# Object detection and segmentation in cluttered scenes through perception and manipulation

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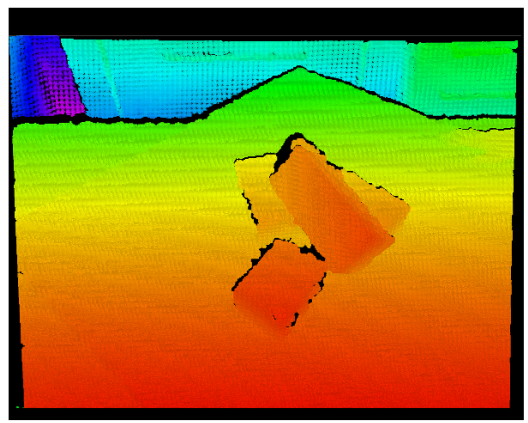
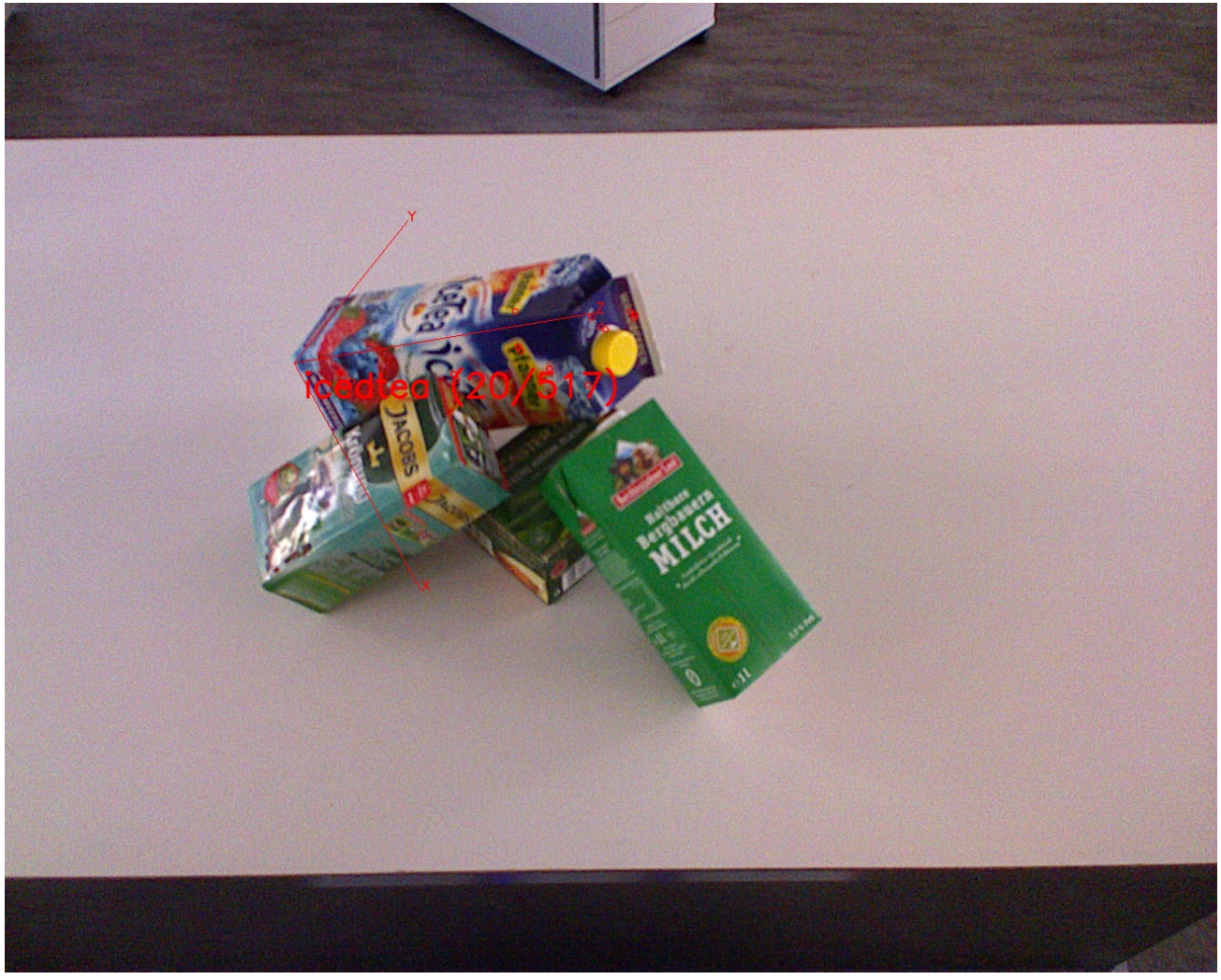


