Prior-free 3D Object Tracking

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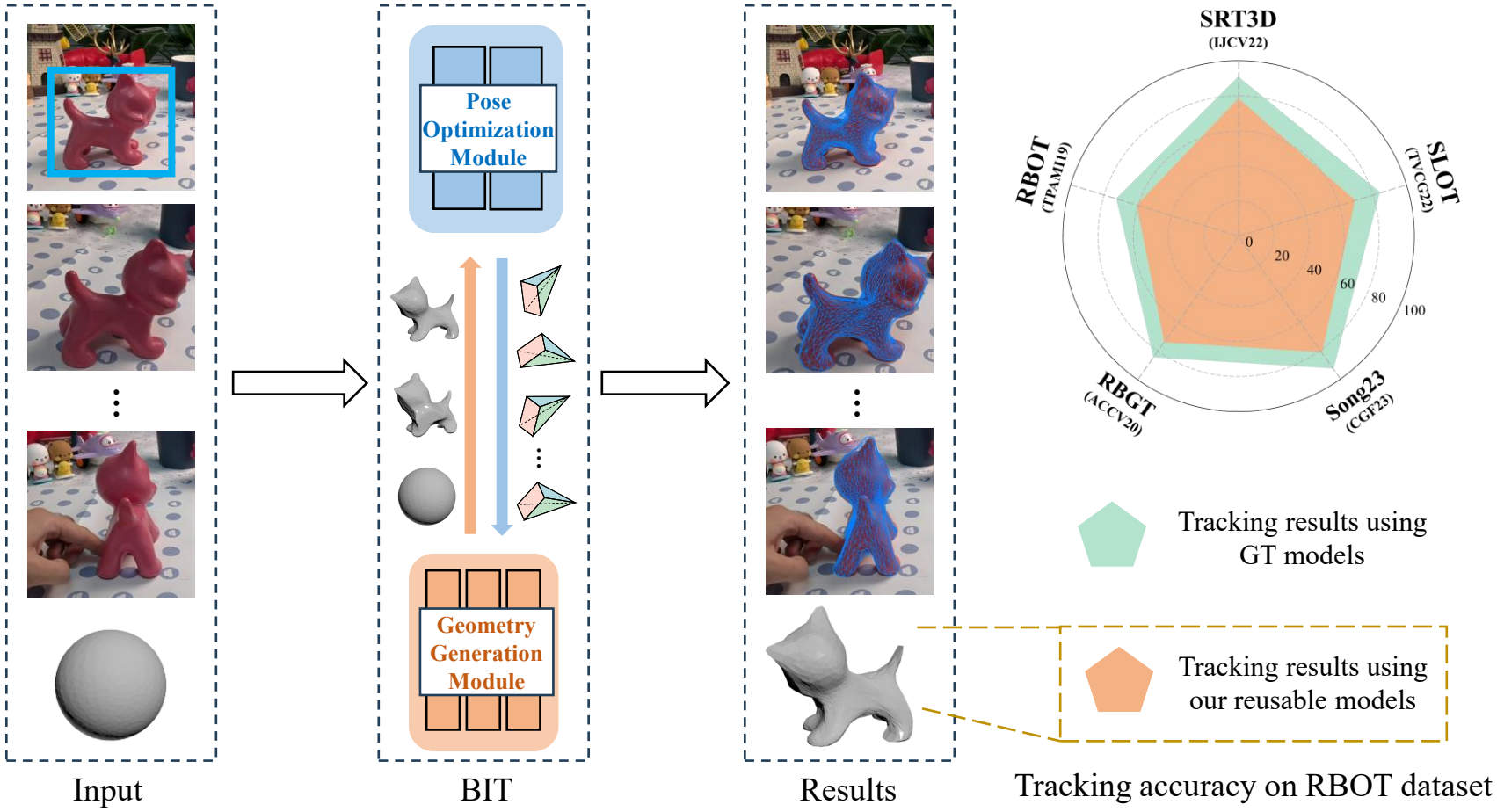
https://github.com/songxiuqiang/BIT.git

Introduction

Problem Dependence on pre-given model priors or training priors from annotated data limits the flexibility of 3D object tracking.

