

STRUCTURED INDOOR MODELING

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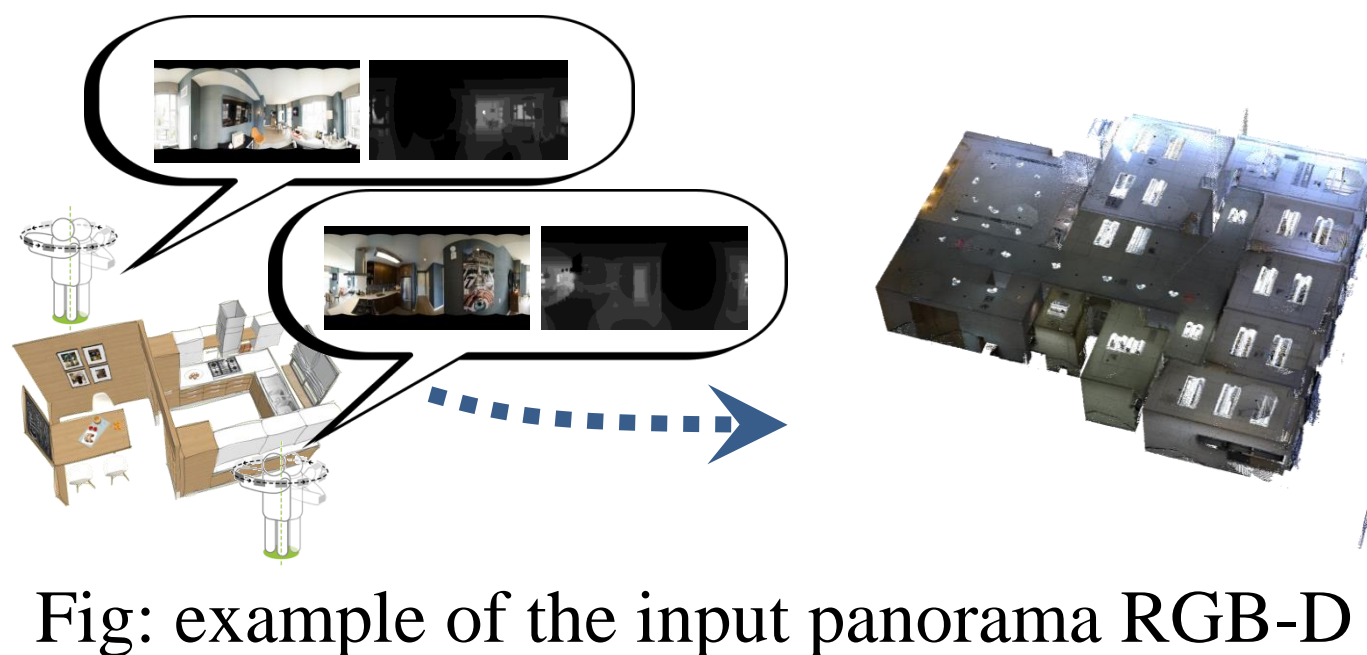
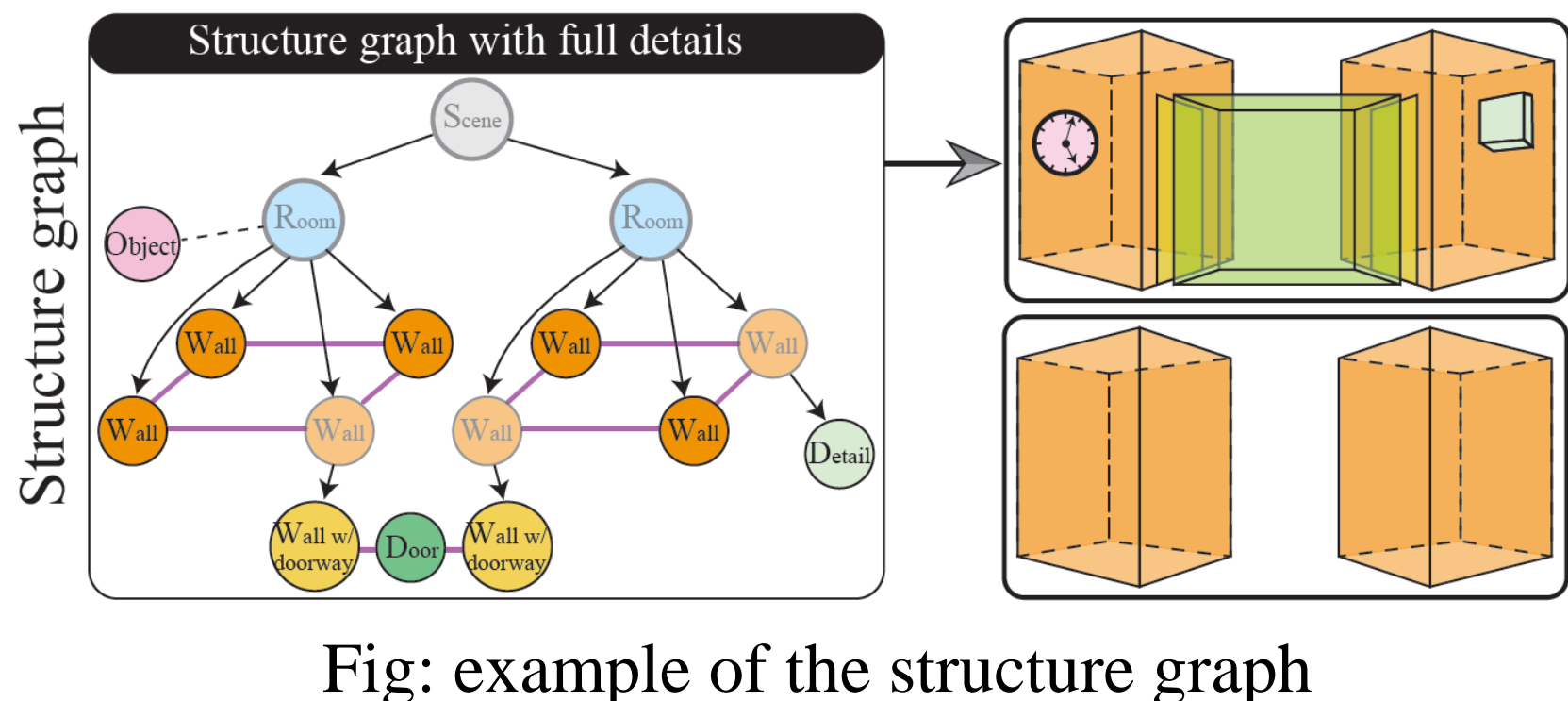
SUMMARY