# Resolving a cluttered scene - Problem



# Resolving a cluttered scene - Challenge

**S**imilar shapes

**C**lutter

**O**cclusion

**D**uplicates

**A**rbitrary orientations

**G**rasping with PR2

# Demo video

http://www.youtube.com/watch?v=60bs-ISDgeU

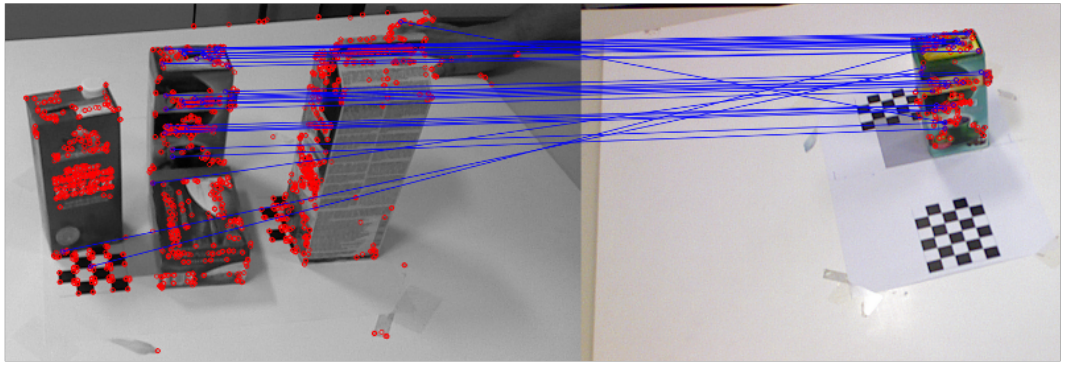
# Starting with ROS packages

- 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

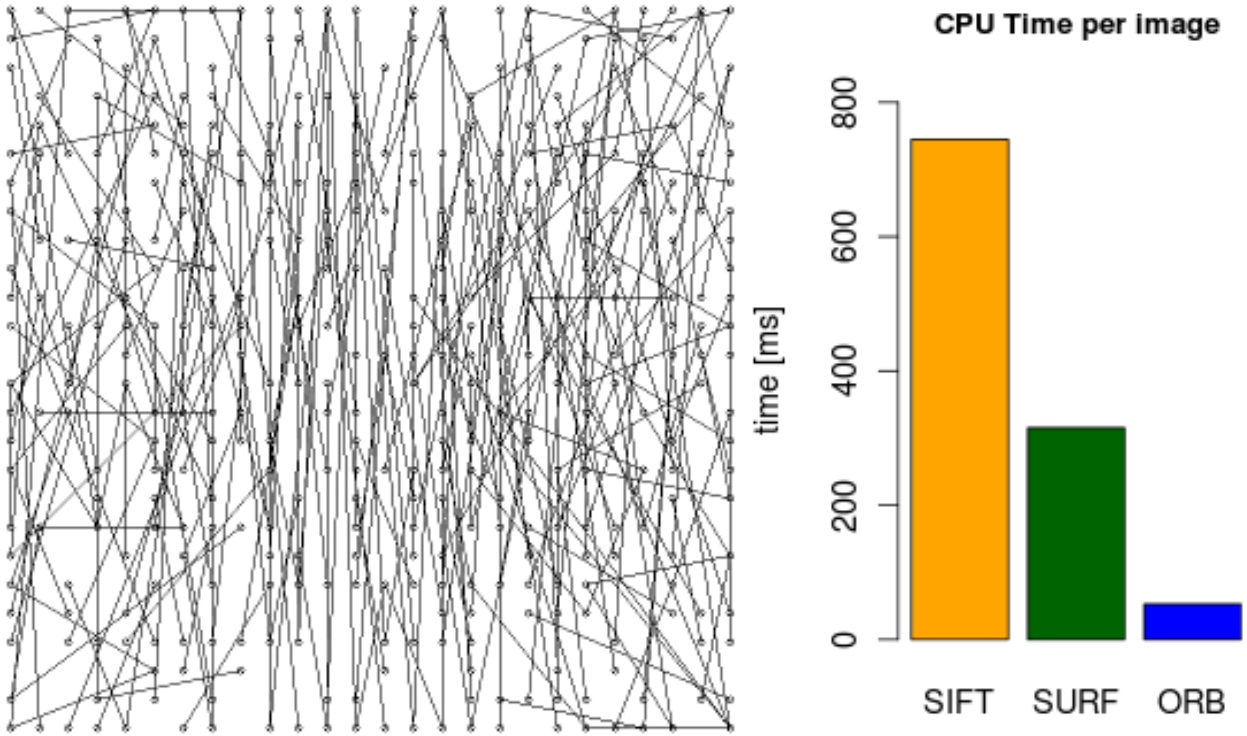
2. Matching local features



3. Pose Estimation

