BUOL: A **B**ottom-**U**p Framework with **O**ccupancy-aware **L**ifting for Panoptic 3D Scene Reconstruction From A Single Image

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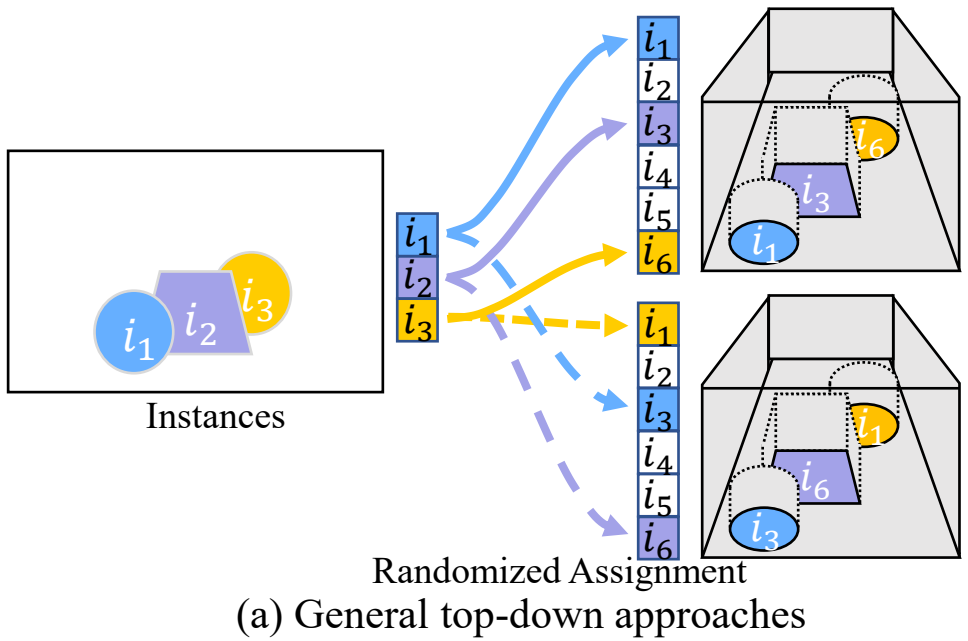
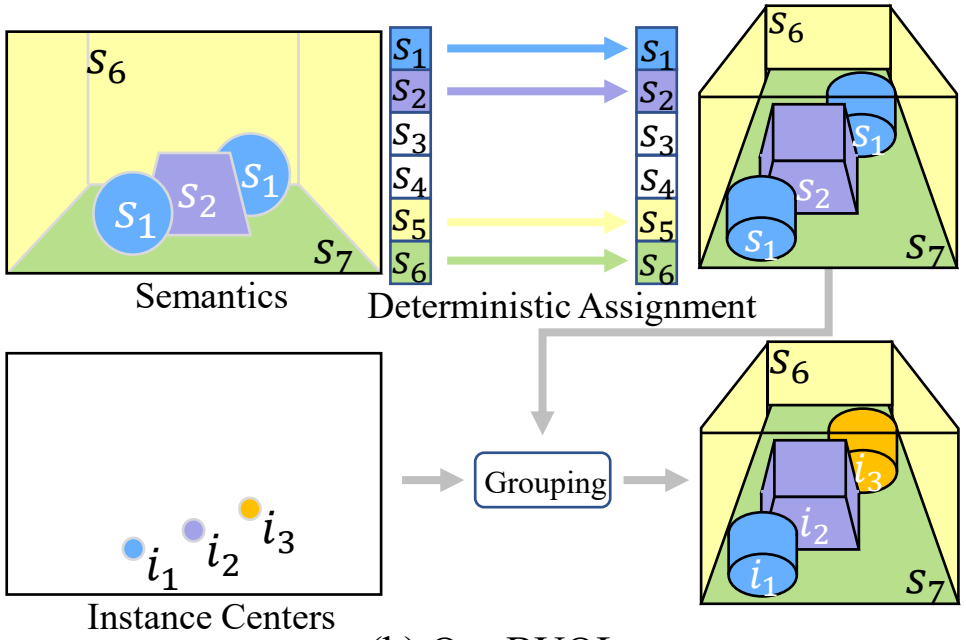
Introduction

