Object detection and segmentation in cluttered scenes through perception and manipulation

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Resolving a cluttered scene - Problem
Resolving a cluttered scene - Challenge

- Similar shapes
- Clutter
- Occlusion
- Duplicates
- Arbitrary orientations
- Grasping with PR2
Demo video

http://www.youtube.com/watch?v=60bs-lSDgeU
Starting with ROS packages

- Textured Object Detection (TOD) stack
- by Willow Garage
- very experimental
- Solutions in Perception Challenge, ICRA 2011
- http://www.ros.org/wiki/tod_detecting
- http://www.ros.org/wiki/tod_training
Selecting the approach

1. Model from multiple views

2. Matching local features

3. Pose Estimation

4. Ranking, refinement, rejection
Describing local features - Oriented BRIEF (ORB)

“Oriented BRIEF = FAST + Harris Response + modified BRIEF”
Matching local features - Locality-Sensitive-Hashing (LSH)
Estimating poses - Random Sample Consensus
Making the system robust

1. ranking
2. refinement
3. rejection
Finding good parameters

- factorial design intractable; 5 levels, 10 parameters: $5^{10} \approx 10^6$.
- success if errors less than 3cm and 20 degrees
- LSH does not decrease success rate
- 80% success on validation set
Evaluating the results - Many
Evaluating the results - Duplicates
Evaluating the results - Clutter
Future work

In-hand modelling
Ground truth collection for cluttered scenes
Evaluation of Willow’s announced replacement of tod_*
Incorporate feature uncertainty
Include 3D information
Thank you