

Robotics, Artificial Intelligence
and Embedded Systems



3D Object Detection based on Object Relation

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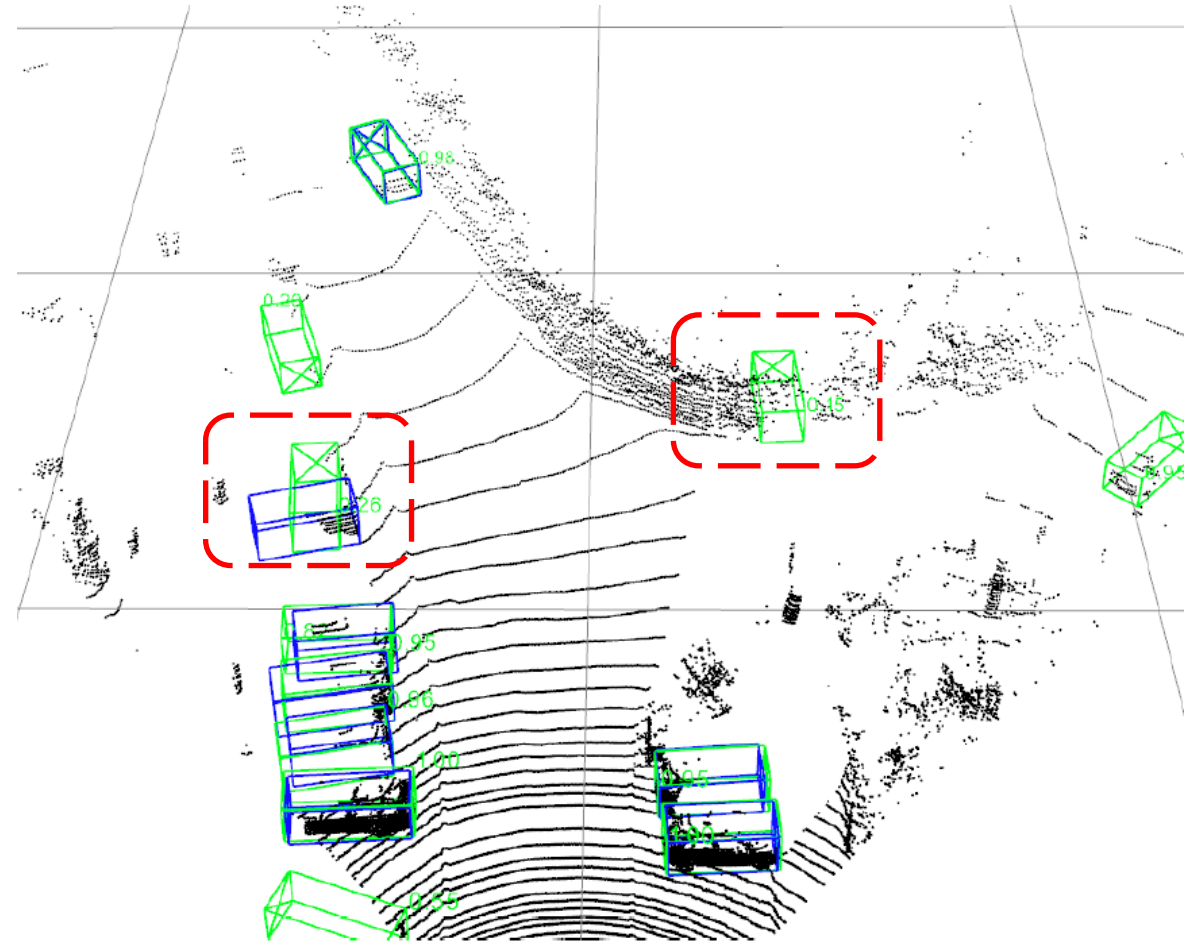
Motivations and Hypothesis

Limitations of current detectors:

Occlusions & Sparse Point Cloud

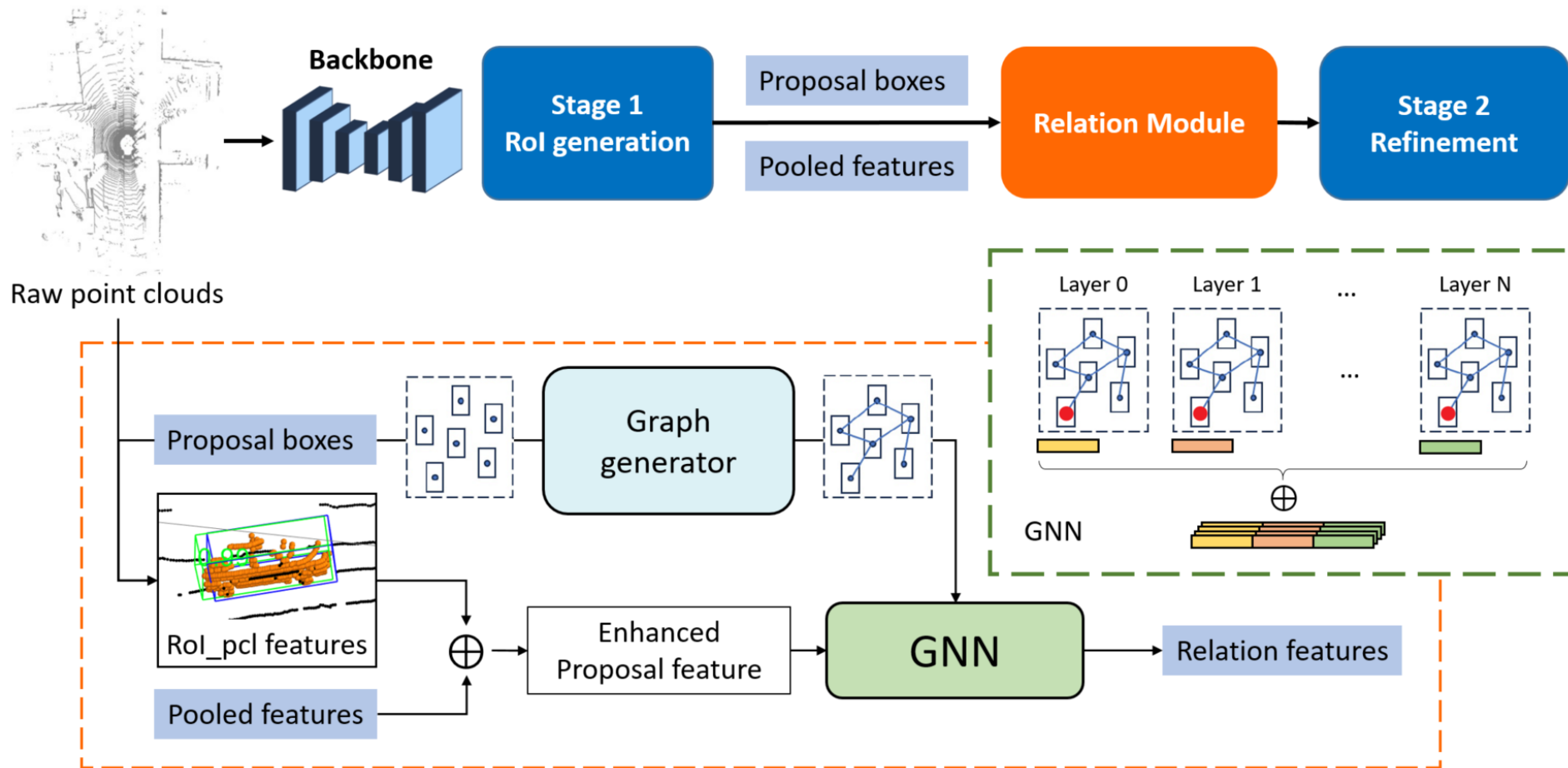