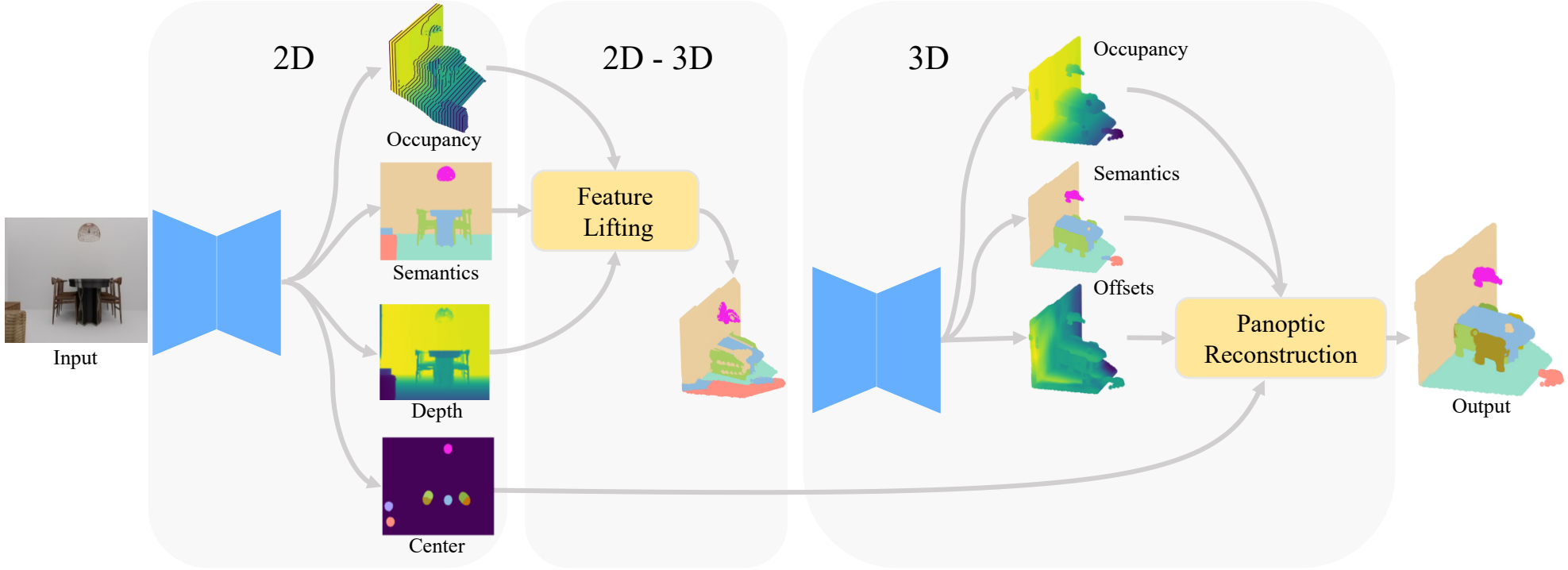


(a) General top-down approaches

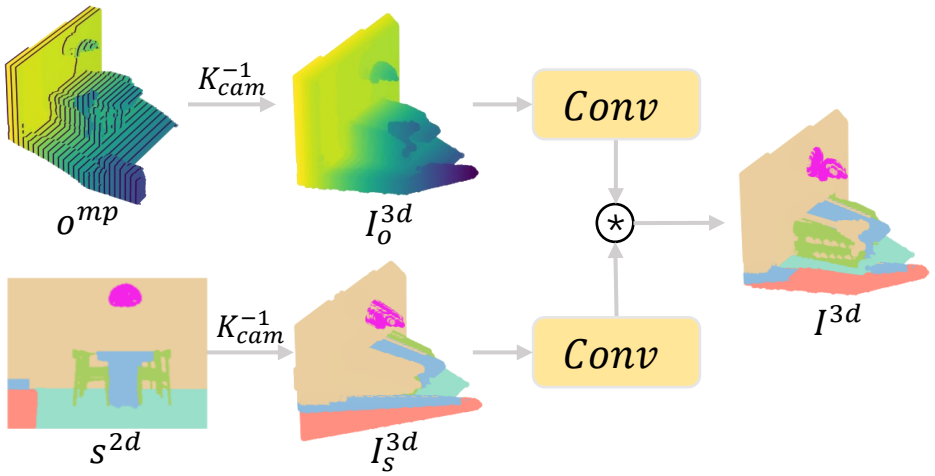


(b) Our BUOL

Framework


2D
2D - 3D
3D
Input
Occupancy
Semantics
Depth
Center
Feature Lifting
Occupancy
Semantics
