Simple Object Tracking

Radu Dondera

Tracking

- Major component in a number of Computer Vision applications
  - surveillance
  - intelligent user interfaces
  - driver assistance
- Definition
  - continuously computing object location

Tracking & Distance Learning

- Specific interest: Distance Learning project
  - install pair of cameras in physical classroom
  - track the instructor in pairs of images acquired simultaneously by the cameras
  - update the image of the virtual classroom according to triangulated head position
    - add to the realism of the system
      - the instructor sees the back screen as a window to a new physical space

Simplification

- Tracking human faces is a non-trivial problem
  - several approaches have been proposed; ex. a rul-based method, neural networks, spatial masking with a kernel, etc.
- Solving a simpler task may provide insight and an approach to start from
  - tracking a small & regular red ball
    - also useful by itself in the Distance Learning project
      - can attach to instructor's body

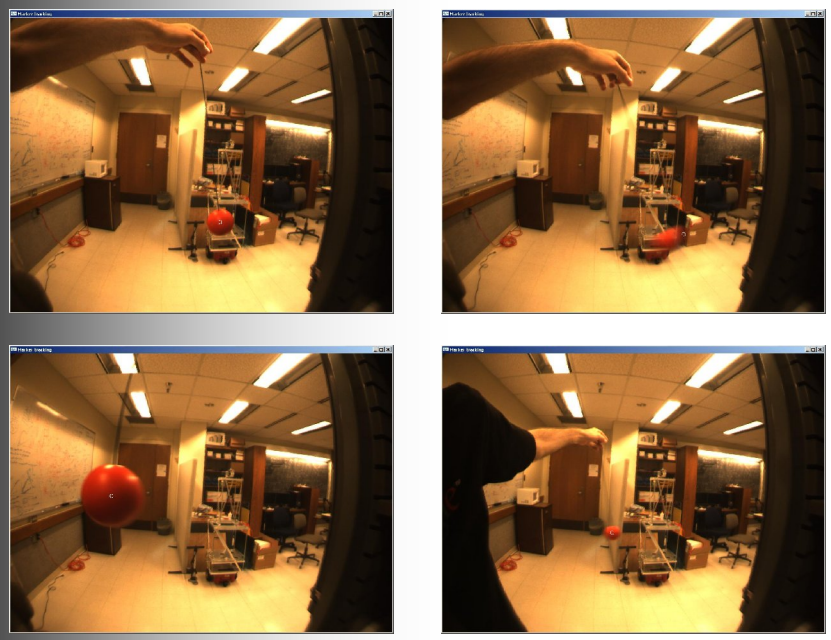
Simple Object Tracking (1)

- Detecting a colored ball in an image still isn't a trivial problem: several papers (RoboCup)
- Approach: learn the "signature" of the ball and attempt to match it in the new image
  - signature can be the color histogram
  - main problem is high computational cost
    - can't compute signature at every pixel

Simple Object Tracking (2)

- Solution: learn the “color” of the ball and only compute signature at pixels classified as having the ball color
- Learning the color
  - crude clustering of ball pixel colors
- Recognizing the color
  - can’t check color against all representatives
    - downscale color space and precompute match

Results



- Typical time for learning phase: 1.9 s
- Typical time for pixel classification: 0.07 s
- Typical time for object detection: 0.01 s
- Image size: 1024x768
- 2.00GHz, 2GB PC

Looking Forward (1)

- The presented approach will be applied to face tracking
  - determine interesting pixels based on color
  - group the interesting pixels into regions
  - compute the signature at pixels inside the regions
  - select pixel with signature closest to the learned signature as the center of the tracked object

Looking Forward (2)

- Problems & issues
  - the signature and colors need to be updated dynamically
    - re-clustering colors may be expensive
  - computing the signature for a large number of pixels may be expensive too
    - how to use locality properties
  - two images of the instructor are available
    - how to use both signatures/sets of colors

Thank you!