

GAT-CADNet: Graph Attention Network for Panoptic Symbol Spotting in CAD Drawings

Supplementary Material

As the space limitation in the paper, more quantitative and qualitative results are illustrated in supplementary material part.

A. Quantitative results

More ablation study. Two more extra experiments are conducted to further prove the superiority of our model. One is using graph convolution network(GCN) as baseline. Similar to GAT, GCN is also a widely used graph neural network. Thus, we replace GAT stages in our model with GCN stages and take the normalized Laplacian matrix equivalently to one head attention score in our RSE and CEE modules. Another is using vertices features only. Once the center coordinates are added to current vertices features, spacial relationship can be figured out with any two given segments. To verify the necessity of explicitly encoded edge features in our model, we conduct another experiment with only vertices features. As shown in Tab. 4, neither of two extra experiments reaches the performance of our baseline, let alone our best model.

Quantitative results. As the space limitation in main body, only the total evaluation results of panoptic quality(PQ), segmentation quality(SQ) and recognition quality(RQ) are shown ahead. Here we provide the evaluation results of each class in Tab. 5.

B. Qualitative results

Visualized results of more cases are illustrated in this section. Fig. 13 and Fig. 14 show the cases of residential buildings and core of towers, in which things and stuff are usually in regular layout, and are also the cases in which our model gives best results. Fig. 15 are plans of shopping malls, which have lager amount of stuff including parking and curtain wall. Our model also performs well in these cases. Fig. 16 and Fig. 17 are cases of schools, in which tables and chairs are arrayed orderly and densely. Although some instances have lower confidence, most instances are well segmented.

Furthermore, all figures are illustrated as vector graph, such that details can be shown clearly after zooming in. Annotations and confidence are labeled on the upper left corner of the instances blocks. Segments belong to different classes are drawn with different colors, while background segments are drawn in light gray.

Model	RQ	SQ	PQ
our baseline	0.687	0.875	0.602
GCN based	0.655	0.859	0.563
w/o edge features	0.599	0.850	0.509
ours	0.807	0.914	0.737

Table 4. Extra experiments. GCN based model and GAT without edge features show inferior results.

C. limitations

Our GAT-CADNet treats the instance symbol spotting as a subgraph detection problem, with proposed RSE and CEE modules, surpasses existing state-of-the-art methods by a large margin. There are still limitations. Two failed cases are shown in Fig. 18. For some cases, simple symbols could be missing or wrongly recognized with mistaken labeled or lager variation in graph, e.g. our model misses all L shape tables (upper) and recognizes all windows as curtain wall (lower) by mistake. Future work would be focusing on failed cases and improving the robustness of our model.

