Scene-level Pose Estimation for Multiple Instances of Densely Packed Objects

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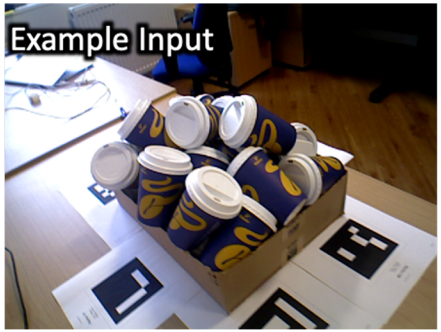
6D Object Pose estimation: Datasets and Challenges

Challenges

- Occlusion.
- Lighting variations.
- Lack of representative training data.

Additional challenges in Multi-instance clutter

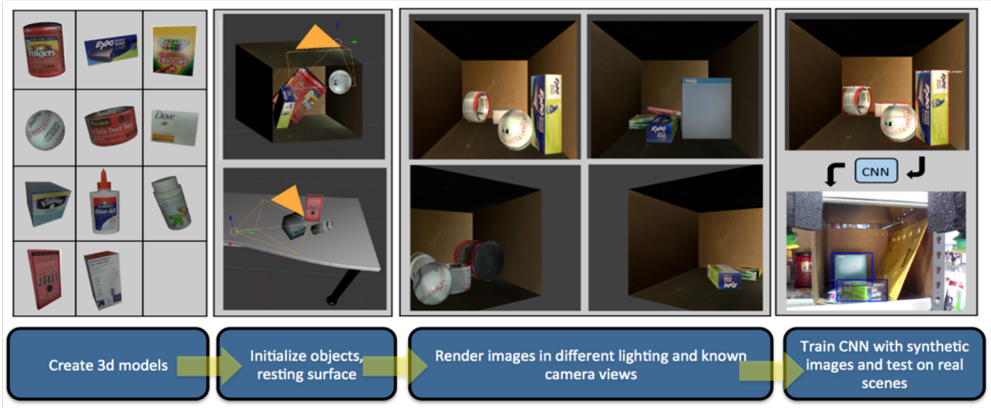
- Challenging segmentation.
- Surface ambiguity and symmetry.



OUR CONTRIBUTIONS:

- Training CNNs with Synthetic images.
- Robust pose hypothesis generation strategy.
- Scene-level pose estimation

Training CNNs with Synthetic images



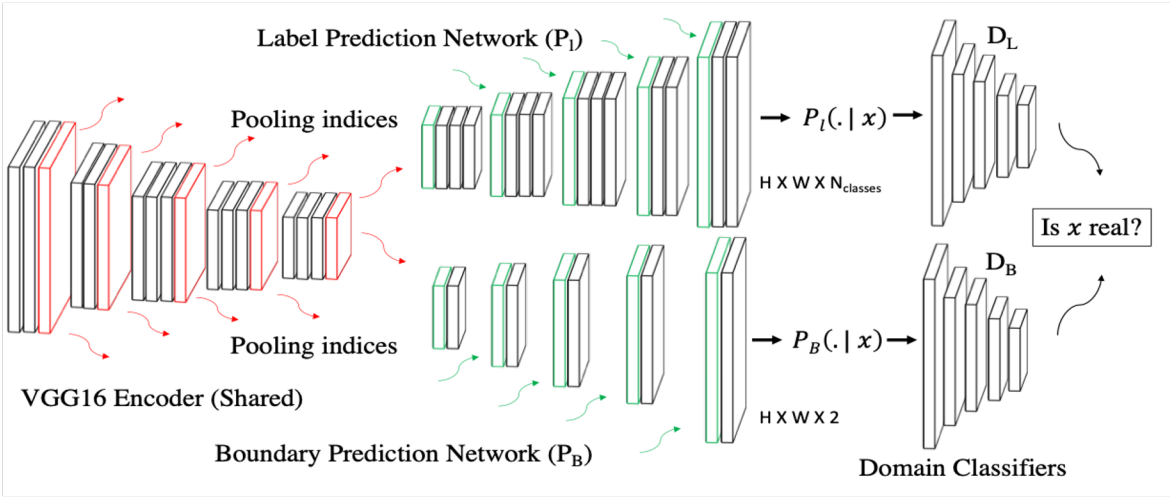
A Self-supervised Learning System for Object Detection using Physics Simulation and Multi-view Pose Estimation
Mitash, Boularias, Bekris [IROS' 17]

We utilize the **environmental constraints** and **physics** to generate training data **in simulation** that is **representative** of the distribution of data in test scenarios with respect to object poses.