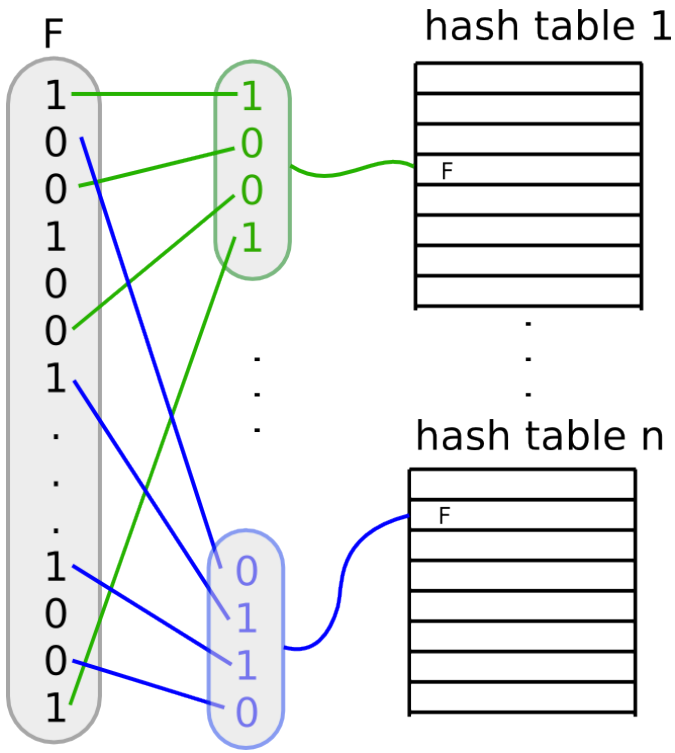
4. *Ranking*, *refinement*, *rejection*

# Describing local features - Oriented BRIEF (ORB)

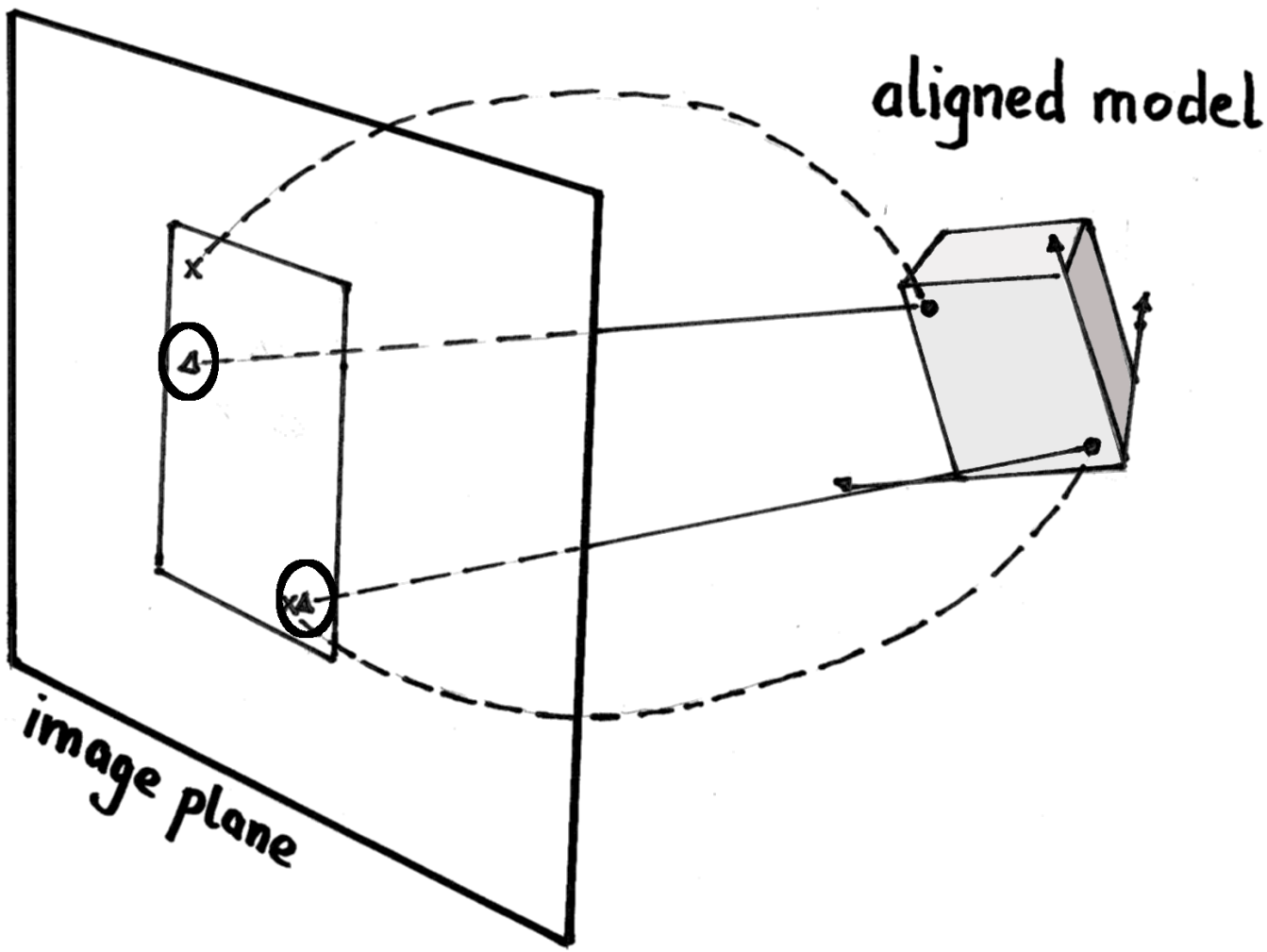



"Oriented BRIEF = FAST + Harris Response + modified BRIEF"