Offsets
Panoptic Reconstruction
Output

Occupancy-aware Lifting

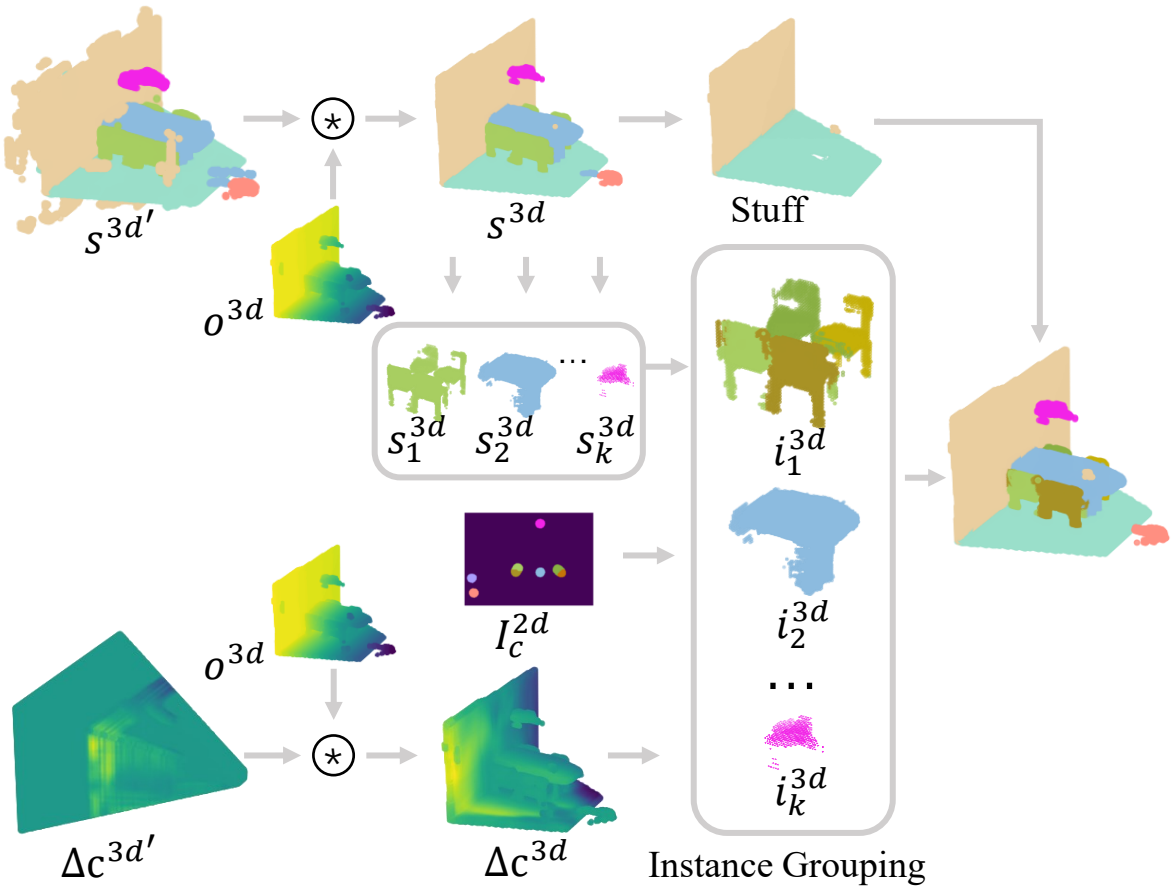


$$I_s^{3d}(u,v,z) = \begin{cases} s^{2d}(K_{cam}^{-1}[u,v,1]), & \text{if } z \geq d(u,v) \\ 0, & \text{otherwise} \end{cases}$$