Problems?

- Existing indoor 3-D models **have no semantics** constituting indoor scenes such as rooms and walls
- Existing indoor 3-D models are a **polygonal soup** that is hard to edit afterwards

Contributions?

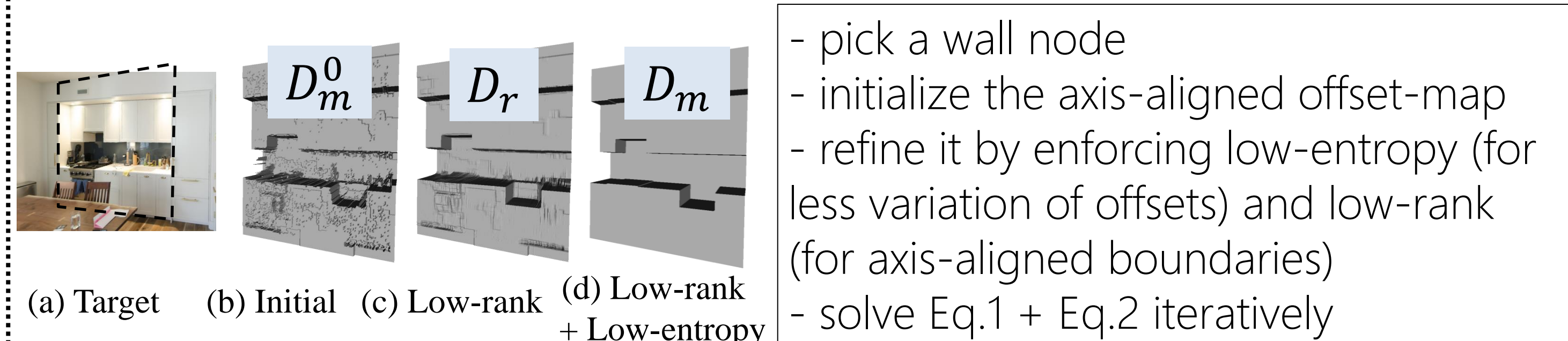
