CMPT 882 – Recognition Problems in Computer Vision

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Outline

- Intro to class
- Administrative details

Overview

- This class is about visual "recognition"
  - Objects: cups, cars, horses, … accordions to zebras
  - Textures: grass, leaves, dirt, water, …
  - Human figures: faces; whole body; elbows, wrists, knees,…
  - Human actions: running, jumping, waving, …
  - Places: office, city street, beach, jungle, …
- Goal is to provide view of state-of-art for these problems

Objects

- What is "Object recognition?"
  - overloaded term

Pontiac Grand Prix

- Is there a car in this image?
  - Object/image categorization
  - Object category recognition

- Where is the car?
  - Object localization
  - Object detection

- Which car is it?
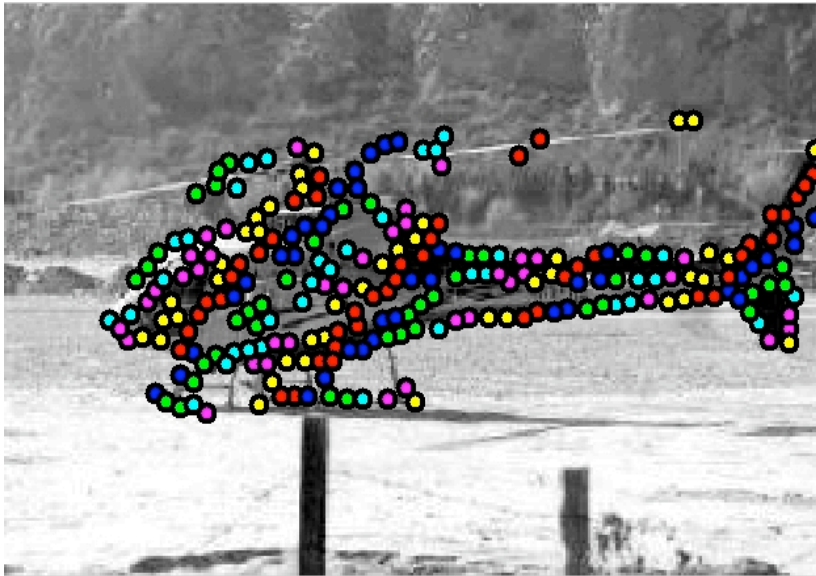 - Object recognition
  - Object identification

Challenges in Recognition

- Intra-class variation
- Object pose variation
- Background clutter
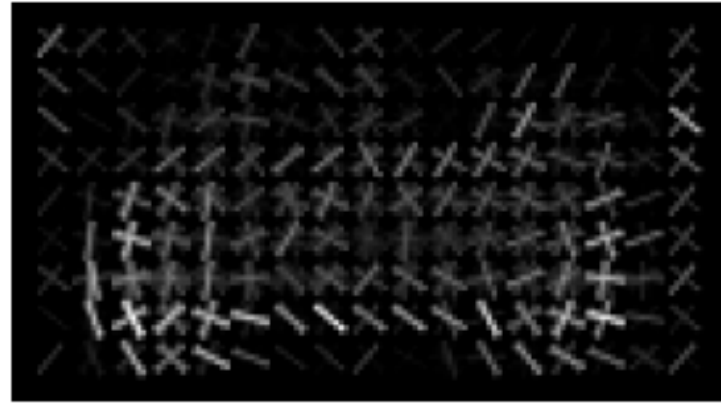- Occlusion
- Lighting