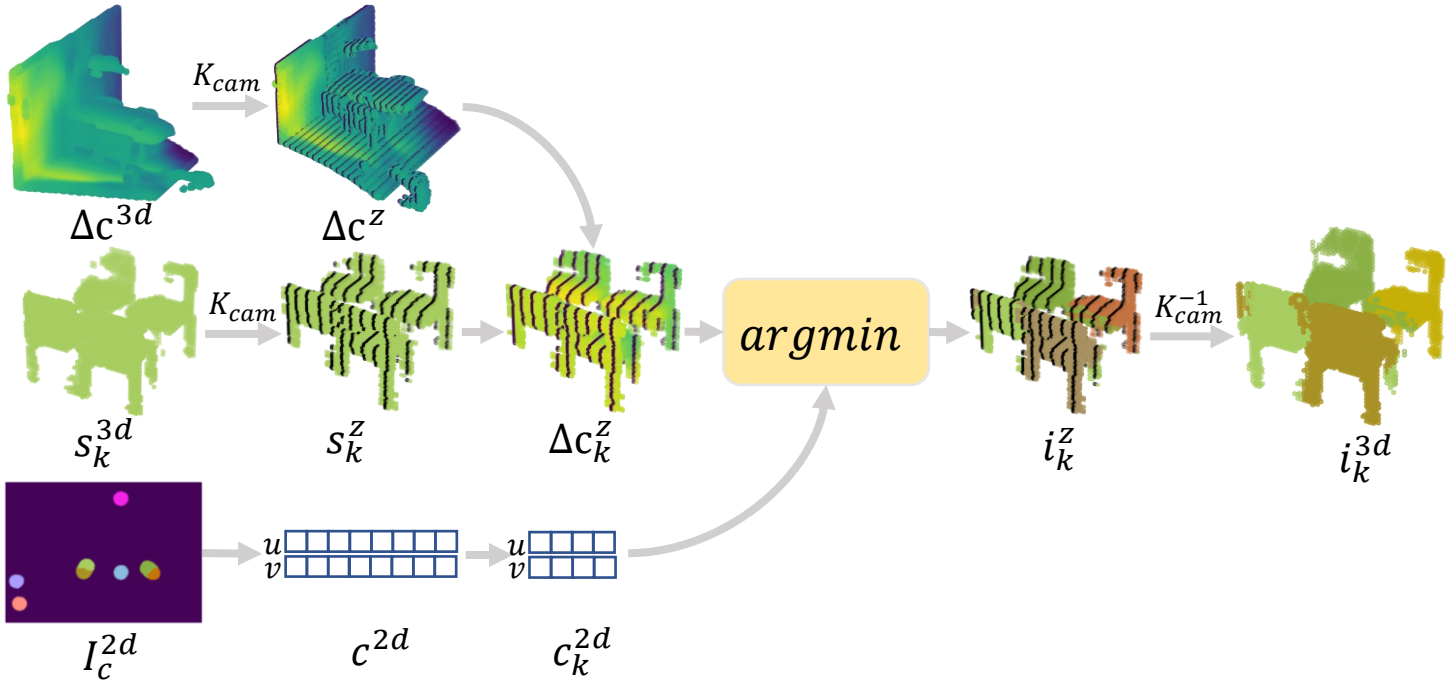
$$I_o^{3d}(u,v,z) = \begin{cases} o^{mp}(K_{cam}^{-1}[u,v,z]), & \text{if } z \geq d(u,v) \\ 0, & \text{otherwise} \end{cases}$$