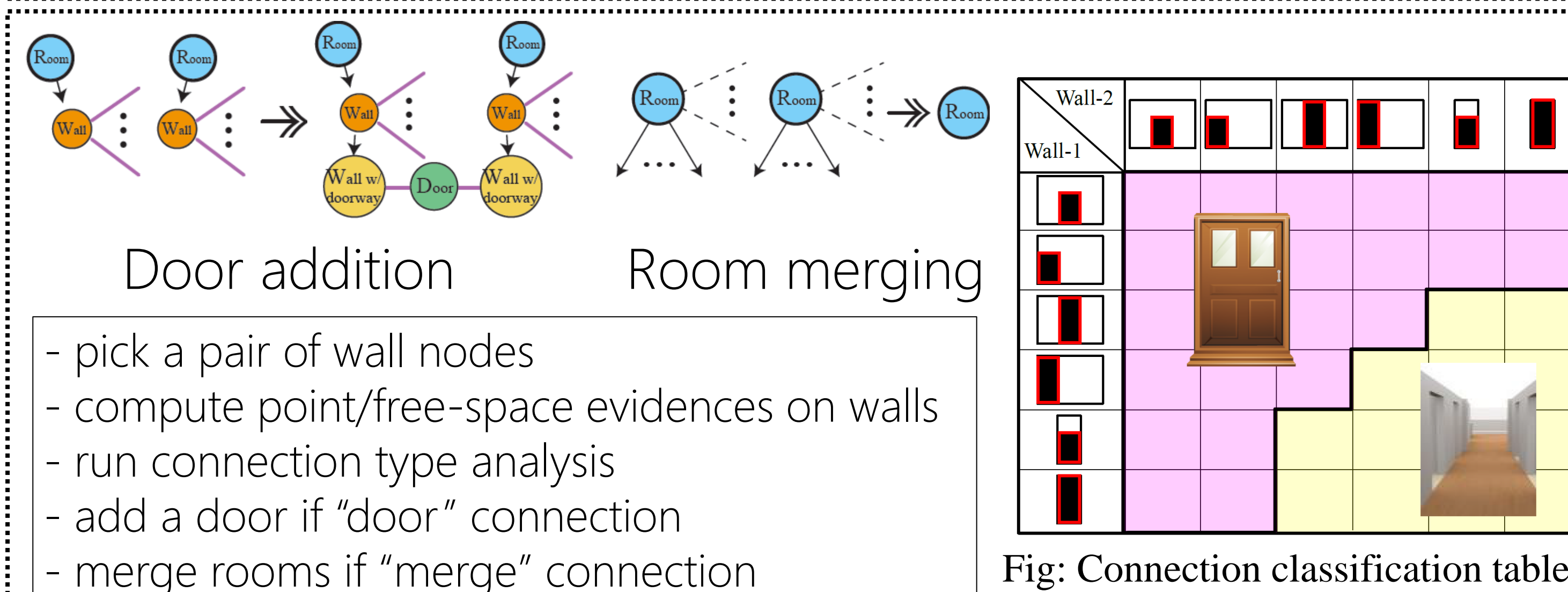
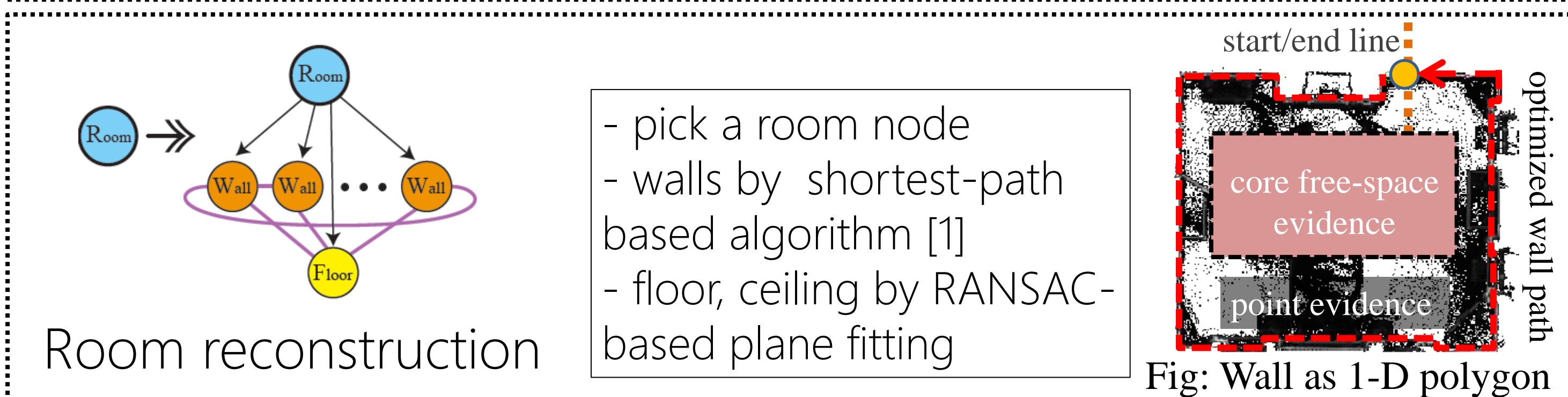
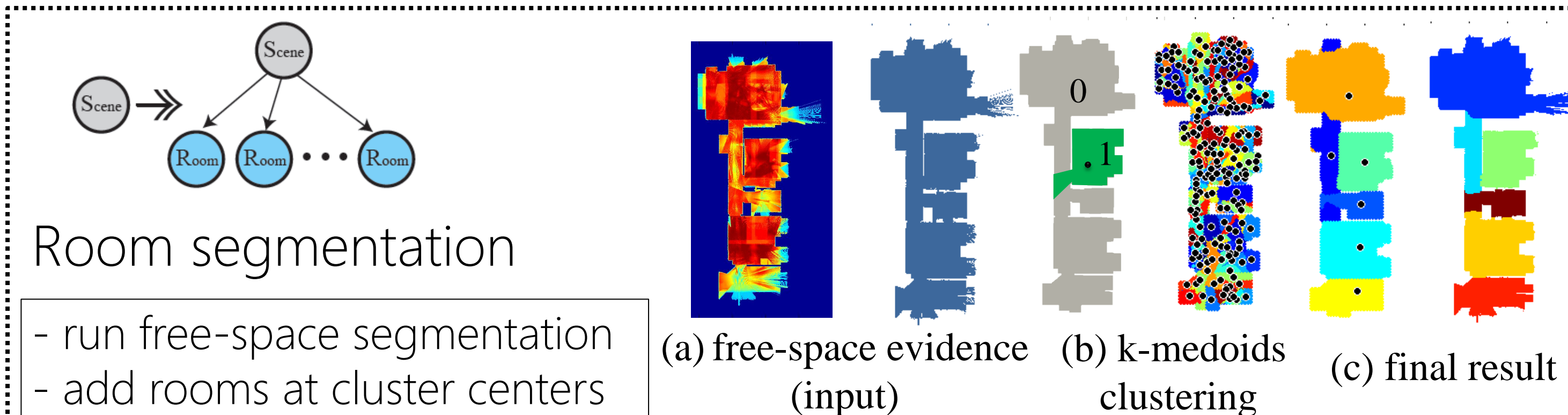
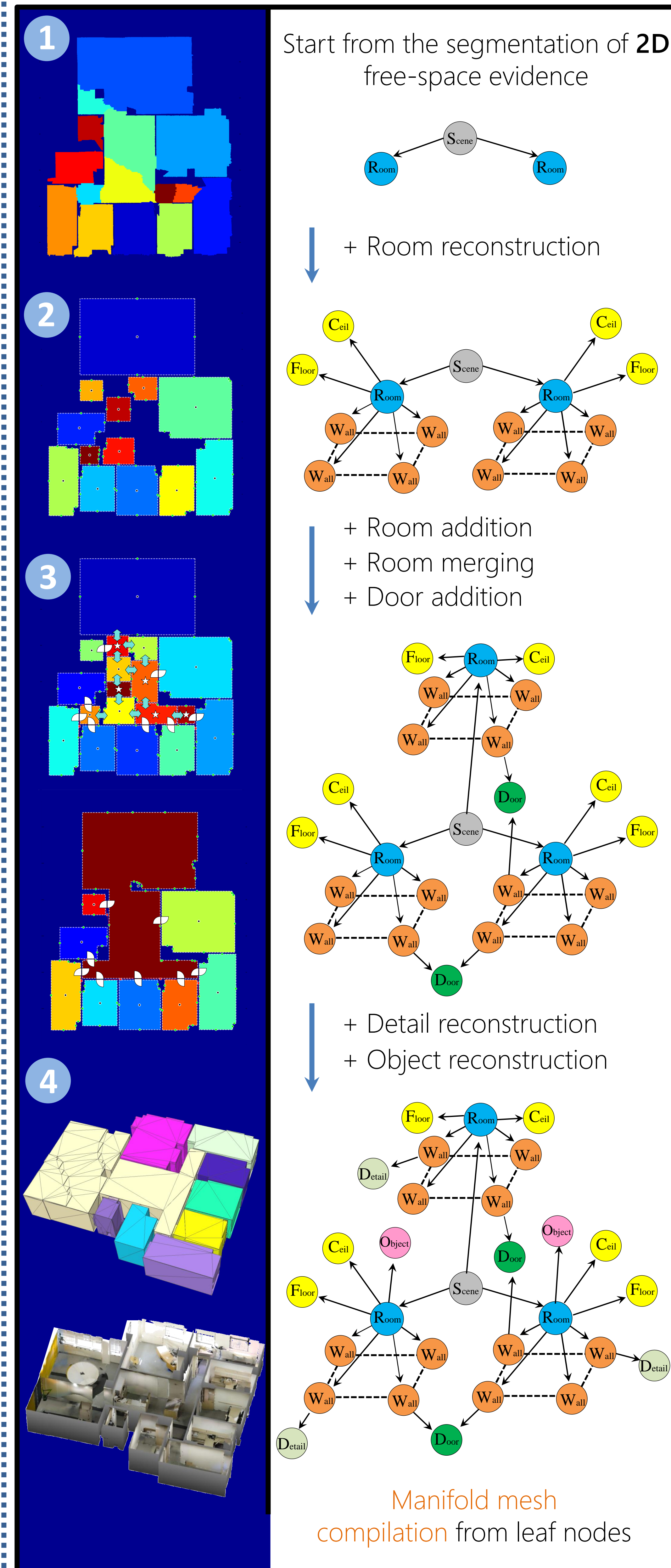
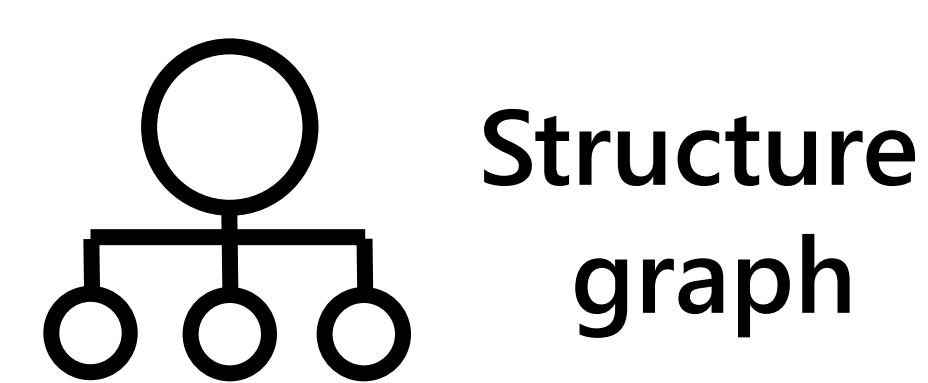
- New reconstruction framework called **structured reconstruction**
- Propose **structure grammar** to recover a **structure graph** from panorama RGB-D images
- Human editable, annotated and segmented indoor 3-D model
- Various applications such as indoor scene viewer, inverse CAD and tunable reconstruction