class	Baseline			Baseline + RSE			Baseline + CEE			Baseline + RSE + CEE		
	RQ	SQ	PQ	RQ	SQ	PQ	RQ	SQ	PQ	RQ	SQ	PQ
single door	0.78	0.91	0.71	0.84	0.93	0.78	0.88	0.93	0.82	0.91	0.95	0.86
double door	0.82	0.91	0.75	0.86	0.93	0.80	0.84	0.93	0.79	0.89	0.94	0.83
sliding door	0.89	0.94	0.83	0.90	0.94	0.85	0.90	0.95	0.85	0.94	0.96	0.91
folding door	0.34	0.85	0.29	0.46	0.90	0.42	0.39	0.91	0.35	0.45	0.89	0.40
revolving door	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
shutter door	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
window	0.69	0.81	0.56	0.71	0.82	0.58	0.74	0.81	0.60	0.79	0.84	0.66
bay window	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
shutter window	0.69	0.82	0.56	0.75	0.85	0.64	0.74	0.84	0.62	0.76	0.87	0.66
opening symbol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sofa	0.40	0.81	0.32	0.47	0.89	0.42	0.36	0.91	0.33	0.61	0.96	0.59
bed	0.68	0.90	0.61	0.68	0.88	0.60	0.64	0.91	0.58	0.78	0.91	0.72
chair	0.38	0.84	0.32	0.58	0.85	0.49	0.66	0.94	0.62	0.84	0.93	0.78
table	0.36	0.88	0.32	0.31	0.88	0.27	0.40	0.93	0.37	0.57	0.94	0.53
TV cabinet	0.45	0.84	0.38	0.54	0.83	0.45	0.39	0.87	0.34	0.73	0.94	0.69
wardrobe	0.75	0.81	0.61	0.67	0.81	0.55	0.71	0.87	0.62	0.84	0.92	0.77
cabinet	0.20	0.79	0.16	0.21	0.82	0.18	0.18	0.80	0.14	0.44	0.85	0.37
gas stove	0.92	0.96	0.88	0.81	0.95	0.77	0.92	0.96	0.88	0.94	0.98	0.92
sink	0.75	0.93	0.69	0.78	0.93	0.72	0.77	0.94	0.73	0.81	0.95	0.77
refrigerator	0.72	0.81	0.58	0.72	0.87	0.62	0.76	0.85	0.64	0.88	0.93	0.82
air conditioning	0.46	0.89	0.41	0.59	0.92	0.55	0.68	0.96	0.66	0.66	0.97	0.64
bath	0.24	0.77	0.19	0.31	0.77	0.24	0.36	0.80	0.29	0.46	0.79	0.36
bathtub	0.51	0.78	0.40	0.54	0.85	0.46	0.63	0.81	0.51	0.68	0.88	0.59
washing machine	0.74	0.85	0.63	0.61	0.86	0.53	0.69	0.86	0.59	0.75	0.94	0.70
urinal	0.91	0.97	0.89	0.92	0.97	0.89	0.92	0.98	0.90	0.94	0.99	0.92
squat toilet	0.88	0.90	0.79	0.91	0.93	0.85	0.77	0.93	0.72	0.92	0.96	0.88
toilet	0.88	0.96	0.84	0.89	0.97	0.87	0.91	0.96	0.88	0.94	0.99	0.93
stairs	0.53	0.83	0.44	0.62	0.86	0.53	0.68	0.86	0.58	0.74	0.90	0.66
elevator	0.76	0.92	0.70	0.82	0.93	0.76	0.81	0.93	0.75	0.84	0.95	0.80
escalator	0.17	0.73	0.12	0.23	0.74	0.17	0.25	0.74	0.18	0.22	0.78	0.17
row seat	0.26	0.90	0.23	0.46	0.92	0.42	0.33	0.92	0.30	0.49	0.93	0.45
parking	0.83	0.88	0.73	0.82	0.90	0.74	0.77	0.86	0.66	0.82	0.90	0.74
wall	0.66	0.71	0.47	0.72	0.74	0.53	0.68	0.72	0.48	0.76	0.76	0.58
curtain wall	0.28	0.77	0.22	0.33	0.74	0.24	0.21	0.75	0.15	0.40	0.78	0.32
handrail	0.12	0.65	0.08	0.14	0.72	0.10	0.10	0.69	0.07	0.27	0.78	0.21
total	0.69	0.87	0.60	0.73	0.90	0.65	0.75	0.90	0.67	0.80	0.91	0.74

Table 5. Quantitative results for semantic symbol spotting, instance symbol spotting and panoptic symbol spotting of each class. There are classes in test split with few instances leading to zeros and very low values in results. The total result are weighed with the number of each class.

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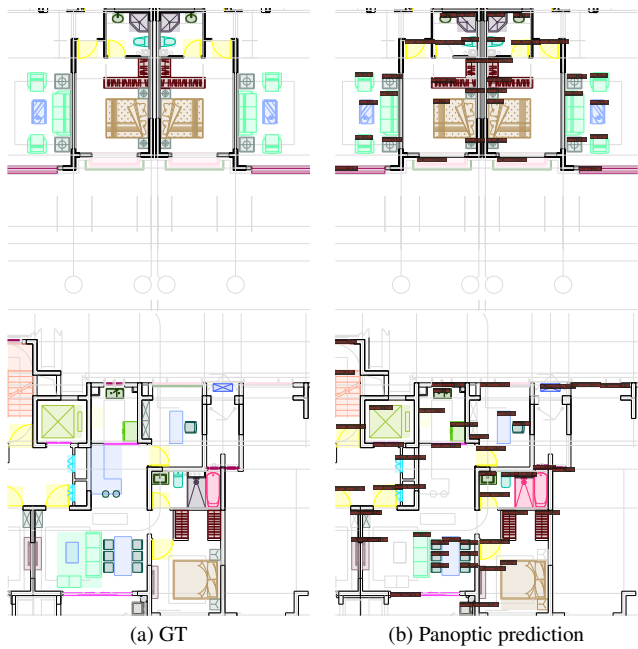


Figure 13. Results of GAT-CADNet on FloorPlanCAD, see the main body for annotation details. The images are part of our test split of residential building CAD drawings.