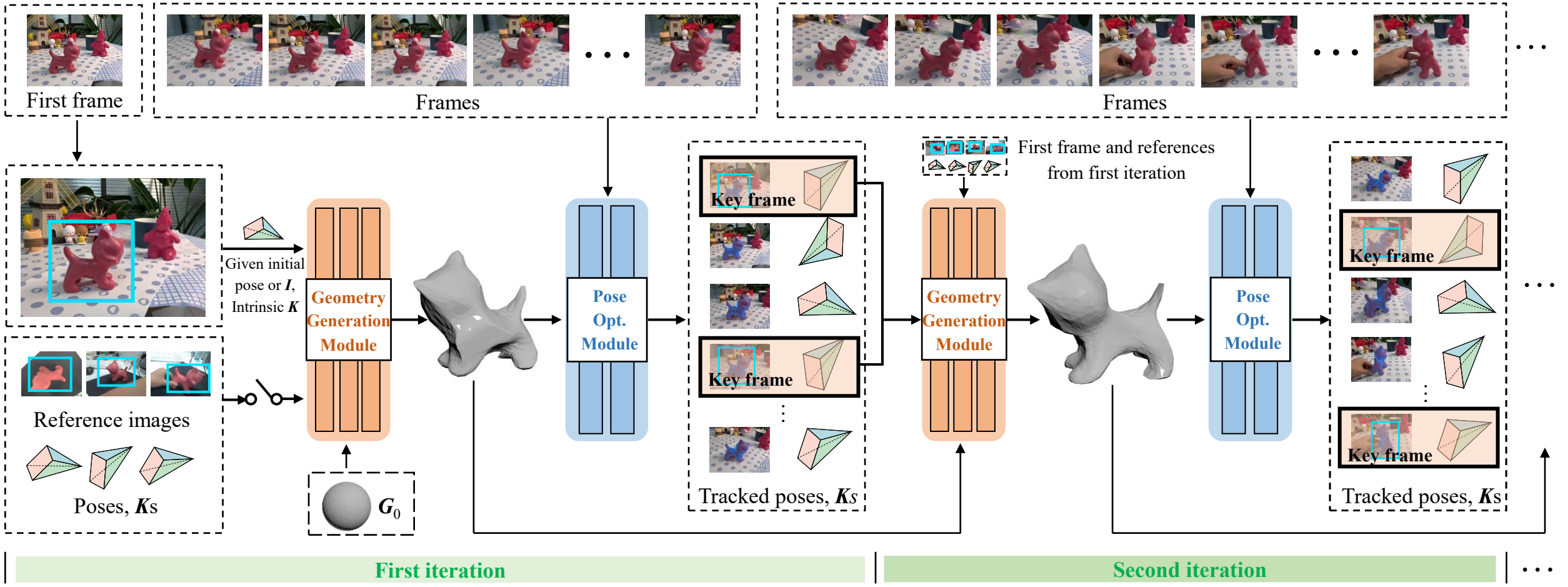
Key Idea Automatically generates necessary information for tracking in a prior-free manner.



We propose a prior-free tracking method called BIT that is both model-free and training-free.

Overview

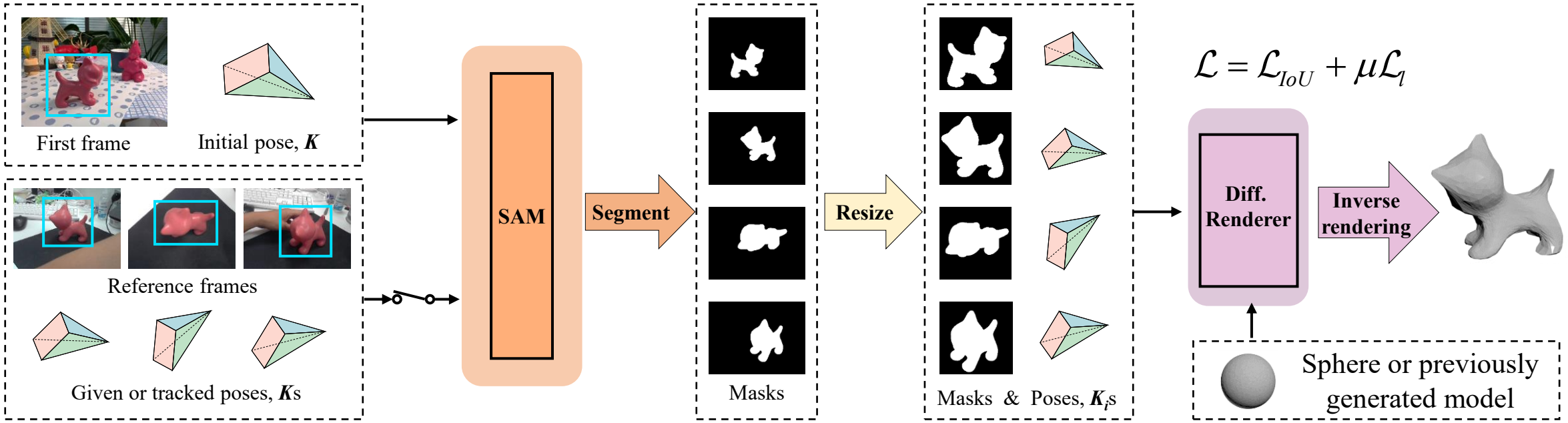
Overview



Overview of our method BIT.