Object Recognition - Shape

- Template matching using shape

Berg et al. CVPR 05
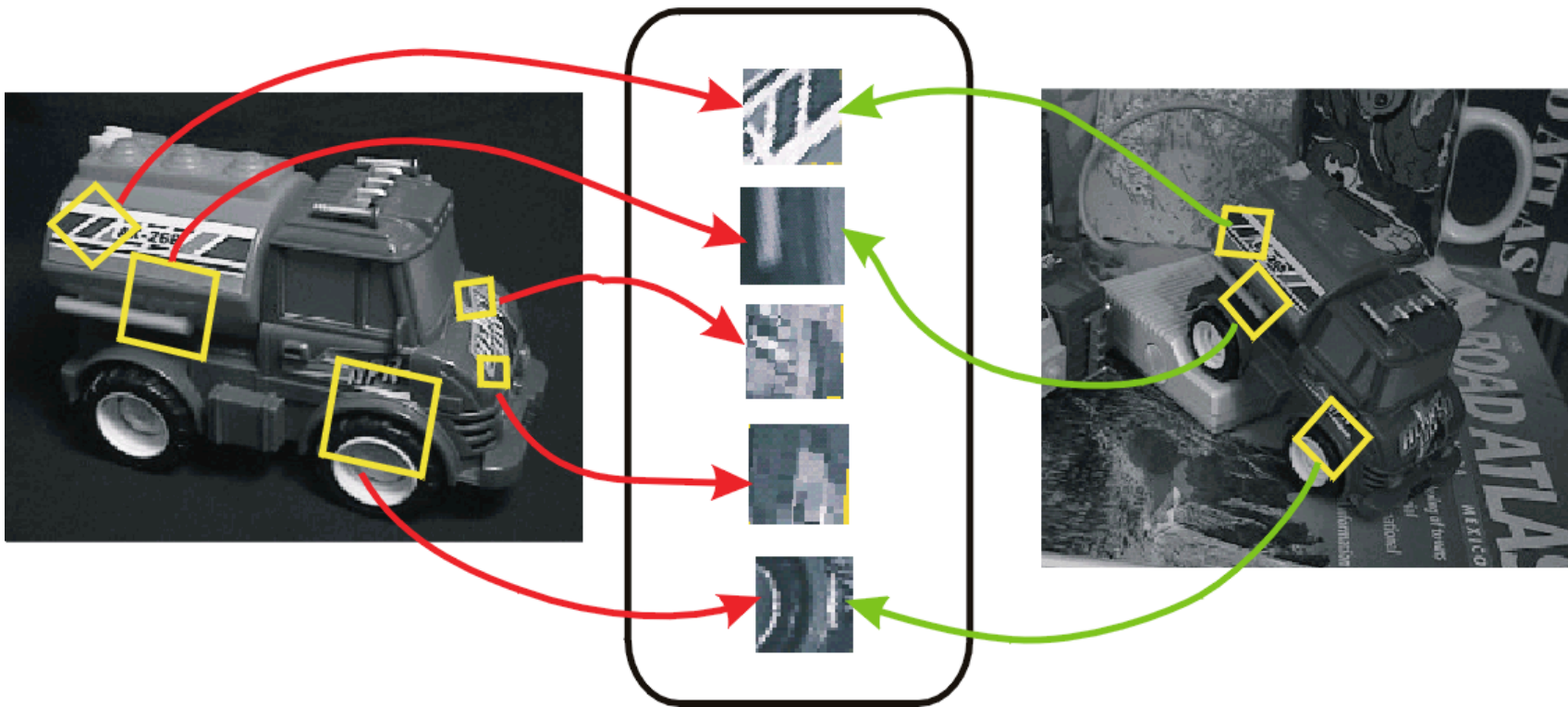
Object Recognition – Appearance

