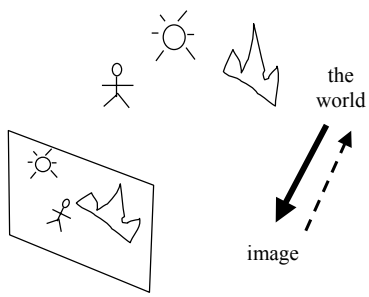
Multimedia Database

VfG: video texture

This video was generated from a 20-frame short sequence

What is Computer Vision?

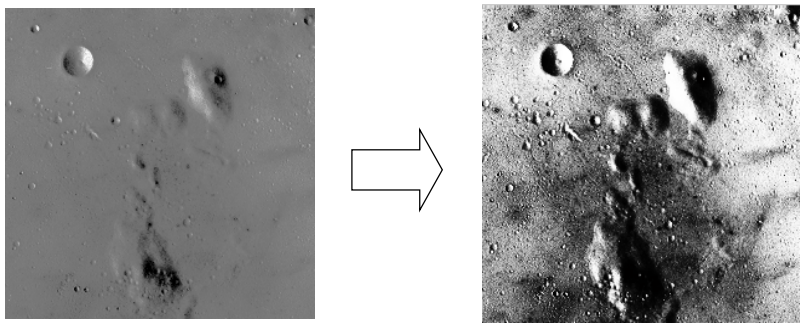
- Infer the world through images/video
  - Motion?
  - 3D structure/shape?
  - Lighting?
  - Texture?
  - Semantics?
  - …
- An inverse problem



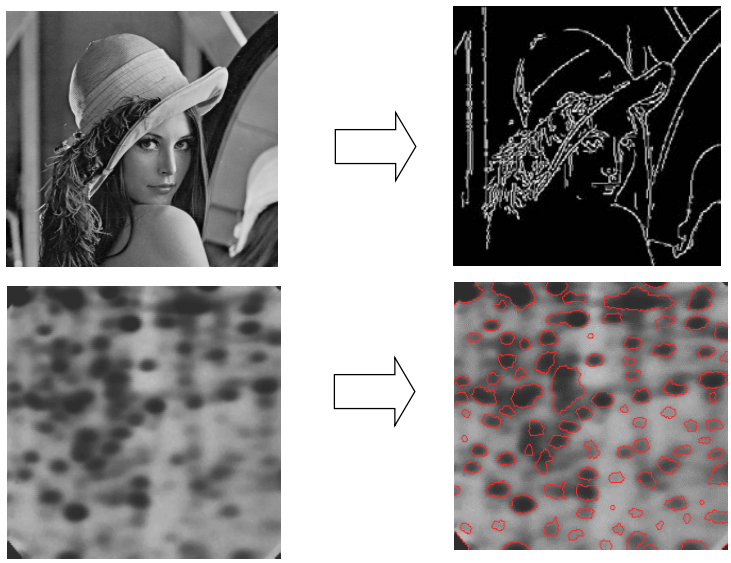
Broad Research

- Image processing
  - Filtering, enhancement, compression, …
- Low-level vision
  - Edge/corner detection
  - Image matching, optical flow
  - Segmentation, …
- Middle-level vision
  - 3D recovery
  - Motion recovery
  - Lighting recovery, …
- High-level vision
  - Object detection/recognition
  - Image/video understanding, …