Geometry Generation Module

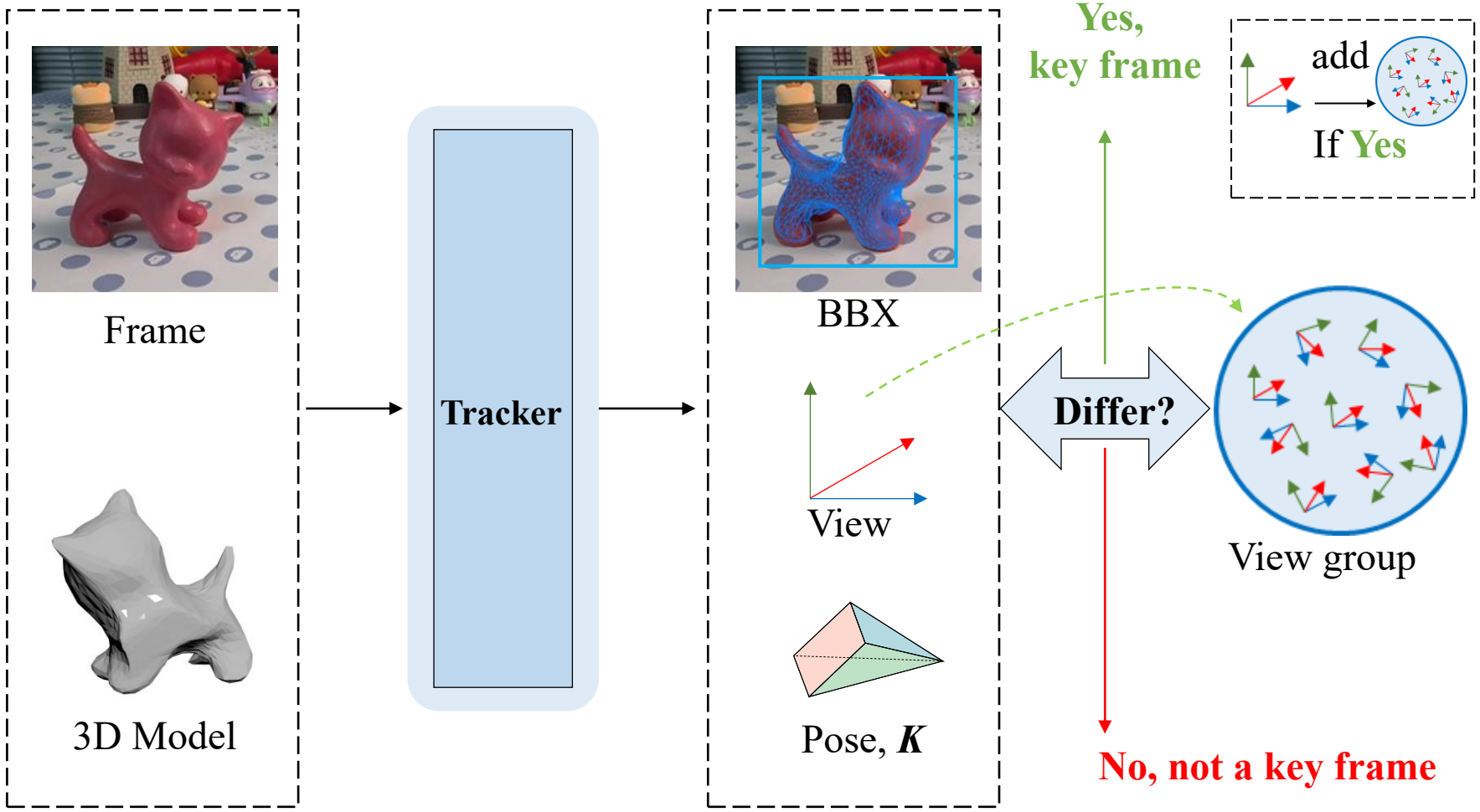
Geometry Generation Module



The geometry generation module.

Pose Optimization Module

Pose Optimization Module



The pose optimization module, which can track the object's pose and generate key frames for the geometry generation module.