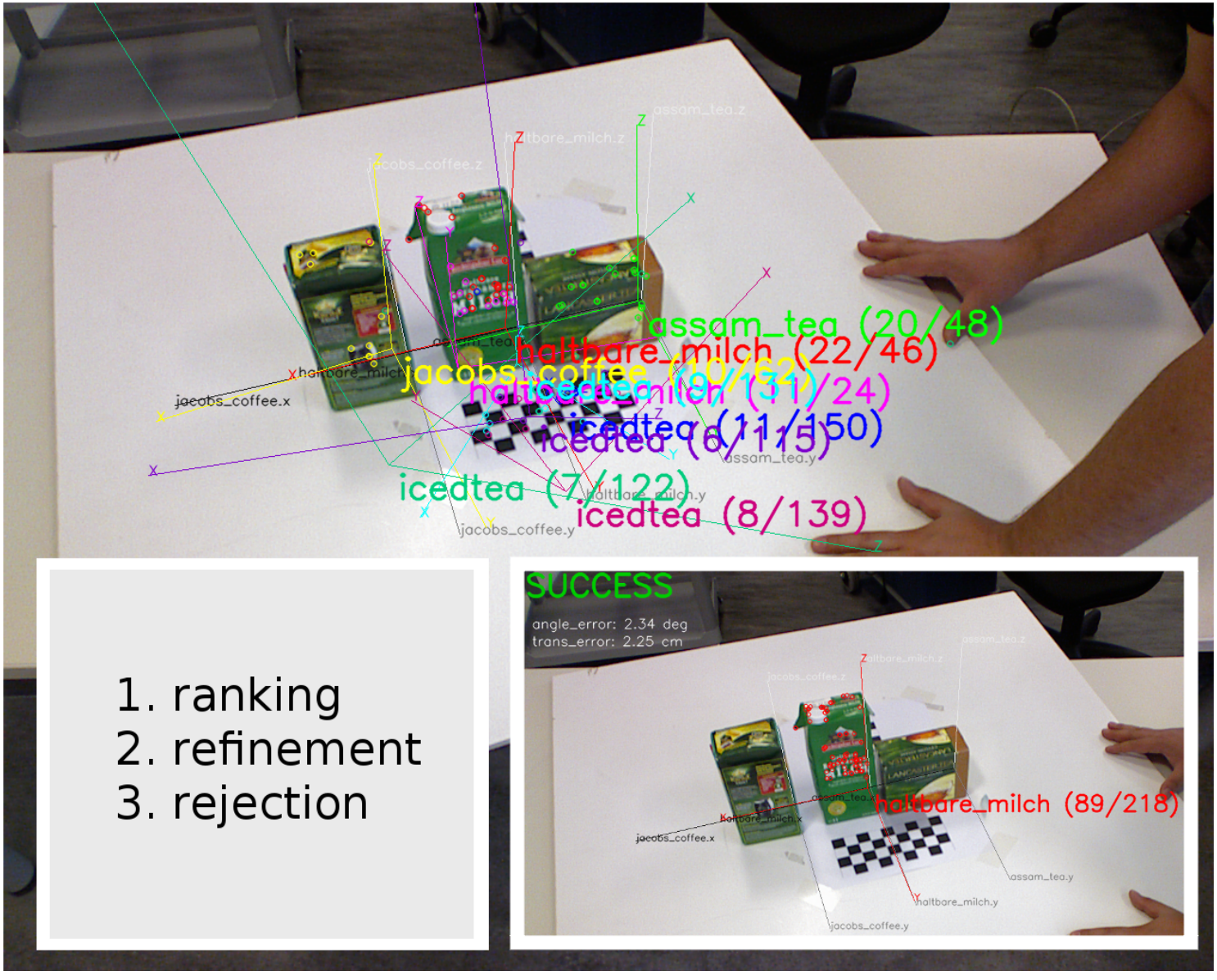
# Matching local features - Locality-Sensitive-Hashing (LSH)



