Better Vision through Experimental Manipulation

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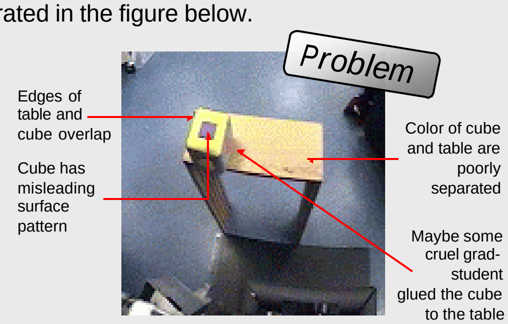
Our Goal

To investigate the *development* of the association between *visual* information and *motor* commands in the learning, representation, and understanding of *manipulative gestures*.

A practical problem

For manipulation, we need to know what parts of the environment are physically coherent ensembles. This is a difficult judgement to make from purely visual information, as illustrated in the figure below.

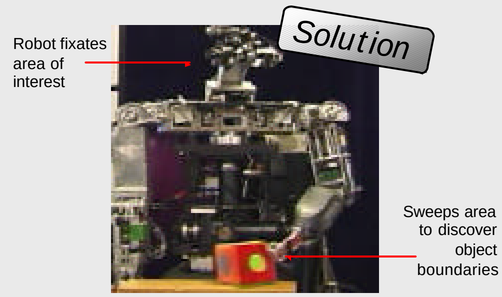


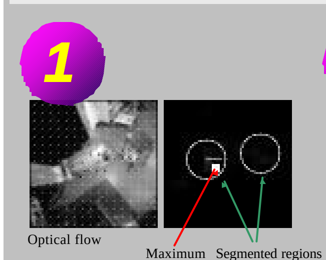
Our solution

Use poking and prodding to solve the figure/ground problem *experimentally*, in the following steps:

1. Locate arm from motion
2. Learn to predict arm location
3. Detect contact events
4. Segment impacted objects

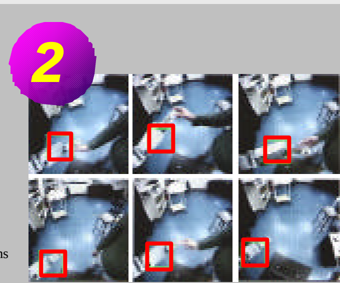
Steps 1–2: *Training phase*. Steps 3–4: *Active segmentation*.





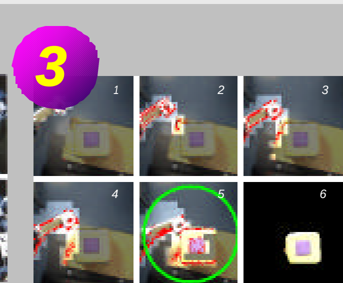
Locate arm from motion

Use motion signature to detect arm and filter out distractors



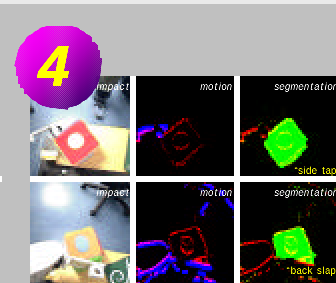
Learn to predict arm location

Relate arm location to proprioceptive feedback



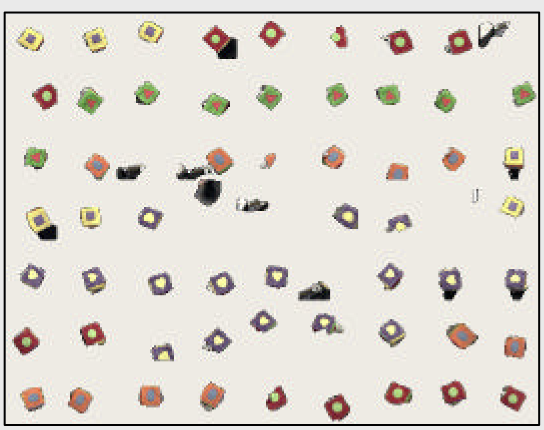
Detect contact events

At moment of impact, there is a characteristic, discontinuous spread of perceived motion



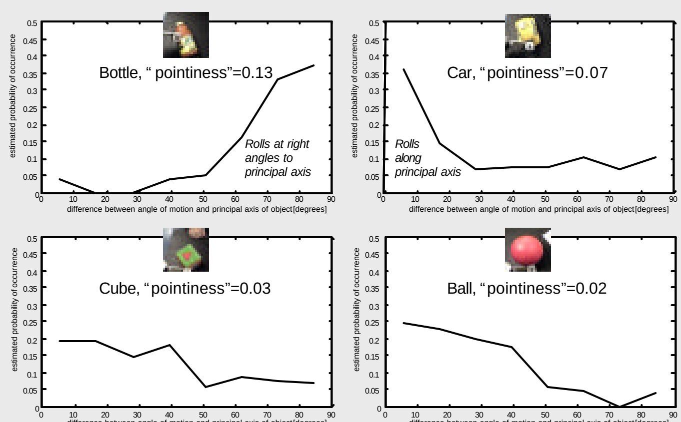
Segment impacted objects

Differentiate motion of arm from that of the object to reveal the object's boundary



Typical results

63 consecutive proddings of the cube, illustrating the frequency and types of error encountered.



Exploring an affordance: objects that roll

Experimentation by robot reveals that certain objects (a bottle, a toy car) have a preferred direction of motion relative to the principal axis of their shape. The objects are clustered online.

Acknowledgments:

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