$$I^{3d} = Conv(I_s^{3d}) * Conv(I_o^{3d})$$

Bottom-Up Panoptic Reconstruction



Instance Grouping

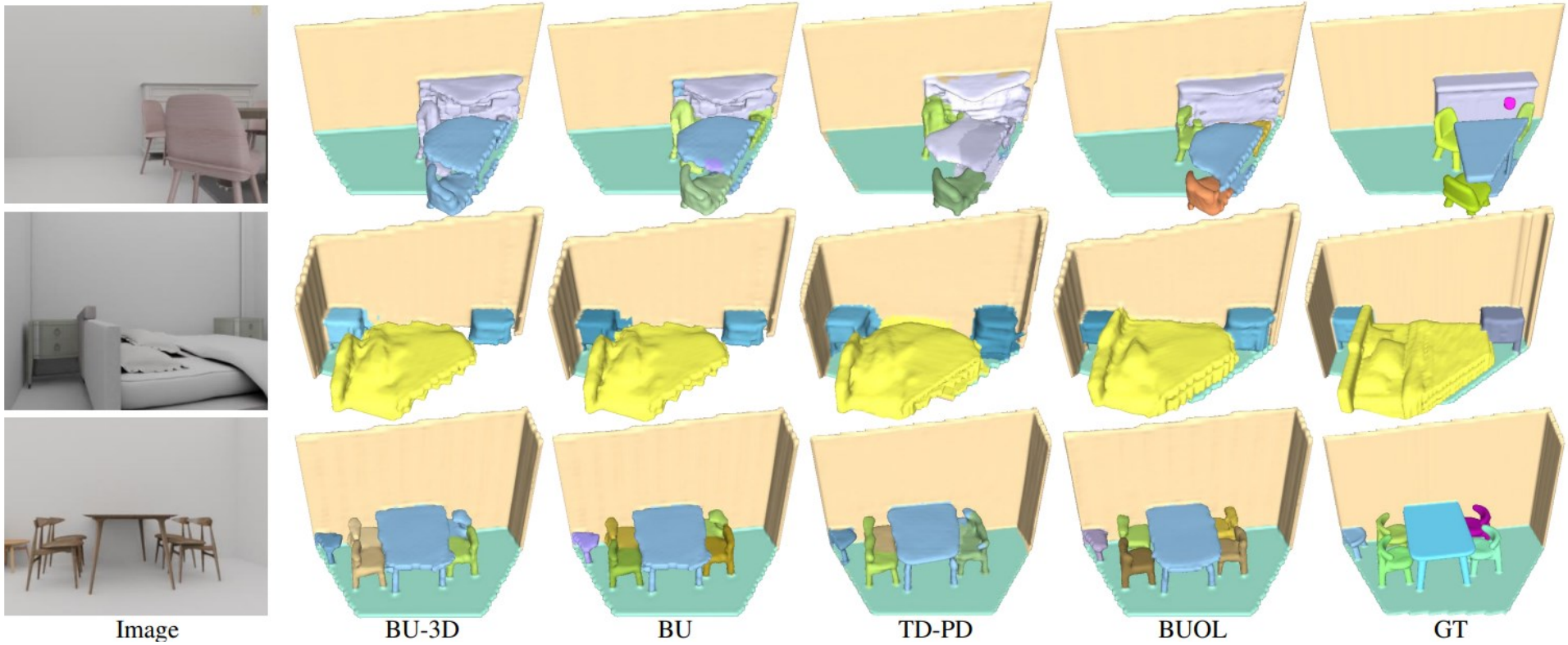


$$i_k^z(u,v) = argmin_{k_j} \| c_{k_j}^{2d} - (u + \triangle c_k^z(u,v)_u, v + \triangle c_k^z(u,v)_v) \|$$

Experiments: 3D FRONT

Method	PRQ	RSQ	RRQ	PRQ_{th}	RSQ_{th}	RRQ_{th}	PRQ_{st}	RSQ_{st}	RRQ_{st}
SSCNet [31]+IC	11.50	32.90	33.00	8.03	32.07	24.69	26.95	36.75	70.25
Mesh R-CNN [11]	-	-	-	20.90	38.00	53.20	-	-	-
Total3D [28]	15.08	36.63	40.15	13.77	34.88	38.89	20.94	44.49	45.85
Dahnert et al. [6]*	42.20	55.59	73.19	36.51	51.47	69.21	67.78	74.15	91.09
Dahnert et al. [6]*+PD	47.46	60.48	76.09	42.25	56.90	72.45	70.94	76.59	92.45
Our BUOL	**54.01**	**63.81**	**82.99**	**49.73**	**60.57**	**80.67**	**73.30**	**78.37**	**93.42**