- Histograms of gradients
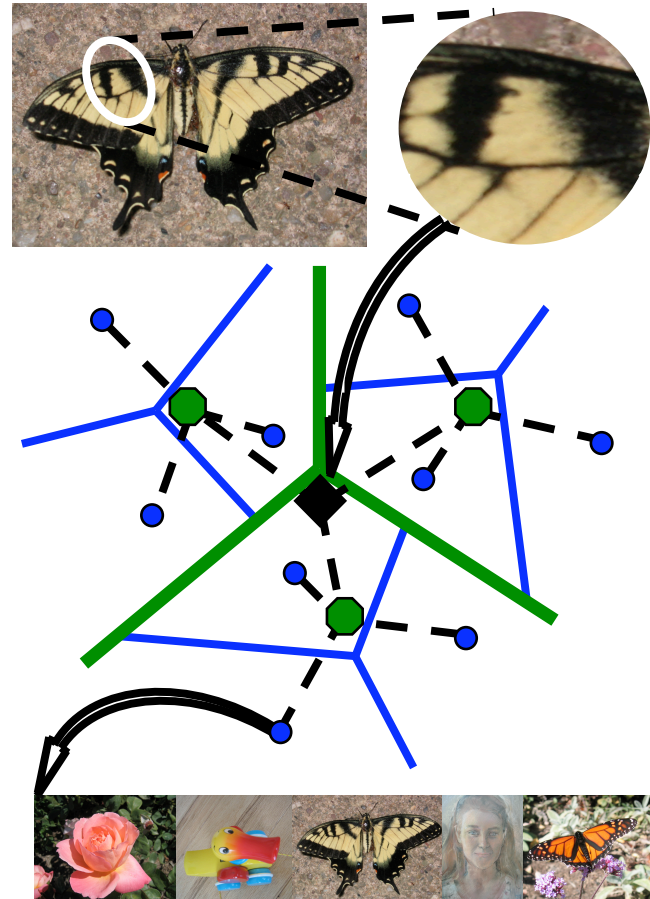

Dalal and Triggs CVPR 05

Object Recognition – Local Features
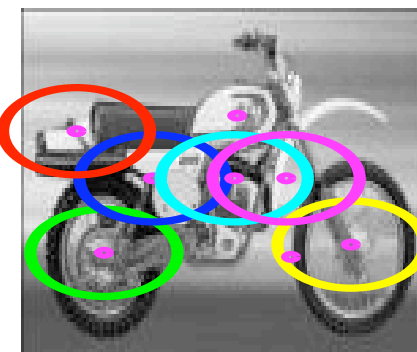
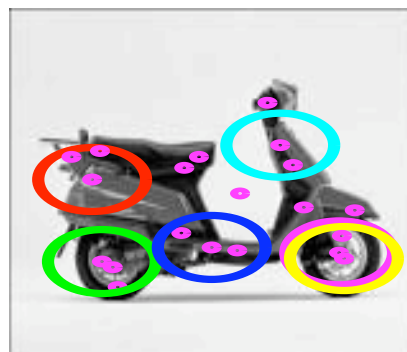- D. Lowe SIFT (ICCV 99, IJCV 04)

Fast Object Retrieval

- Stewenius + Nister, CVPR 06
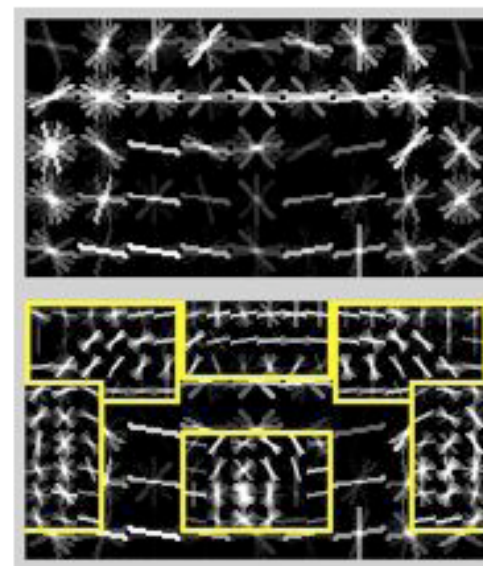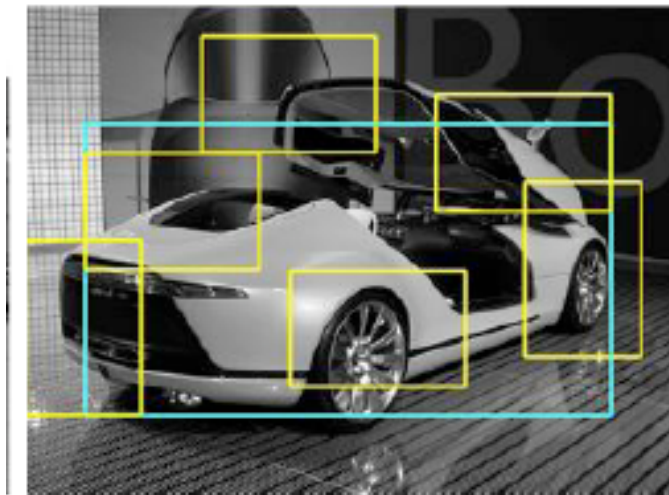 - 50,000 images at 8Hz (laptop)