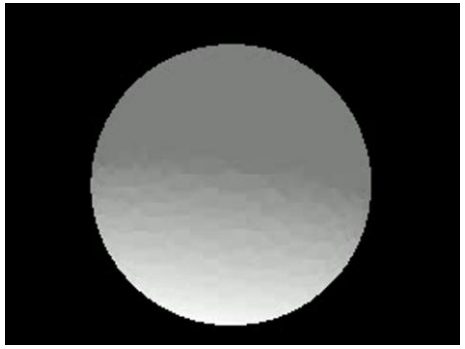
Experiments

Experiments on the MOPED Dataset

Equipment: Desktop computer with 12700 CPU and a single 3080 GPU (10GB VRAM)

Tracking results on the MOPED dataset under the ADD-AUC (0-10 cm, 0.1 cm step)

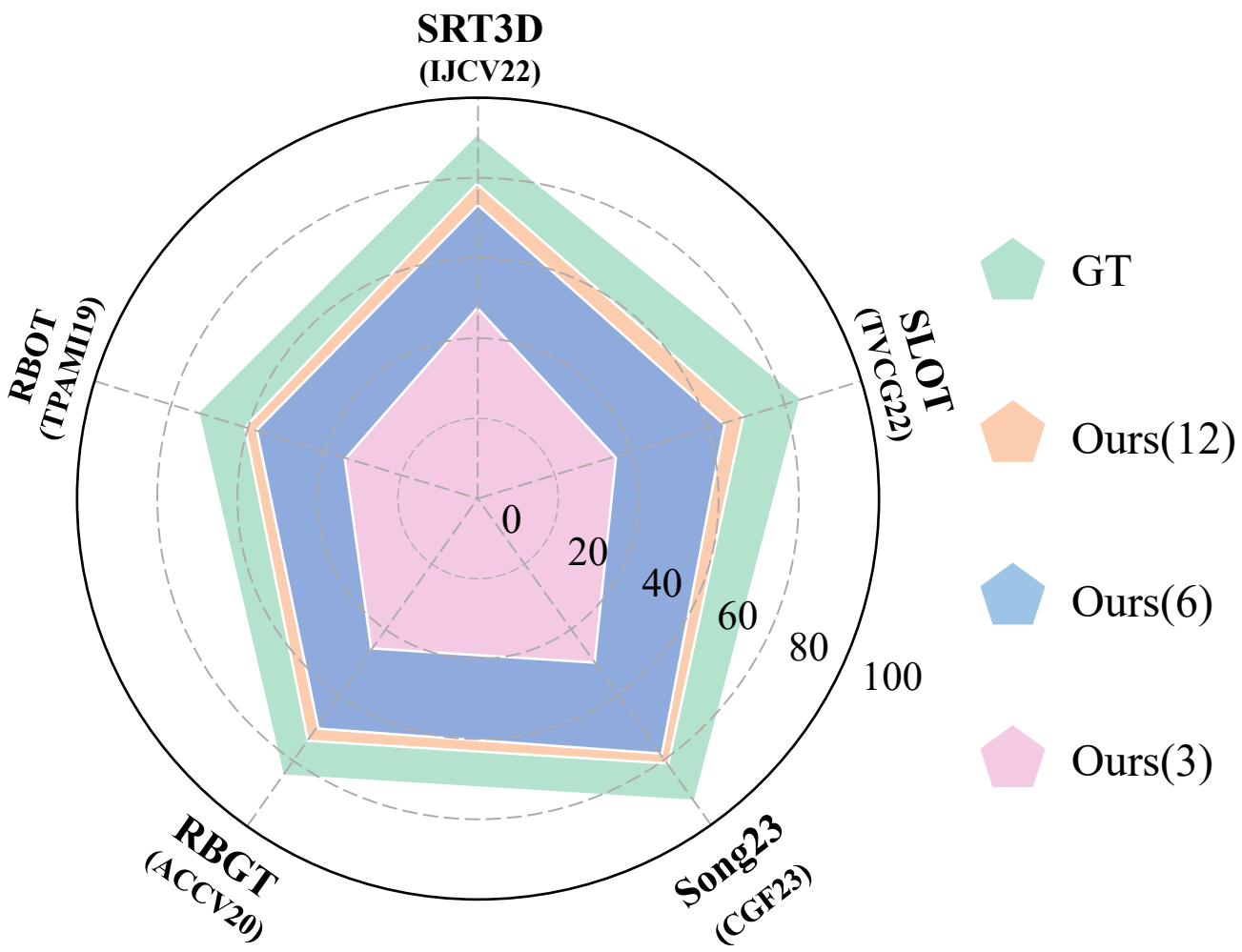
Method	Input	Training	Model	Refers	black_drill	duplo_dude	rinse_aid	toy_plane	vim_mug	Avg.↑
PoseRBPF [1]†	RGB-D*	✓	✓	✘	75.3	84.1	87.2	48.6	59.0	70.8
LatentFusion [13]†	RGB-D	✓	✘	✓	**89.4**	88.9	67.4	**82.9**	40.0	73.7
LatentFusion [13]‡	RGB-D	✓	✘	✓	74.1	75.4	63.0	55.0	38.3	61.1
PVNet [14]‡	RGB	✓	✓	✘	49.5	43.3	72.9	48.6	67.9	56.4
Gen6D [9]‡	RGB	✓	✘	✓	64.9	59.2	72.0	69.8	51.0	63.4
Ours(0)	RGB	✘	✘	✘	63.1	69.7	80.5	76.2	81.4	74.2
Ours(3)	RGB	✘	✘	✓	82.9	**89.9**	**88.3**	81.7	**88.4**	**86.2**