Experiments: 3D FRONT

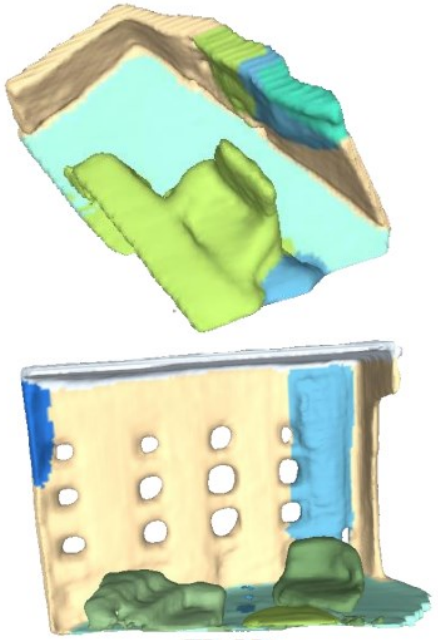


Experiments: Matterport3D

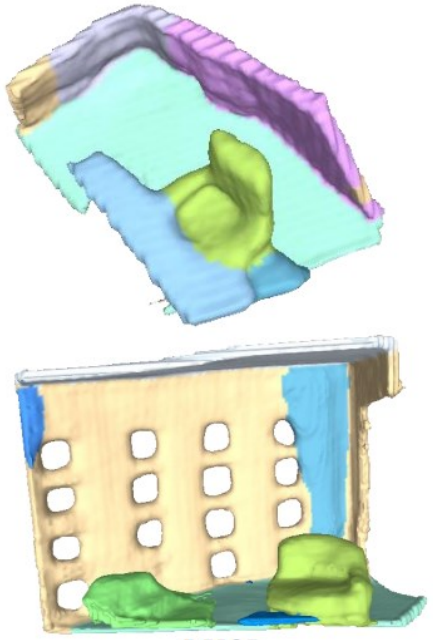
Method	PRQ	RSQ	RRQ	PRQ_{th}	RSQ_{th}	RRQ_{th}	PRQ_{st}	RSQ_{st}	RRQ_{st}
SSCNet [31]+IC	0.49	21.68	1.50	0.19	22.75	0.59	1.43	20.43	4.43
Mesh R-CNN [11]	-	-	-	6.29	31.12	15.60	-	-	-
Dahnert et al. [6]	7.01	28.57	17.65	6.34	26.06	16.06	10.78	40.03	26.77
Dahnert et al. [6]*+PD	10.08	36.04	22.53	7.33	33.23	16.68	18.33	44.47	40.07
Our BUOL	**14.47**	**45.71**	**30.91**	**10.97**	**45.30**	**23.81**	**24.94**	**46.93**	**52.22**

Experiments: Matterport3D

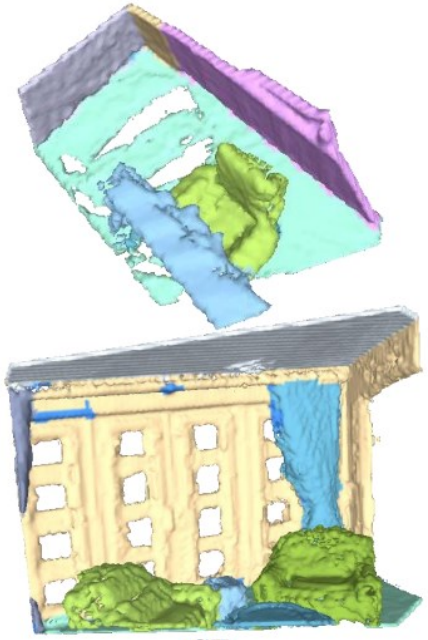
Image



TD-PD



BUOL



GT

Thank you for listening!

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