cf. SnapTell

Object Recognition – Part-based Models

- ## Constellation models

Fergus et al. CVPR 03

- ## Latent SVM

Felzenszwalb et al. CVPR 08
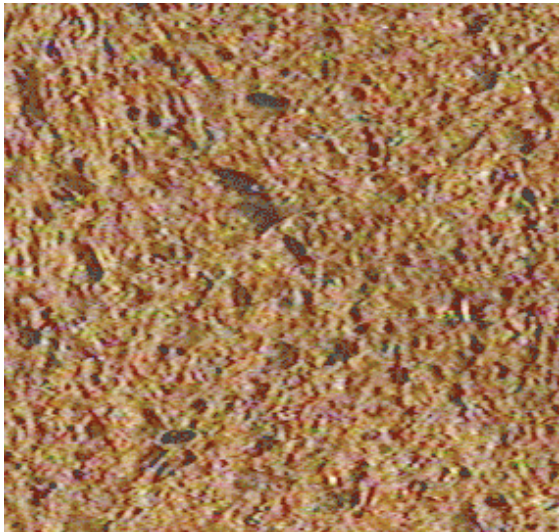
Photosynth

- Noah Snavely, Steven M. Seitz, Richard Szeliski, "Photo tourism: Exploring photo collections in 3D," SIGGRAPH06

[Photo tourism video](#)

Textures

Clothing Textures

Human Figures

- Faces (Viola + Jones CVPR 01)

Human Figures

- Implicit shape model

training images
(+reference segmentation)

