Learning complex visual concepts

early motion abilities
- detection
- segmentation
- tracking

learn to perceive coherent objects
Dorfman, Harari, Ullman

object segregation

Learning to segregate objects – Dorfman et al. (2013)
Computing the 2D motion field

used an “off-the-shelf” motion algorithm (Sun et al., 2010)

divide image into stationary background + moving regions

select a moving region for further processing...

From moving regions to static object segregation

cover image region with SIFT image descriptors (Lowe, 2004)

• capture distribution of image gradients at multiple scales
• computed at “keypoints”
• store location of each SIFT descriptor relative to center of moving region

search for similar distribution of SIFT descriptors in new static image
Testing object segregation in static images

learn object models from each movie (5 sec, 40 sec segments)

test on static images with variety of backgrounds, pose, lighting

overall good performance...

... but some errors

boundaries not delineated well

Learning boundary features

use motion discontinuities to learn static cues for occluding boundaries

in each frame of the training movies:

- detect motion discontinuities
- extract image patches along boundaries (5 sizes)
- represent each patch with a SIFT descriptor
- label figure (moving) & ground (stationary) sides of boundary

in new static images:

- look for image locations with similar SIFT descriptors for same 5 sizes of image patch centered on this location

Informative boundary features

- T-junctions
- convexity
- extremal edges
Combining information sources

Object segregation is a complex task, learned gradually from infancy.

Static object segregation can be learned from motion.

Two mechanisms work in synergy:
- From motion discontinuities, learn cues to occlusion boundaries.
- From regions of common motion, learn object forms.

Summary

- Object segmentation is much more complex.

... but object segmentation by adults is much more complex!