Assumptions

- Single story building (w/o stairs)
- Room structure (i.e., floor, ceiling, and walls) is aligned with the **Manhattan directions**

OUR METHOD



$$\min_{E, D_r} \|E\|_1 + \mu_1 \|D_r\|_* \quad s.t. \quad D_m = D_r + E \quad (\text{Eq.1})$$

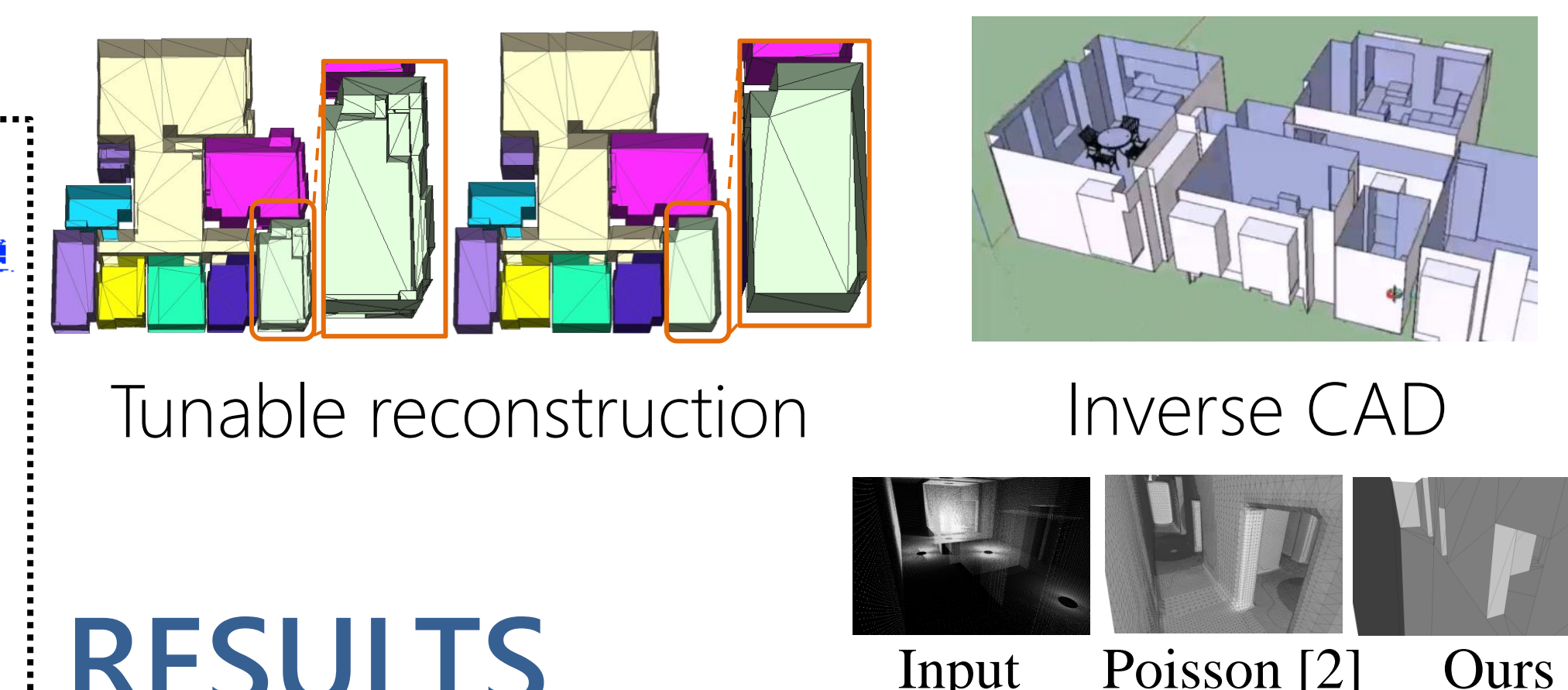
Given D_m , decompose it to low-rank D_r and sparse E (RPCA)

$$\min_{D_m} \|D_m - D_r\|_2^2 + \mu_2 \|\nabla D_m\|_1 + \mu_3 \text{Label}(D_m) \quad (\text{Eq.2})$$

Given D_r , enforce low-entropy to get D_m (Label-cost MRF)