Appearance codebook
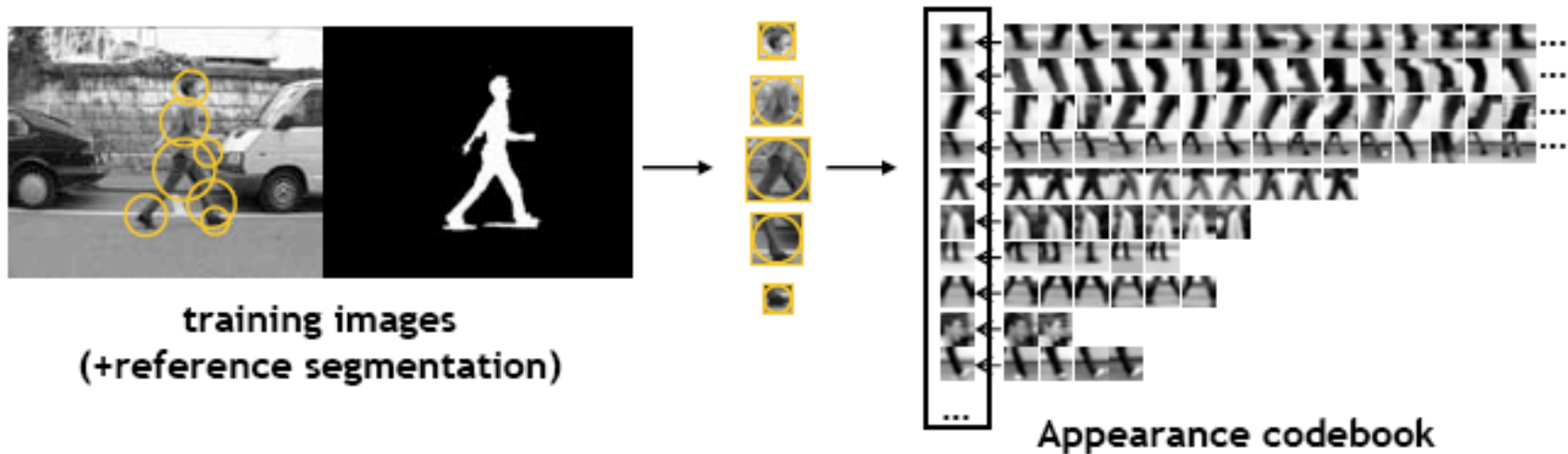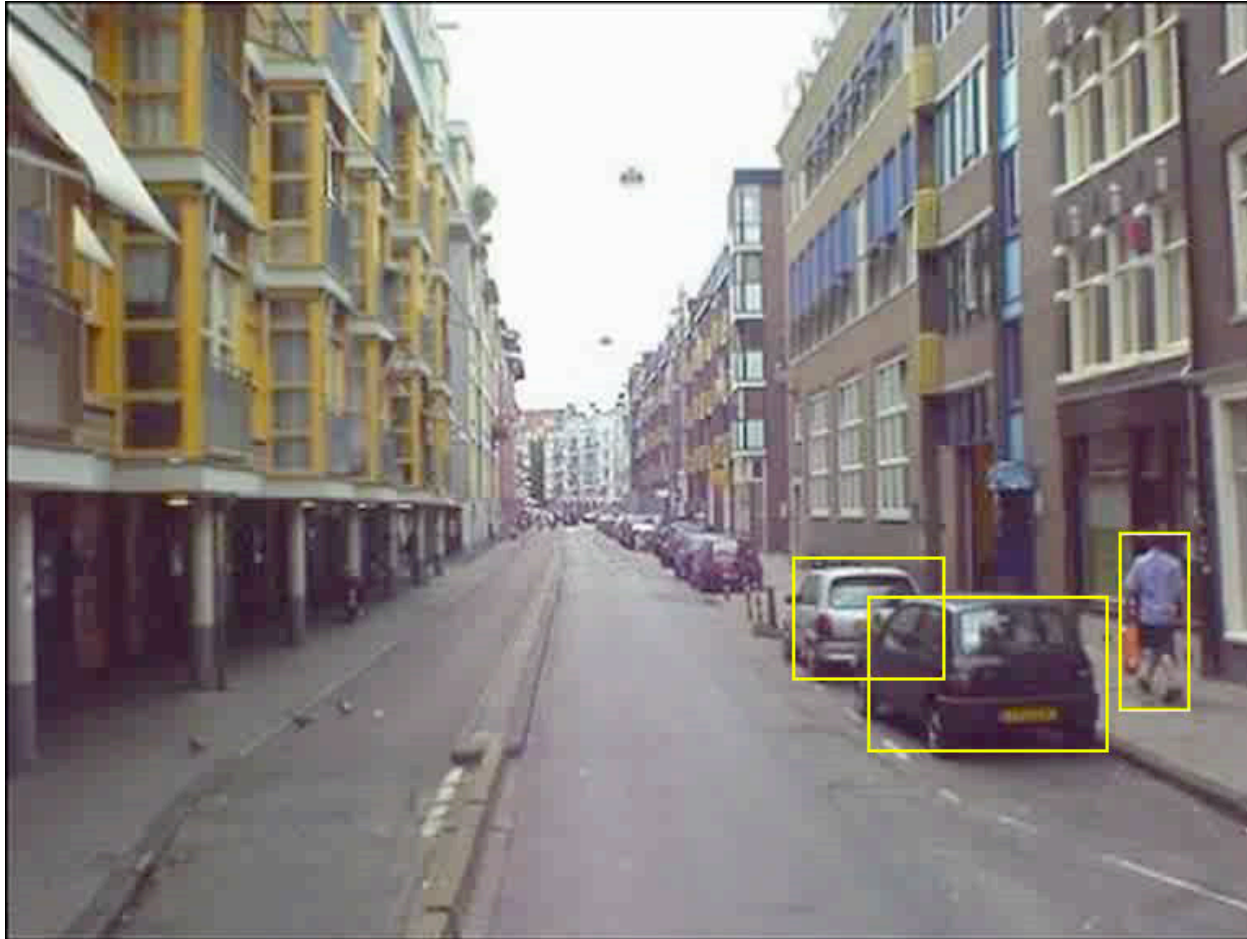
Leibe et al. CVPR 05