# Estimating poses - Random Sample Consensus



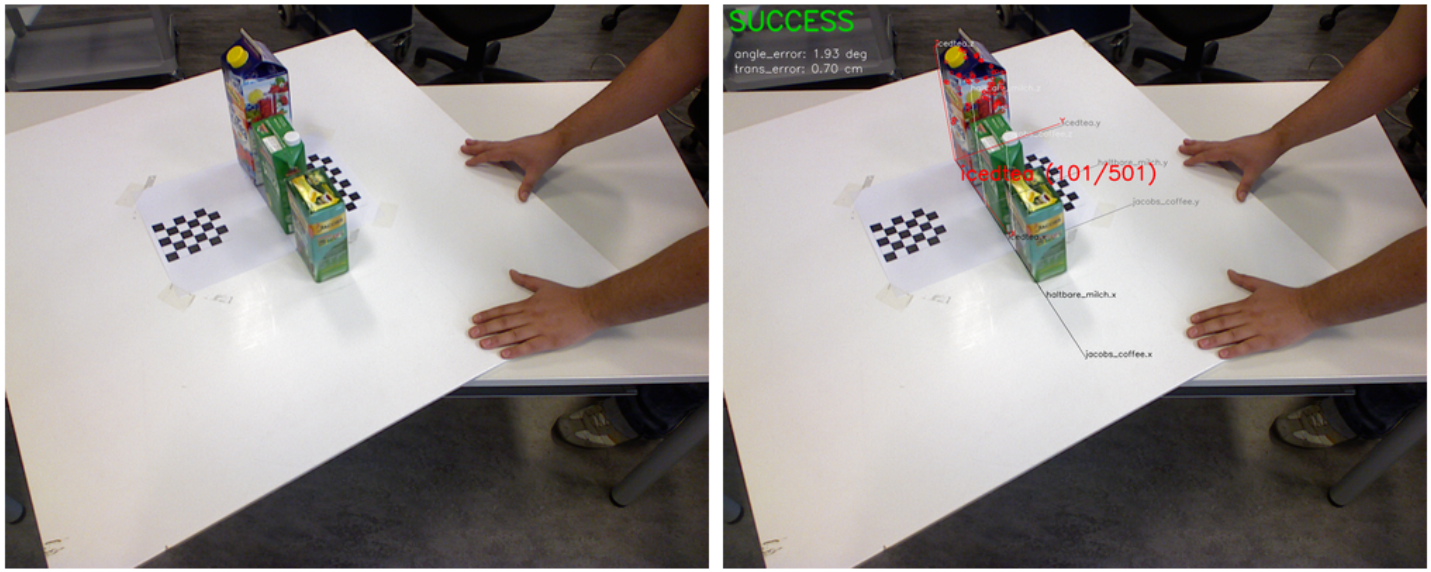
# Making the system robust




1. ranking
2. refinement
3. rejection

# Finding good parameters

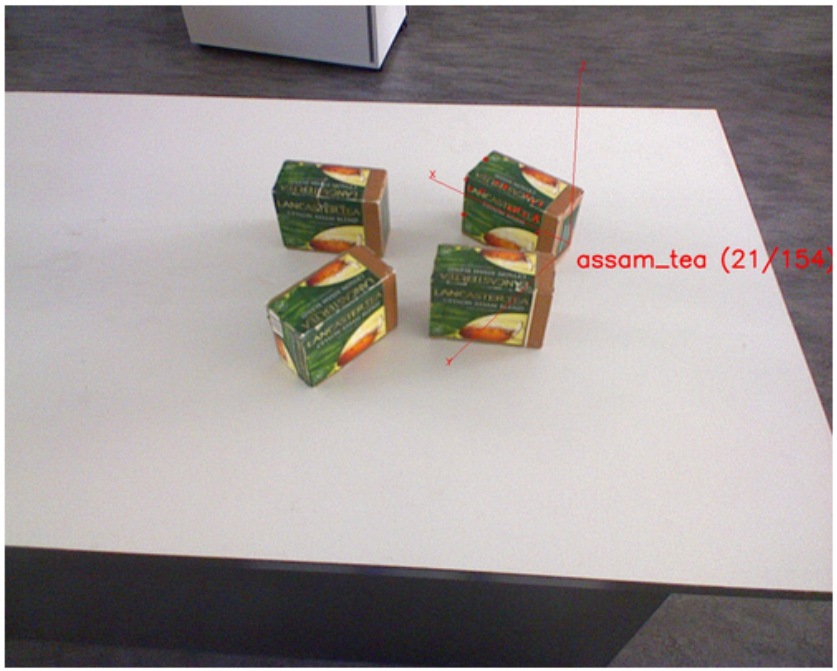
- factorial design intractable; 5 levels, 10 parameters: $5^{10} \approx 10^6$.
- success if errors less than 3cm and 20 degrees



