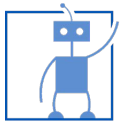

Robotics, Artificial Intelligence
and Embedded Systems

3D Object Detection based on Object Relation

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Automotive Engineering
School of Engineering and Design

Munich, 15. February 2024

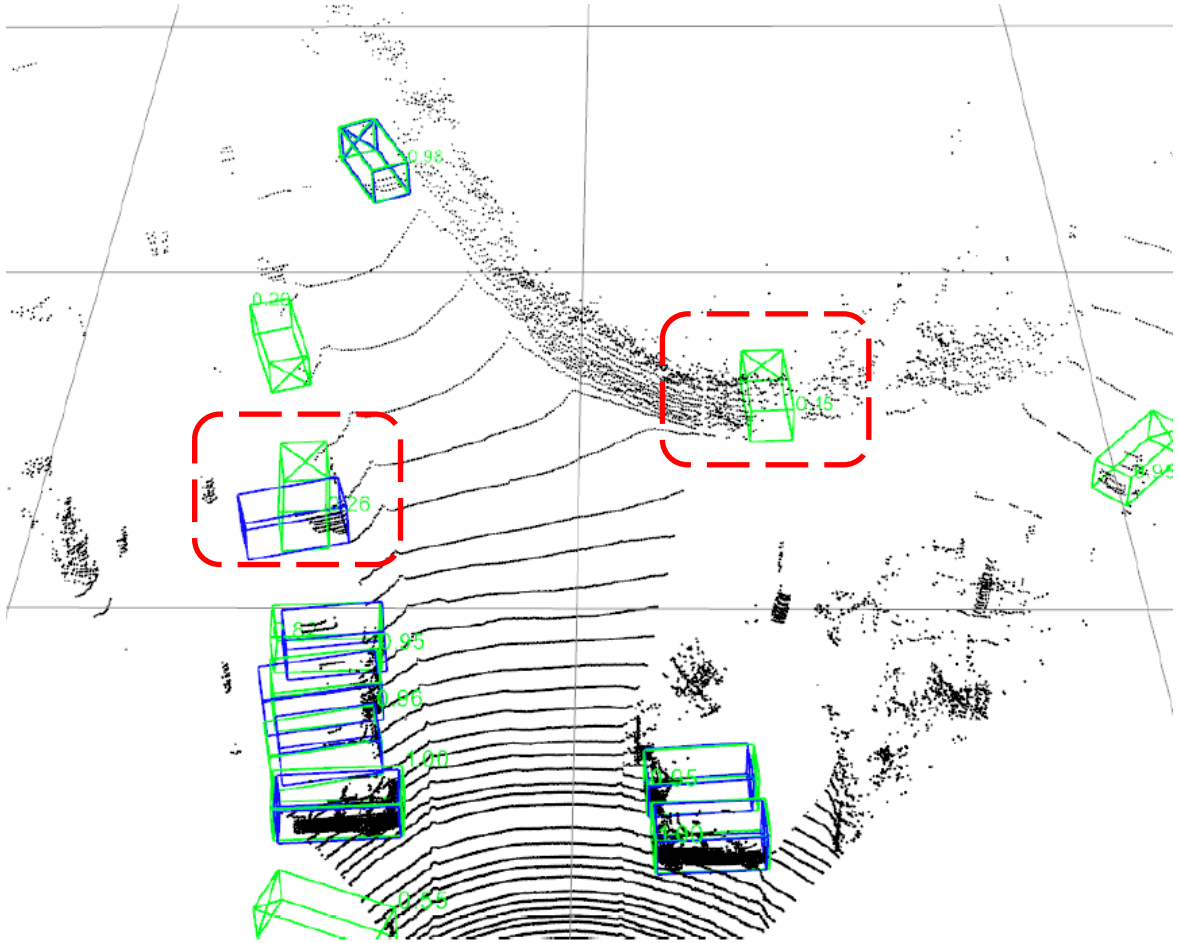
Motivations and Hypothesis

Limitations of current detectors:

Occlusions & Sparse Point Cloud

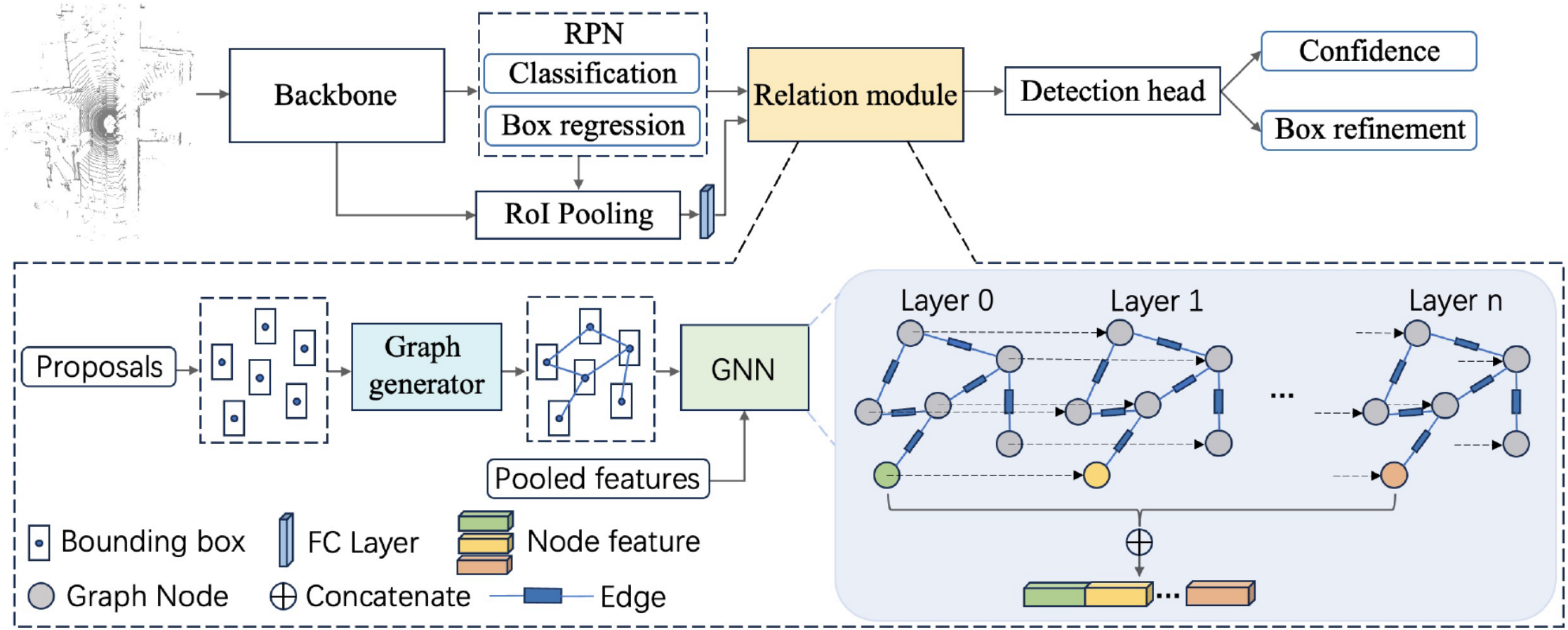
-> Wrong orientation

-> False positives

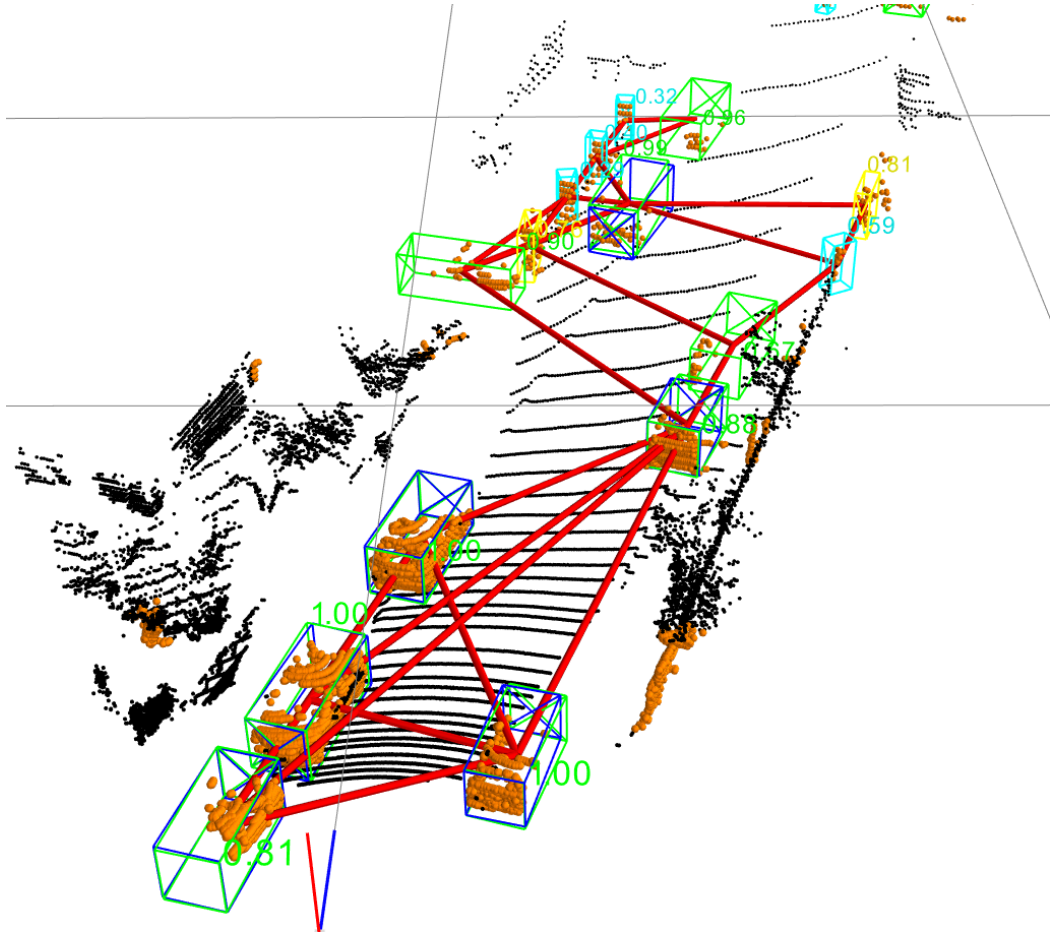