Leibe et al. CVPR 07

Human Figures – Pose Estimation

Mori and Malik, ECCV 02

Human Actions
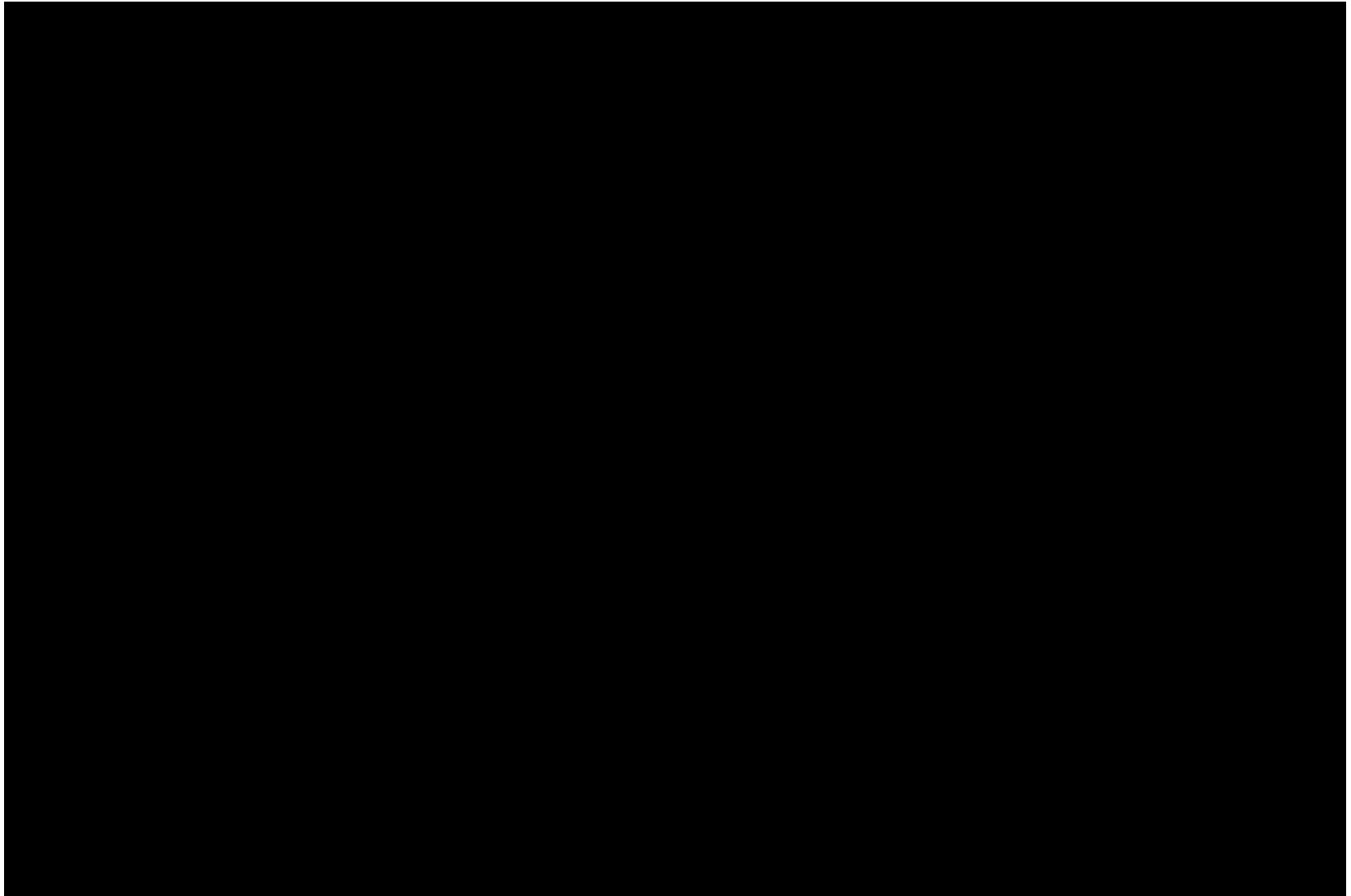
Shechtman and Irani CVPR 05