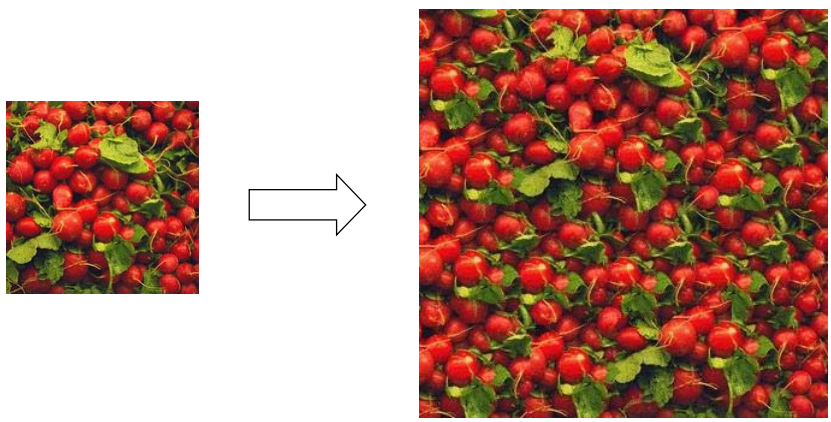
Image processing



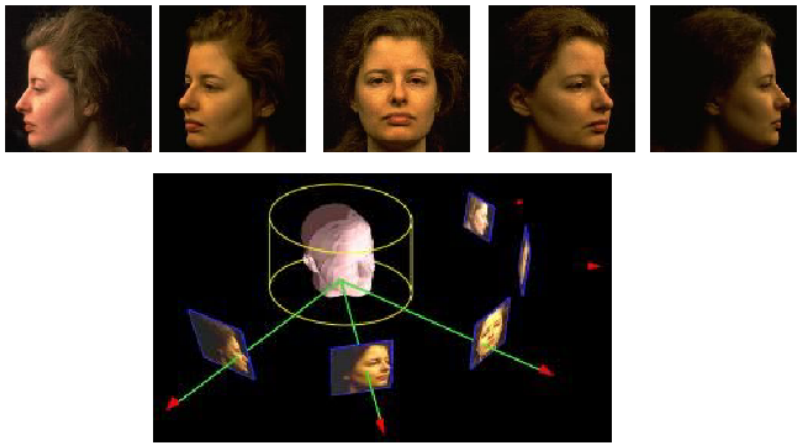
Low-level vision



Low-level vision



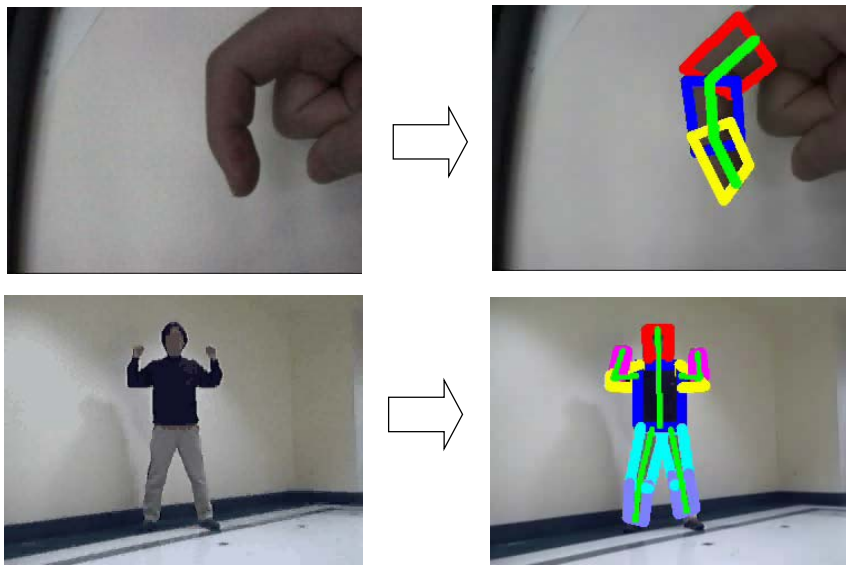
Middle-level vision: geometry



Frederic Pighin, Jamie Hecker, Dani Lischinski, Richard Szeliski, and David Salesin. Synthesizing Realistic Facial Expressions from Photographs. Proceedings of **SIGGRAPH 98**, in Computer Graphics Proceedings, Annual Conference Series, 1998.

Middle-level vision: motion

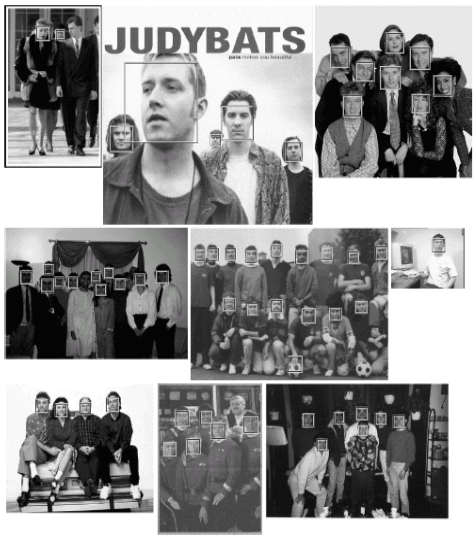
Middle-level vision: motion



Middle-level vision: motion

- Head tracking demo (live)