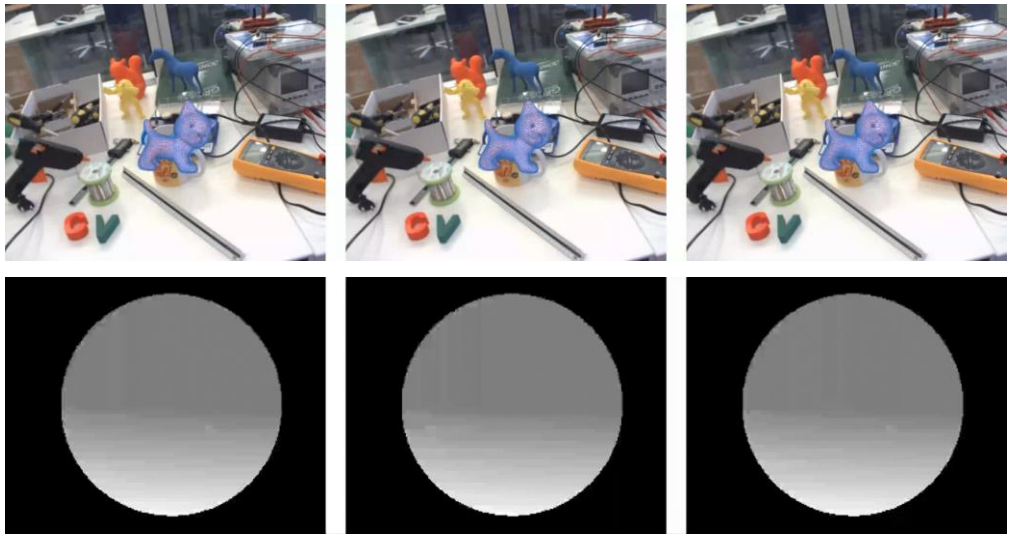
No reference frames

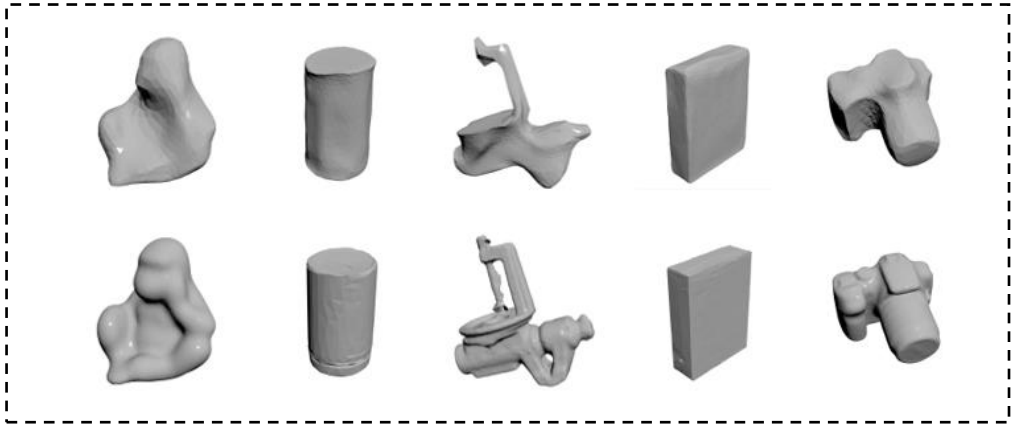

Given 3 reference frames

Experiments on the RBOT Dataset



Tracking accuracy (5 cm / 5°)of various trackers on the RBOT dataset using GT models and our generated models.





The generated (first row) models and the GT models (second row)

Experiments on the Read-world Scenes


No reference frames


Given 6 reference frames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Thanks!