Real-time Gesture Recognition

Bayazit et al. MVA 09

Places

bedroom
livingroom
highway

kitchen
office
ins.city

Using Context

We know there is a keyboard present in this scene even if we cannot see it clearly.

We know there is no keyboard present in this scene

... even if there is one indeed.

Slide: Torralba

Course Plan

- Read research papers
  - For each topic I present important papers
  - Students each present a recent paper
  - We discuss

- Do a project
  - Gain in-depth experience on a problem and algorithm

Introductions

Prerequisite

- No formal prerequisites
- You will need to do the usual things
  - Math (continuous), programming, reading, writing, presenting
- Ask me if you are concerned

Grading Scheme

- 10% Class participation
  - Participate in discussions about papers, ask/answer questions
- 10% Reading assignments
  - 1 or 2 papers each week; the ones I present
- 10% Paper presentation
  - List of recommended papers online
- 10% Assignment
  - Small programming assignment on edges and texture
- 60% Project
  - Individual or in small groups
  - Presentation, written report

Reading Assignments

- Similar to mini paper review
  - One paragraph summarizing paper
  - Critical discussion (what you like / don't like)
  - Questions you have (for me to explain)
- Due before start of lecture via email
- These details and list of papers are online

Paper Presentations

- Choose one recent paper from area that interests you
  - Recommended list online
- 20 minute presentation
  - 10+ minutes questions/discussion
 - Feel free to use slides provided by authors

Assignment

- Short programming assignment
  - Canny edge detection
  - Texture recognition
- Out next week, due 2 weeks later
- Choice of language yours
  - MATLAB recommended

Project

- Major component of course
- Recommended projects:
  - Object category recognition (Caltech 101)
  - Human action recognition (Weizmann)
- Implement existing technique
  - Or variant thereof
- Proposal, presentation, report

Caltech 101
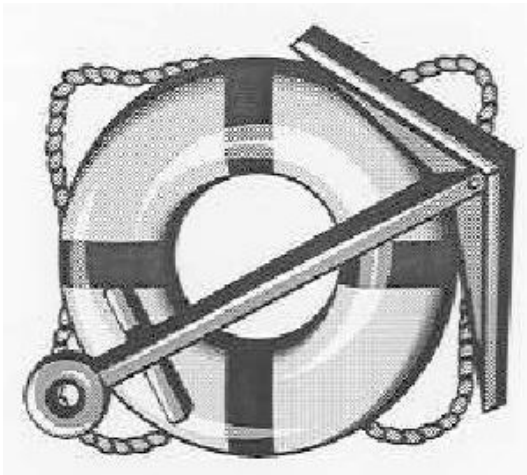
- Object category recognition
  - 101 classes, ~50-100 examples of each

Weizmann Human Action Dataset

- 9 subjects, each performs 9* actions

- Wednesday
  - Edge detection basics
- Next week
  - Edge detection, texture