Recent work,

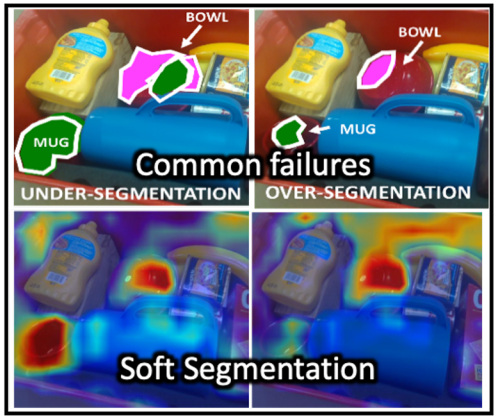
Labeled synthetic data

Unlabeled real data

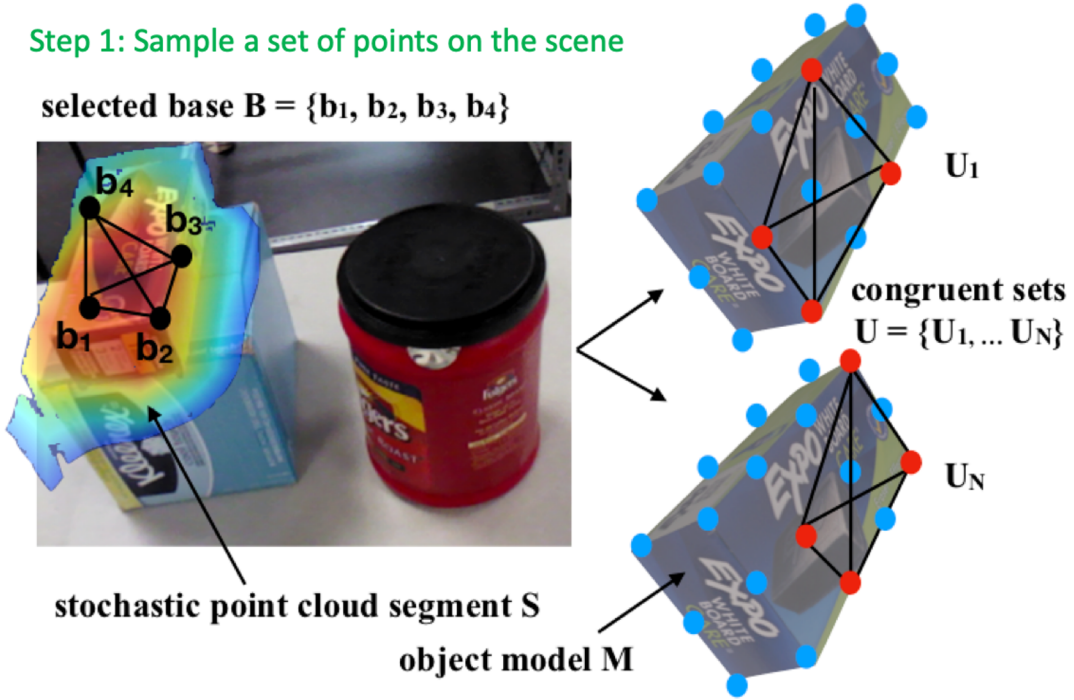


Pose hypothesis generation

Robust 6D Object Pose Estimation with Stochastic Congruent Sets (StoCS)
Mitash, Boularias, Bekris [BMVC' 18]



Step 1: Sample a set of points on the scene

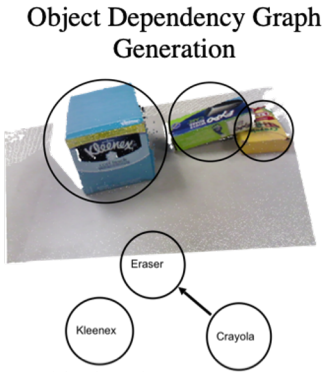


Using the **soft segmentation output** and **geometric matching**, it is possible to generate a set of **pose candidates** that often contains the true solution.