-> Wrong orientation

-> False positives



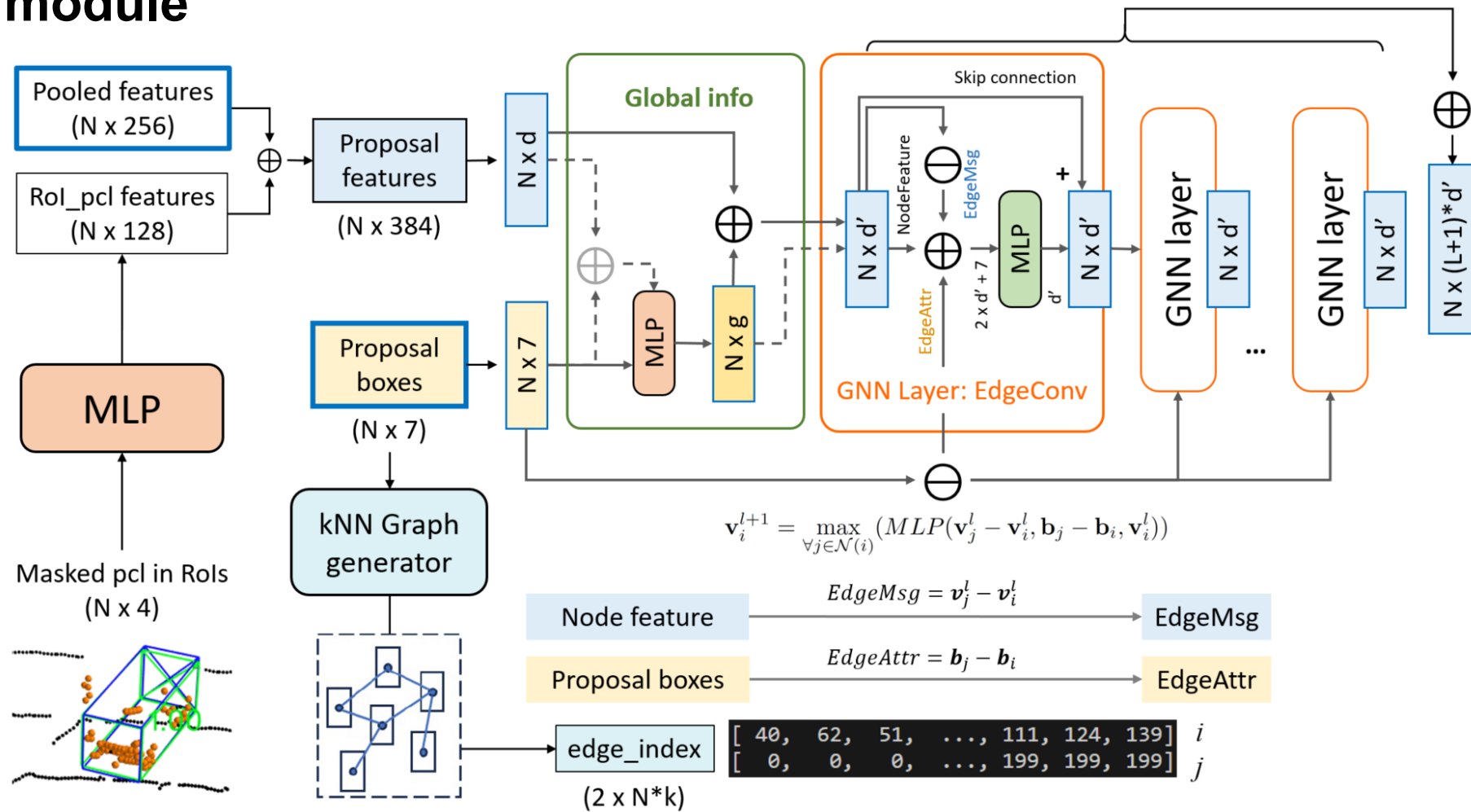