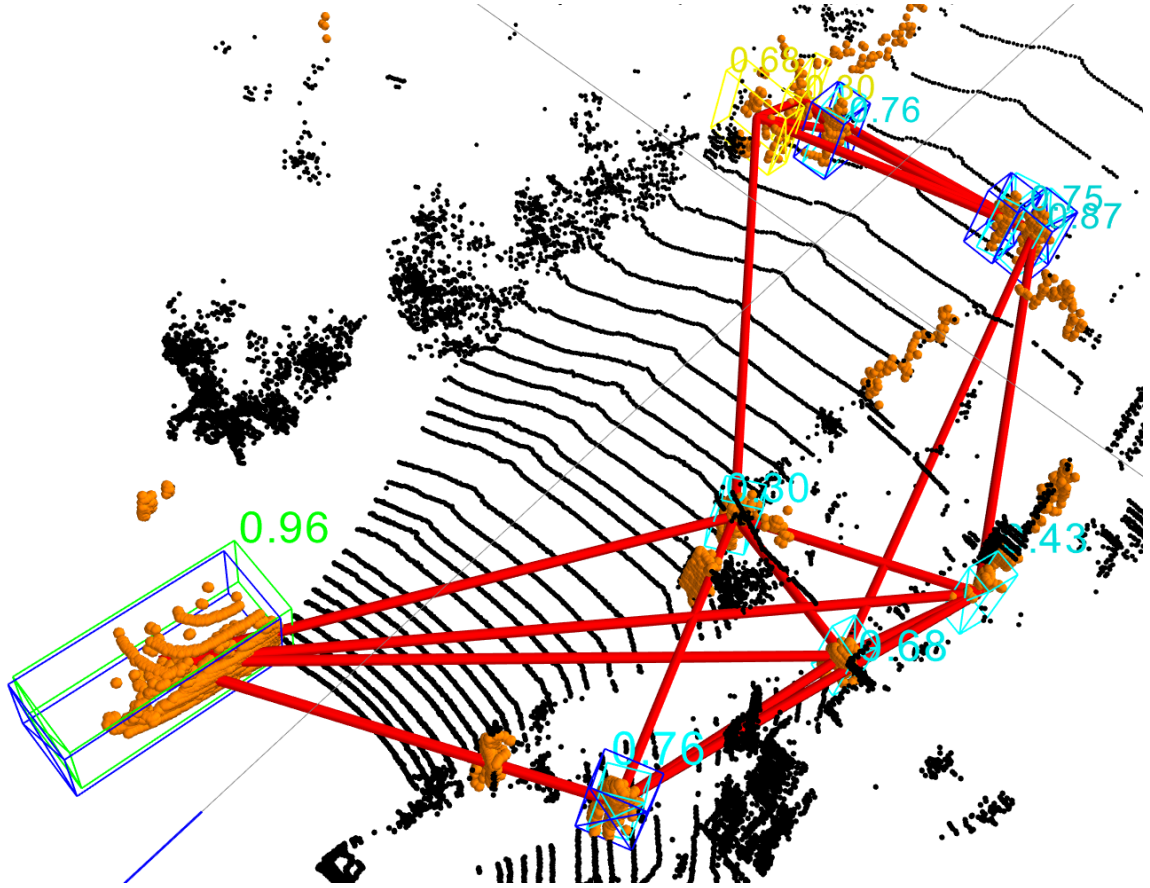
Ours Pipeline

Two-stage detector extended with inter-object relation module

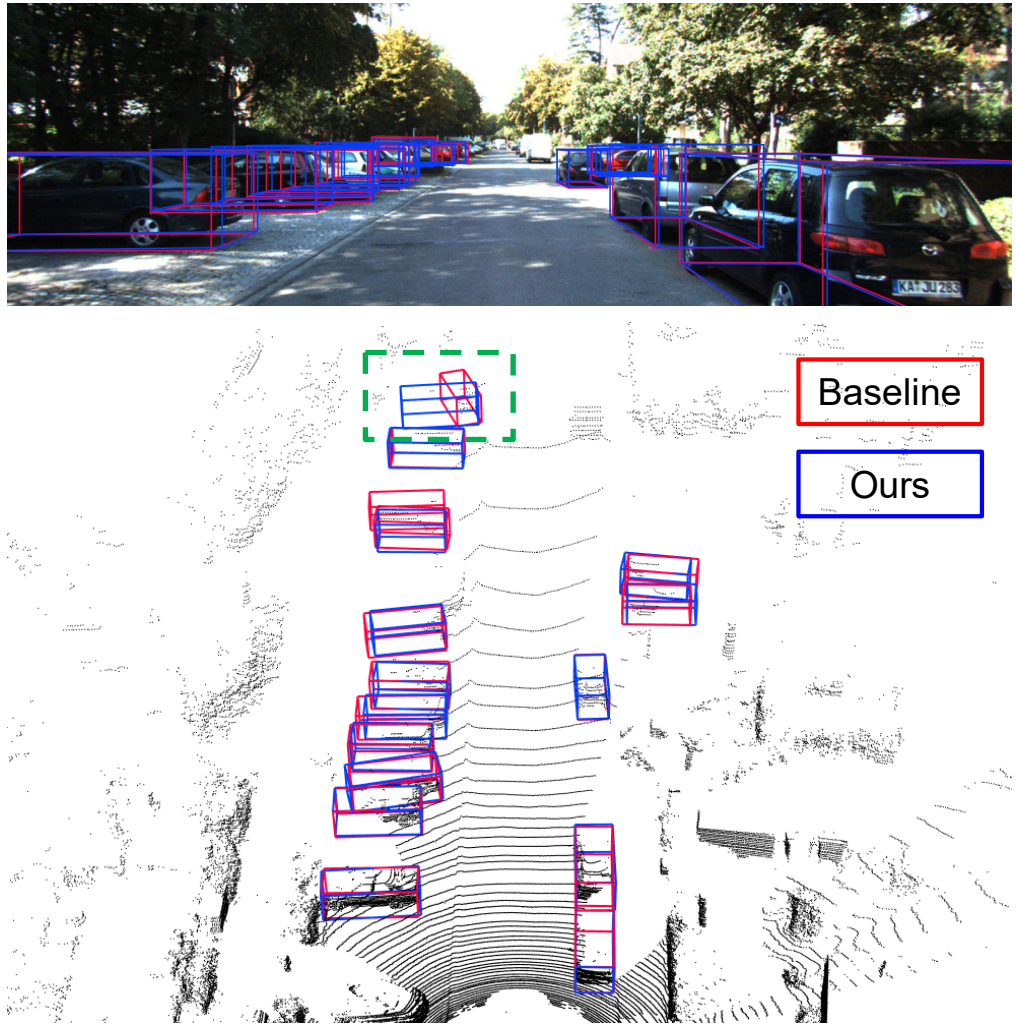


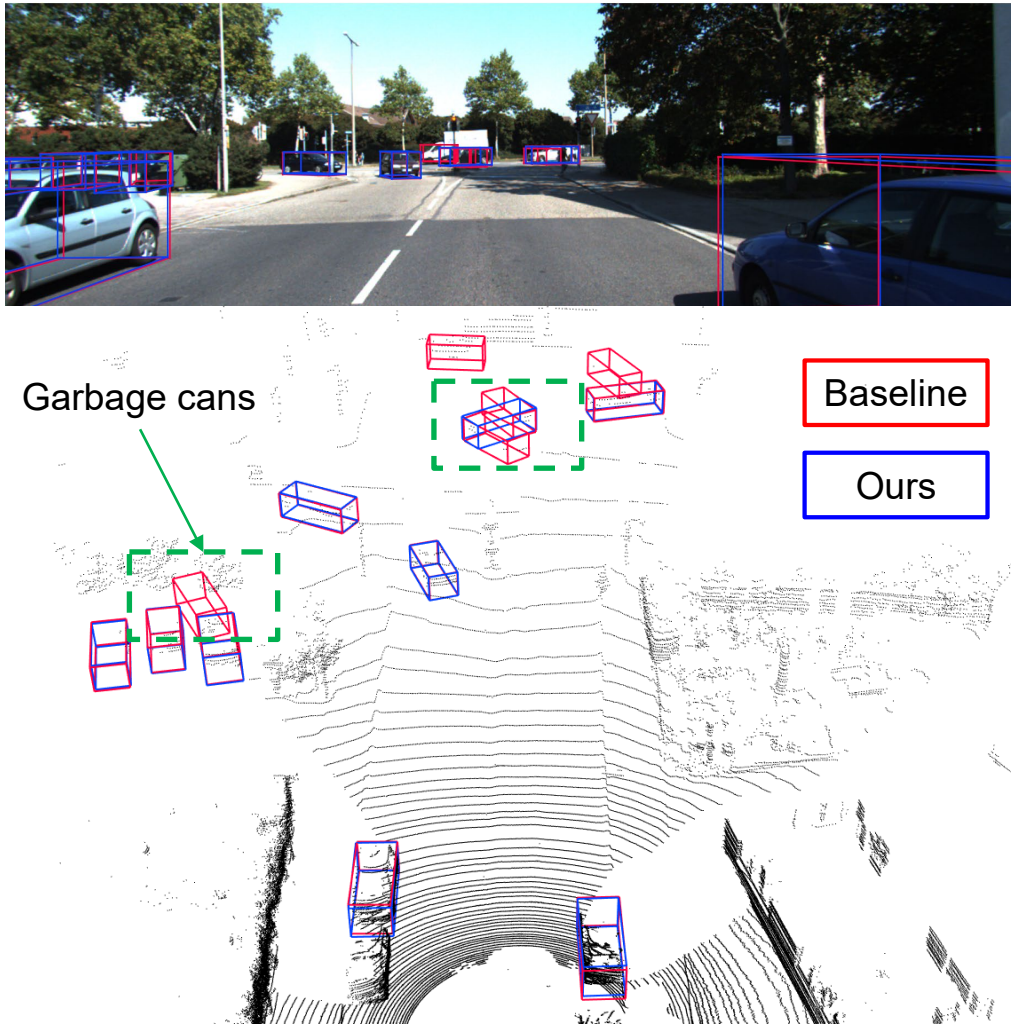
Inspections within proposal boxes (RoIs)





Qualitative Results





Quantitative Results - KITTI

- PVRCNN vs. PVRCNN-Relation trained and evaluated on KITTI for <u>All classes</u>

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
	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
	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