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APPLICATIONS

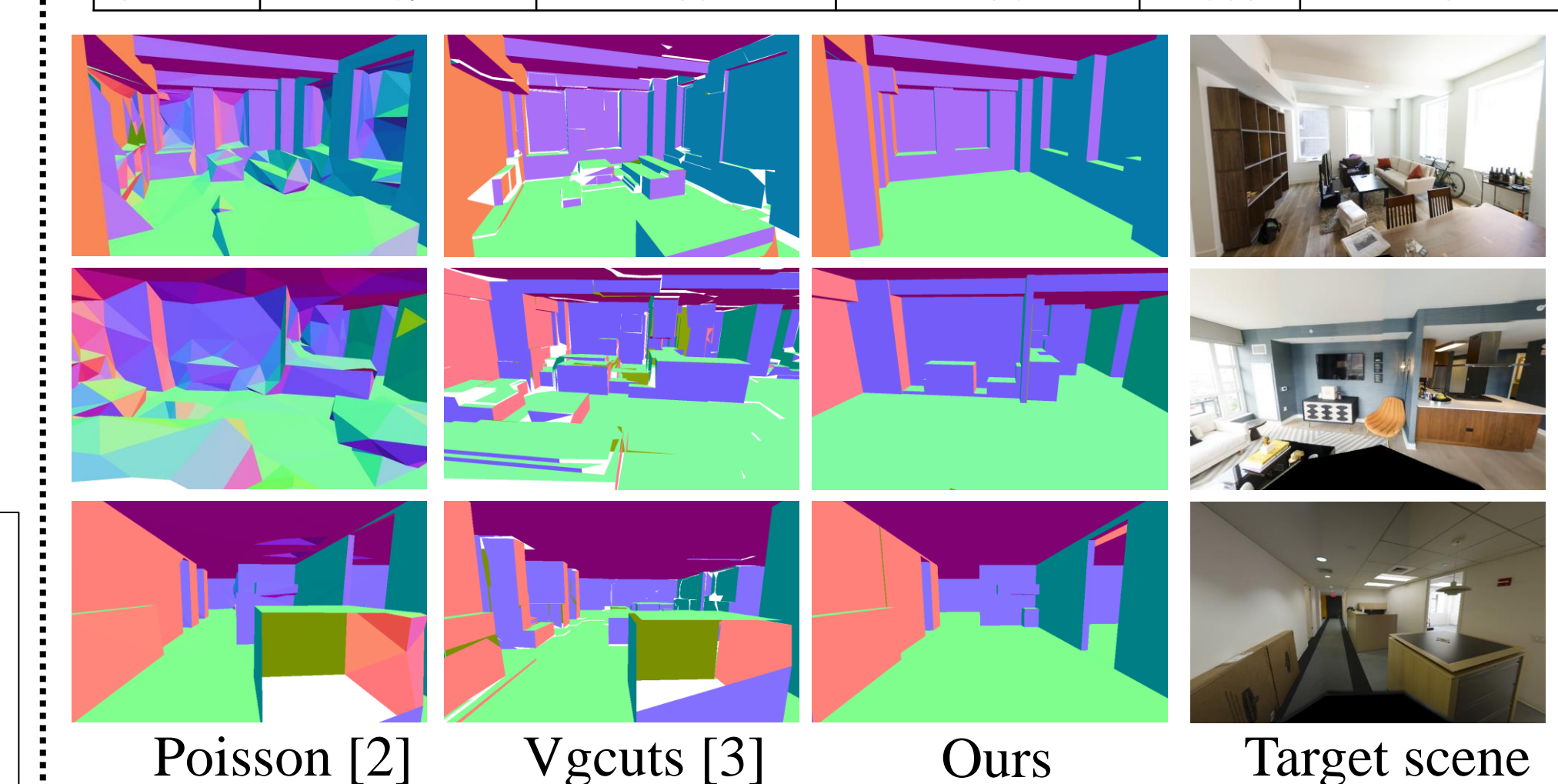


RESULTS



Table: Statistics of reconstructed structured model

			Num. elements				Total dist. Error (mm)		
Dataset	# panos	# points	Room	Wall	Obj.	Door	Wall +Detail	+Object	
Apart. 1	16	4933172	6	62	15	5	139	103	81
Apart. 2	15	10065236	5	63	24	4	181	122	86
Office 1	33	4227235	9	113	19	8	155	145	46
Computational time (sec)									
Dataset	Initialization	Room Segmentation	Room, Floor, Ceil Recon.		Detail Recon.	Model Compilation			
Apart. 1	62	86	682		1034	0.5			
Apart. 2	48	68	468		558	0.8			
Office 1	109	255	1430		1068	1.3			



REFERENCES

- [1] R. Cabral and Y. Furukawa. Piecewise planar and compact floorplan reconstruction from images. CVPR, 2014.
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- [3] Y. Furukawa, B. Curless, S. M. Seitz, and R. Szeliski. Reconstructing building interiors from images. ICCV, 2009.