Step 2: Search for congruent pointsets on the object model

Scene-level pose estimation

Improving 6D Pose Estimation of Objects in Clutter via Physics-aware Monte Carlo Tree Search
Mitash, Boularias, Bekris [ICRA' 18]



Step 1: Select state

Step 2: Expand a node

Step 3: Random policy expands until maximum tree depth.

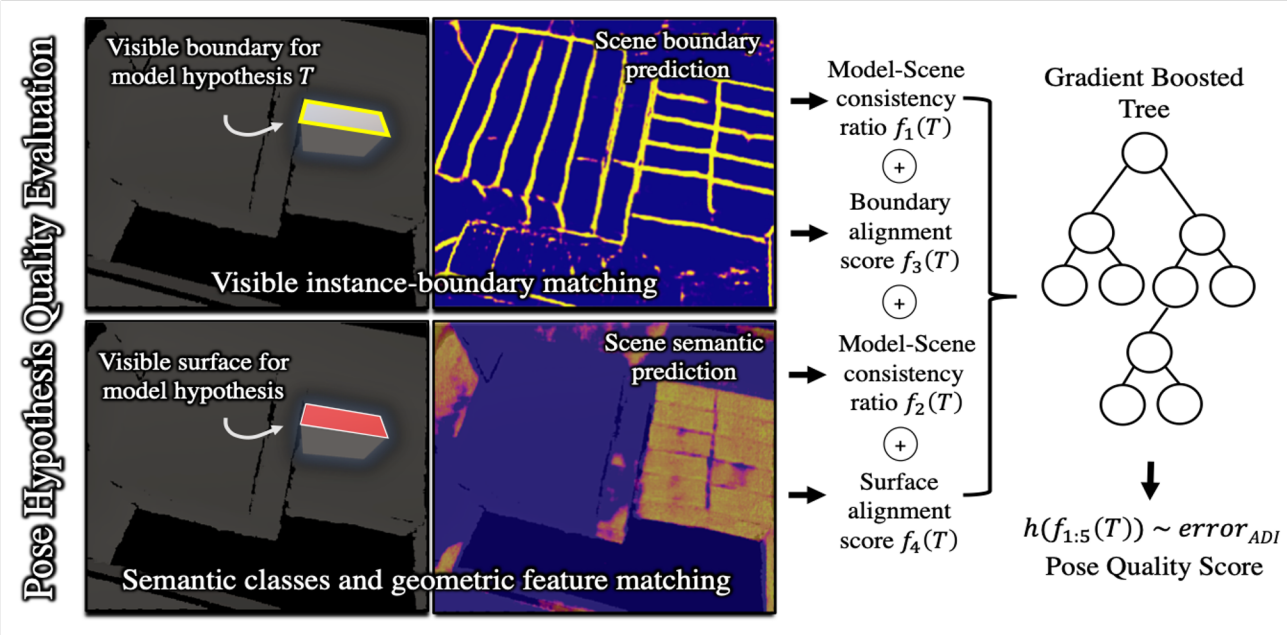
Step 4: Render the leaf state and compare with observed depth data.

Step 5: Backtrack the score to parent nodes.

Score: 10, 264

Qualitative results

Scene-level pose estimation



Scene-level Pose Selection

$max_{y_i} \sum y_i f(T_i)$

Subject to collision constraints

y_i: Binary variables

$f(T_i)$: Pose quality score for T_i

ILP Solver provides very fast estimate of the scene

Qualitative results