Ours Pipeline

Two-stage detector extended with inter-object relation module

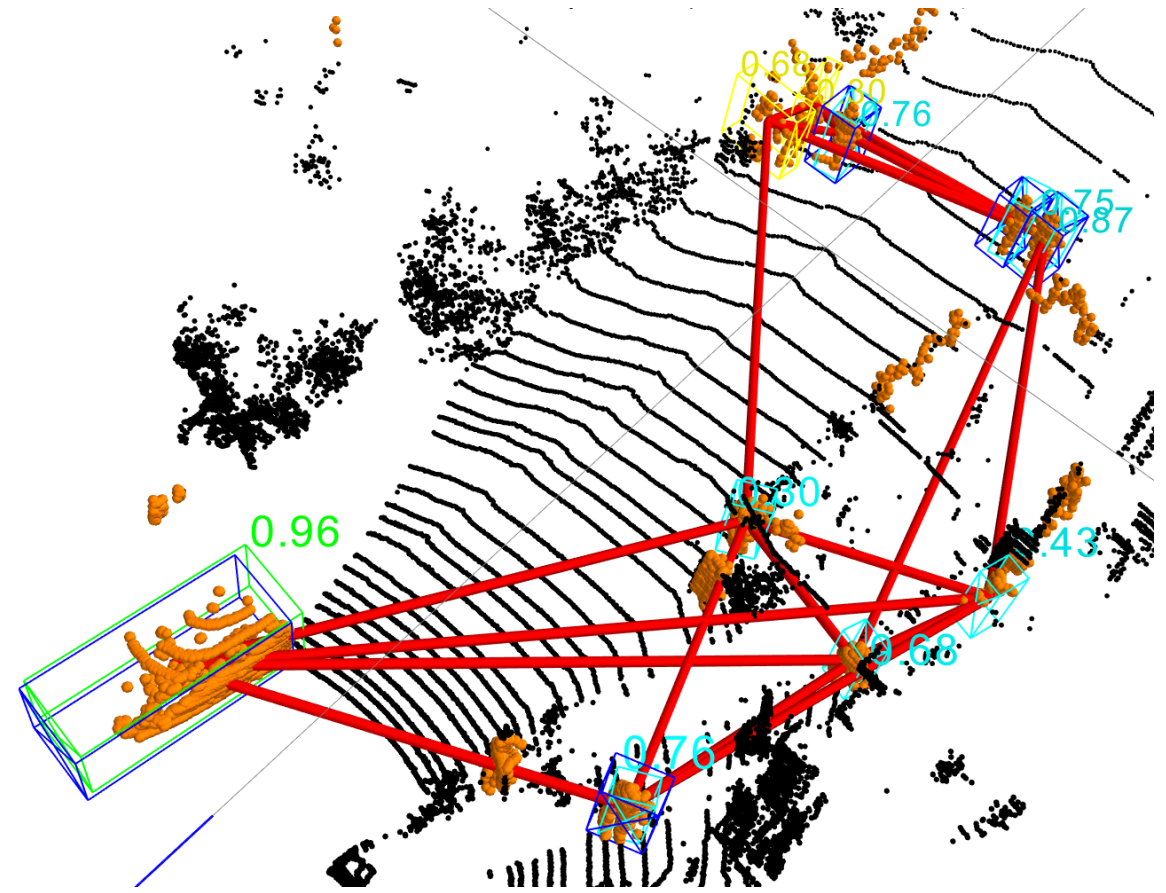
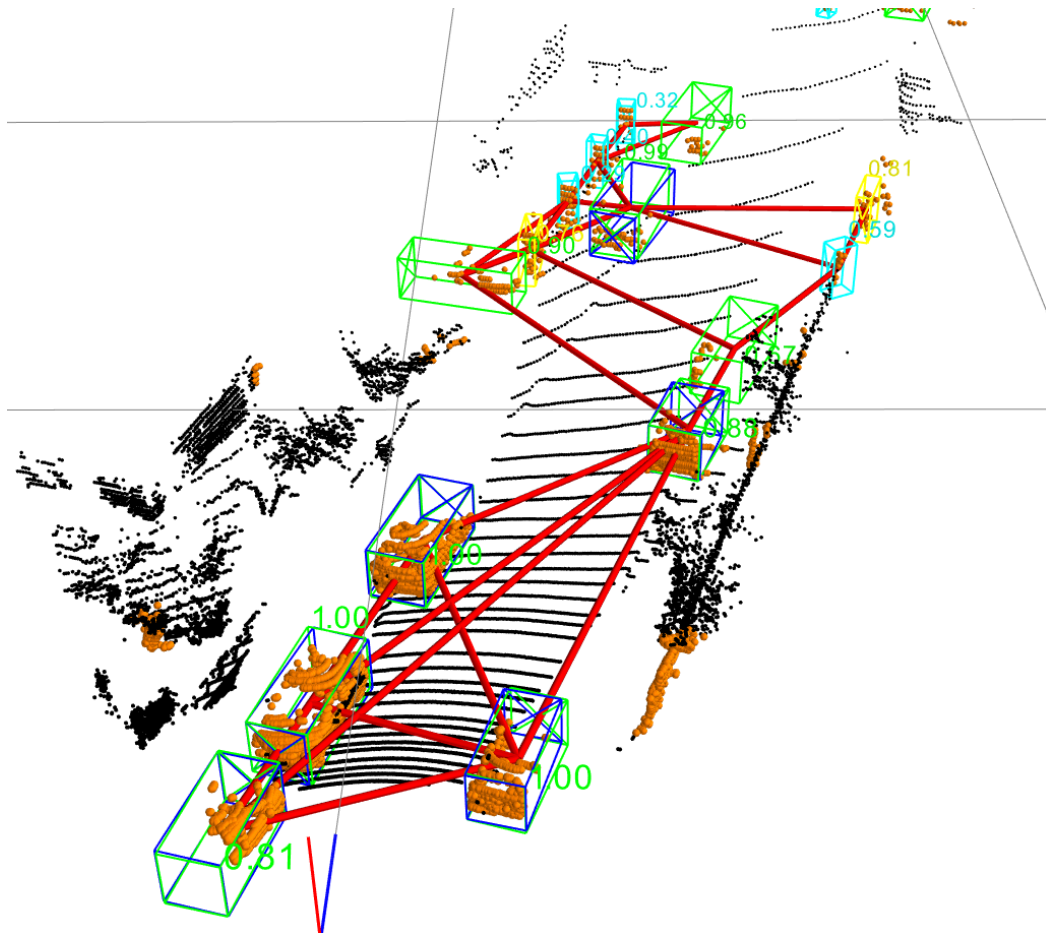


