

ReFlow6D: Refraction-Guided Transparent Object 6D Pose Estimation via Intermediate Representation Learning

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Motivation & Challenges

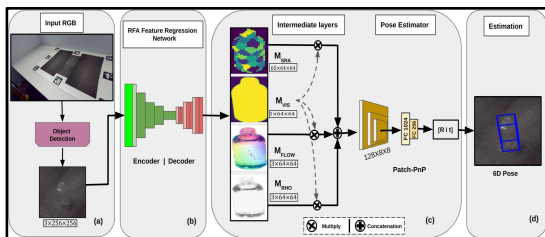
- Transparent objects are common in real-world environments but remain underexplored in 6D pose estimation.
- Their inconsistent visual features and unreliable depth make their perception and manipulation difficult.
- Addressing this problem is crucial for enabling robots to reliably interact with real-world objects.



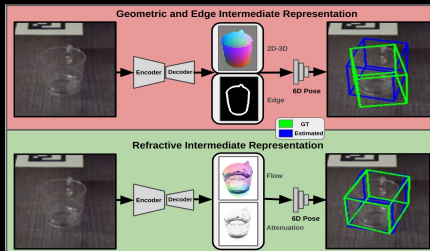
ReFlow6D

- Incorporation of refractive-intermediate representation (RFA) that models the deformations of light paths through transparent objects.
- We leverage GDR-Net₁₁ architecture for our case.
- Direct regression of 6D object pose from the predicted RFA representations.

Reference:
[1] G. Wang, F. Manhardt, F. Tombari, and X. J. "Gdr-net: Geometry-guided direct regression network for monocular 6d object pose estimation." CVPR 2021.



Overview



- Effectiveness of the refractive-intermediate representation vs Geometric and edge intermediate layers for transparent object 6D pose estimation.

Quantitative results

- TOD dataset

AVERAGE RECALL RESULTS ON THE <i>TOD</i> DATASET OBJECTS					
Methods	KeyPose	ReFlow6D	Keypose	GDR-Net	ReFlow6D
Metric	MAE↓		AR↑		
Mean	10.4	3.4	77.0	87.5	90.4

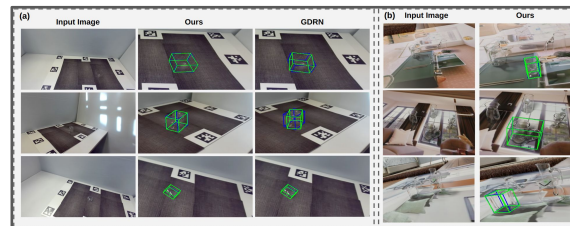
- Trans6D-32K dataset

ADD(-S) ON Trans6D-32K DATASET OBJECTS			
Methods	GDR-Net	TGF-Net	Our Method
Mean	84.6	88.2	93.2

See More



Qualitative results



Real world robot-Manipulation