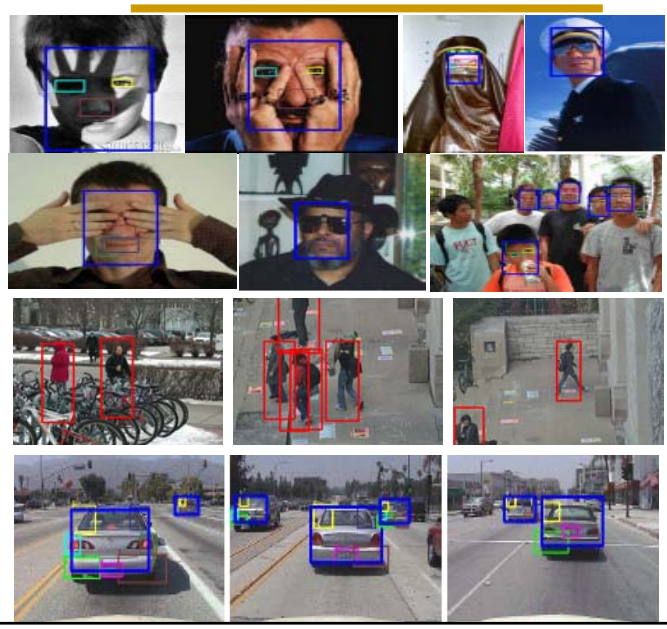
High-level vision: object detection



Viola & Jones, CVPR'01

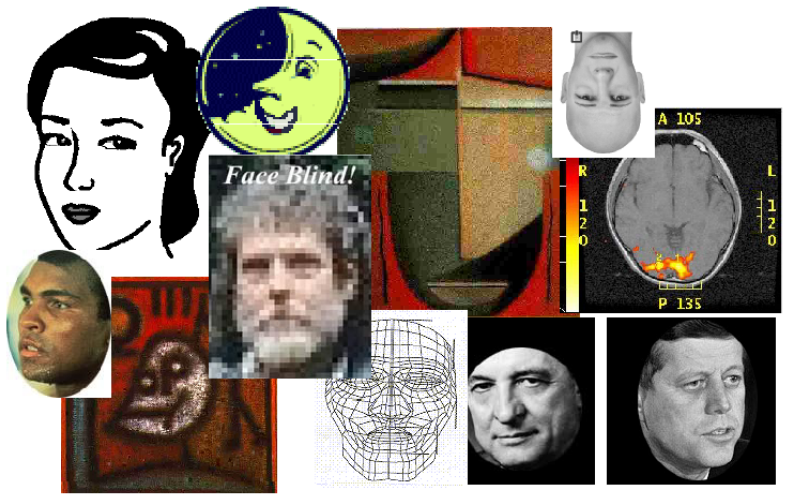
Rowley & Baluja & Kanade, PAMI'98

High-Level Vision: object detection



See video demo

High-level vision: object recognition



High-level vision: recognition

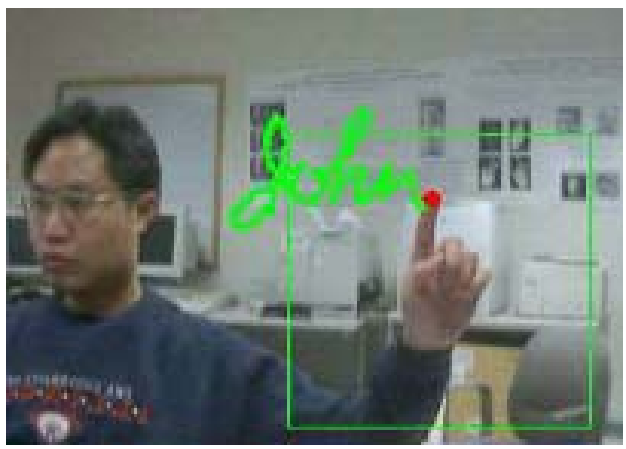
Paper-Rock-Scissors:

playing interactive video games against computers.

EECS 332

- Text
  - R. Jain, R. Kasturi, and B. G. Schunck, *Machine Vision*, McGraw-Hill, Inc. 1995
- What to learn
  - Fundamentals of computer vision
  - Profound understanding of math
  - Building your own tools and demos
- Your grades
  - Machine problems (50%)
  - Final project report (30%)
  - Project presentation (20%)

Possible Term Project I

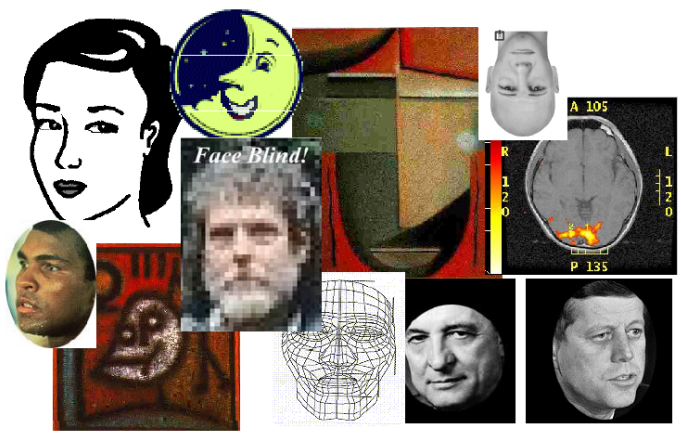


"Finger Cursor"

Possible Term Project II

"Image Google"

Possible Term Project III

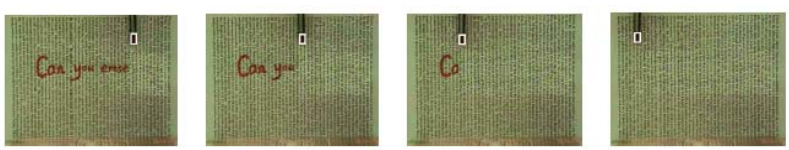


"Face Book"

Possible Term Project IV

"Image Mosaic"

Possible Term Project V



"Smart_Eraser" (see video)