Ours Pipeline

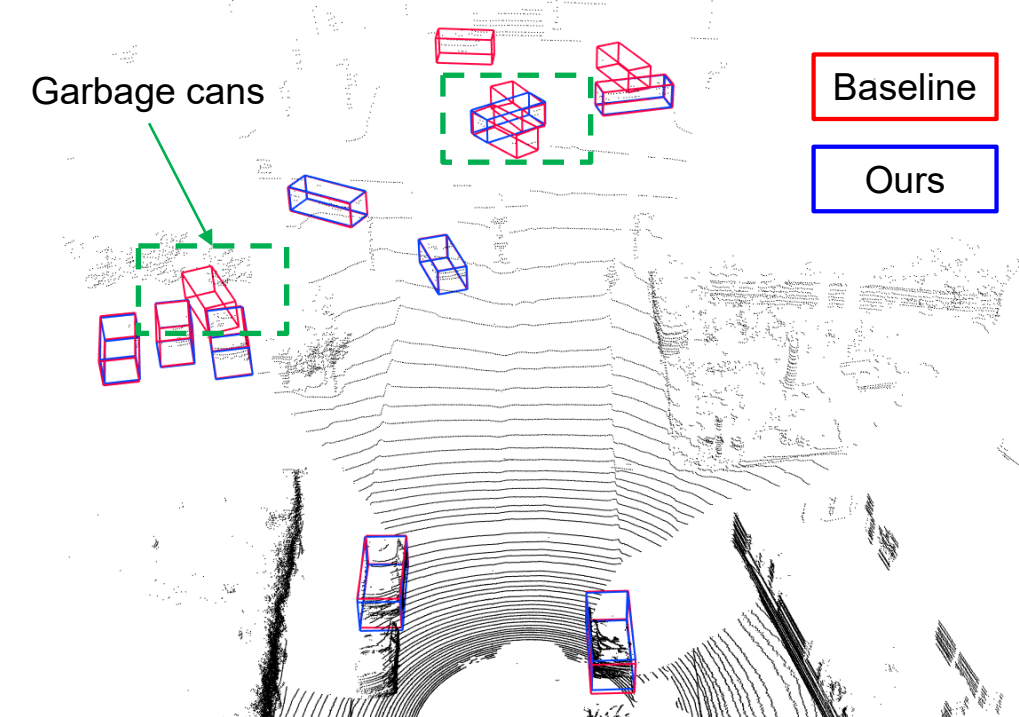
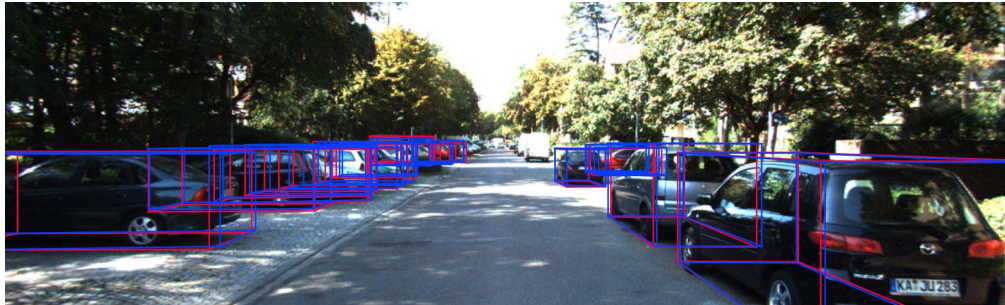
Relation module



Inspections within proposal boxes (Rols)



Qualitative Results



Quantitative Results - KITTI

- PVRCNN vs. PVRCNN-Relation trained and evaluated on KITTI for All classes

Method	Car 3D AP (%) ↑			Car BEV AP (%) ↑		
	Easy	Moderate	Hard	Easy	Moderate	Hard
PV-RCNN	91.87	84.53	82.41	94.58	91	88.51
PV-RCNN Relation (ours)	92.45	85.36	83	95.54	91.57	89.26
Improvement	+0.58	+0.83	+0.59	+0.96	+0.57	+0.75
Method	Cyclist 3D AP (%) ↑			Cyclist BEV AP (%) ↑		
	Easy	Moderate	Hard	Easy	Moderate	Hard
PV-RCNN	89.95	70.81	66.37	91.26	73.94	69.53
PV-RCNN Relation (ours)	91.52	71.13	66.59	93.50	74.55	69.81
Improvement	+1.57	+0.32	+0.22	+2.24	+0.61	+0.28
Method	Pedestrian 3D AP (%) ↑			Pedestrian BEV AP (%) ↑		
	Easy	Moderate	Hard	Easy	Moderate	Hard
PV-RCNN	65.38	57.99	53.17	68.47	61.37	56.51
PV-RCNN Relation (ours)	65.93	58.13	51.81	68.59	60.60	55.17
Improvement	+0.55	+0.14	-1.36	+0.12	-0.77	-1.34