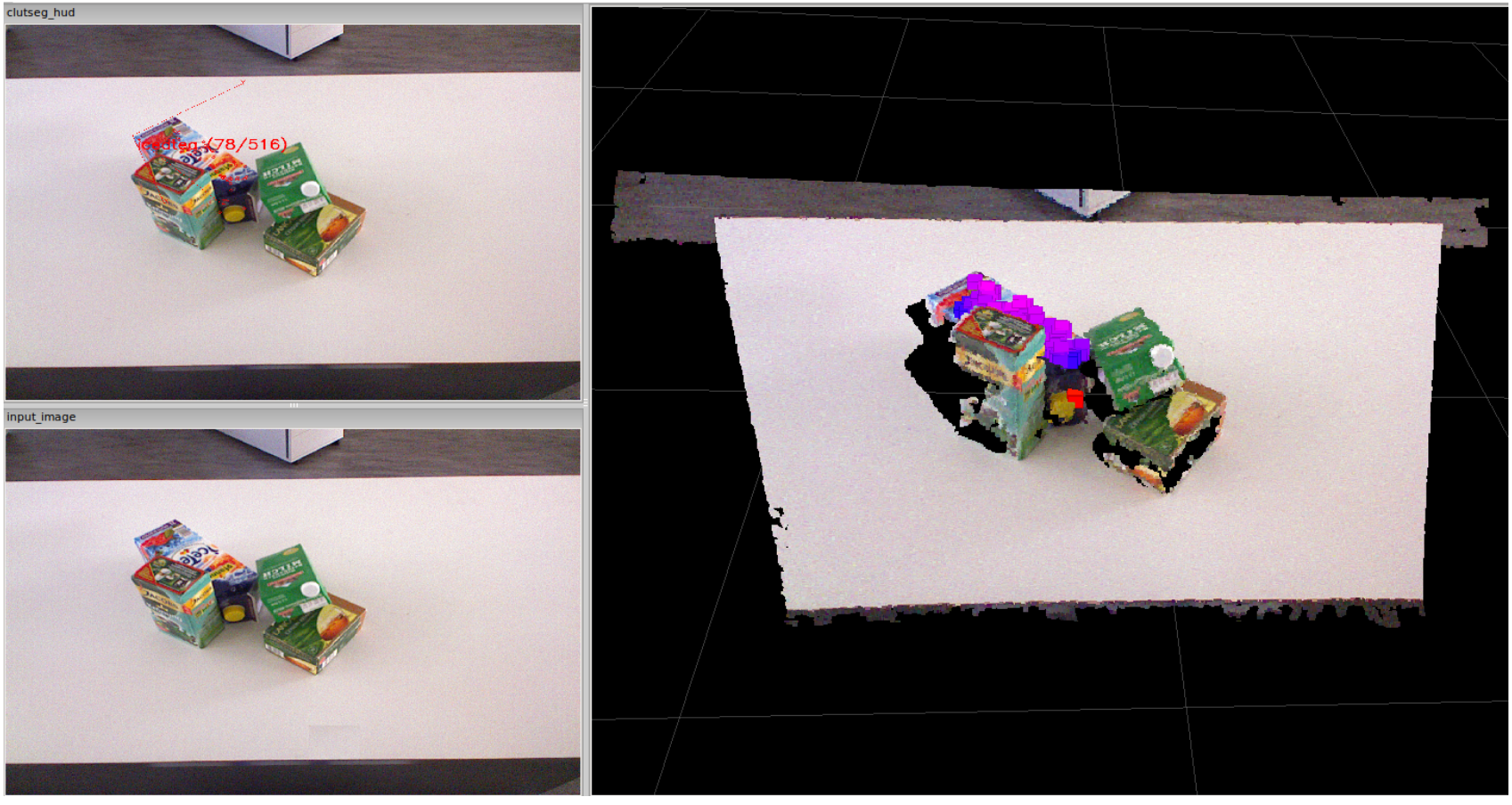

- LSH does not decrease success rate
- 80% success on validation set

# 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