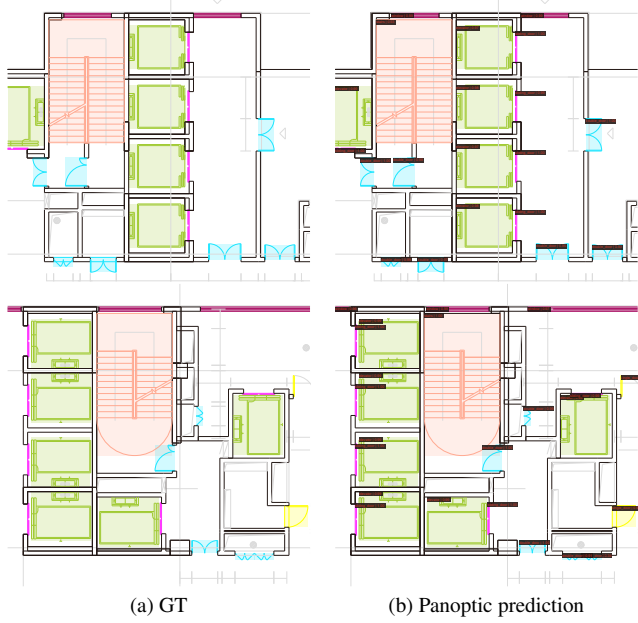


Figure 14. Results of GAT-CADNet on FloorPlanCAD, see the main body for annotation details. The images are part of our test split of tower CAD drawings.

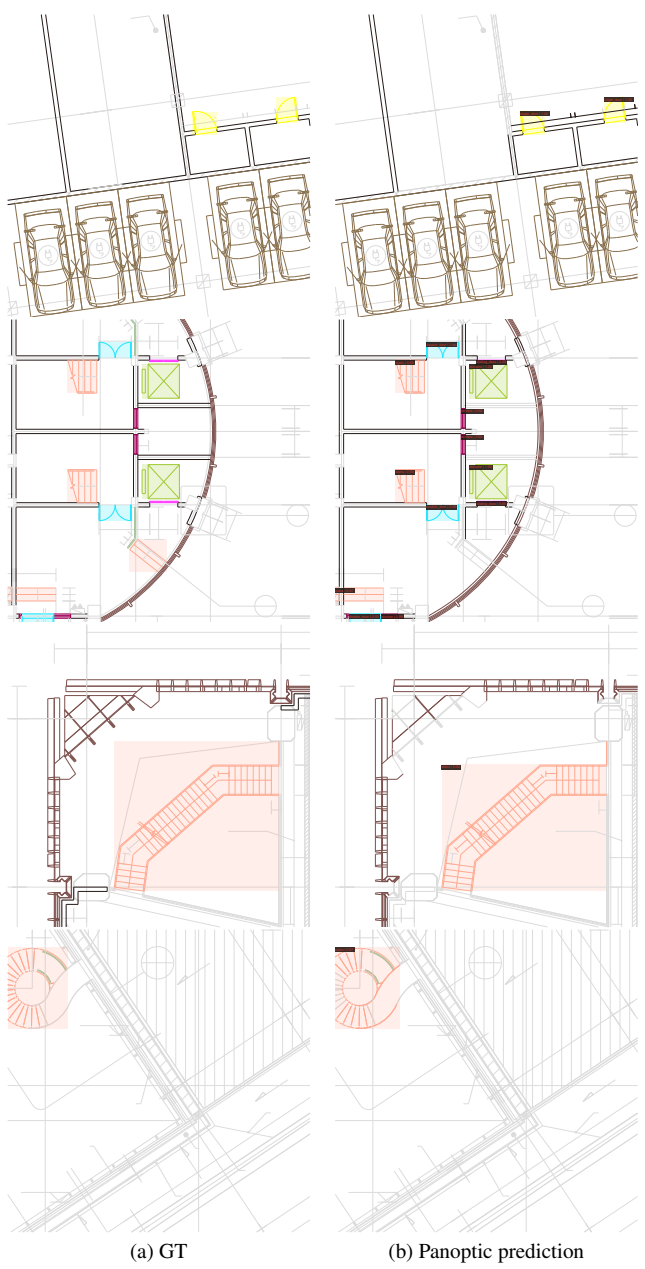


Figure 15. Results of GAT-CADNet on FloorPlanCAD, see the main body for annotation details. The images are part of our test split of shopping mall CAD drawings.

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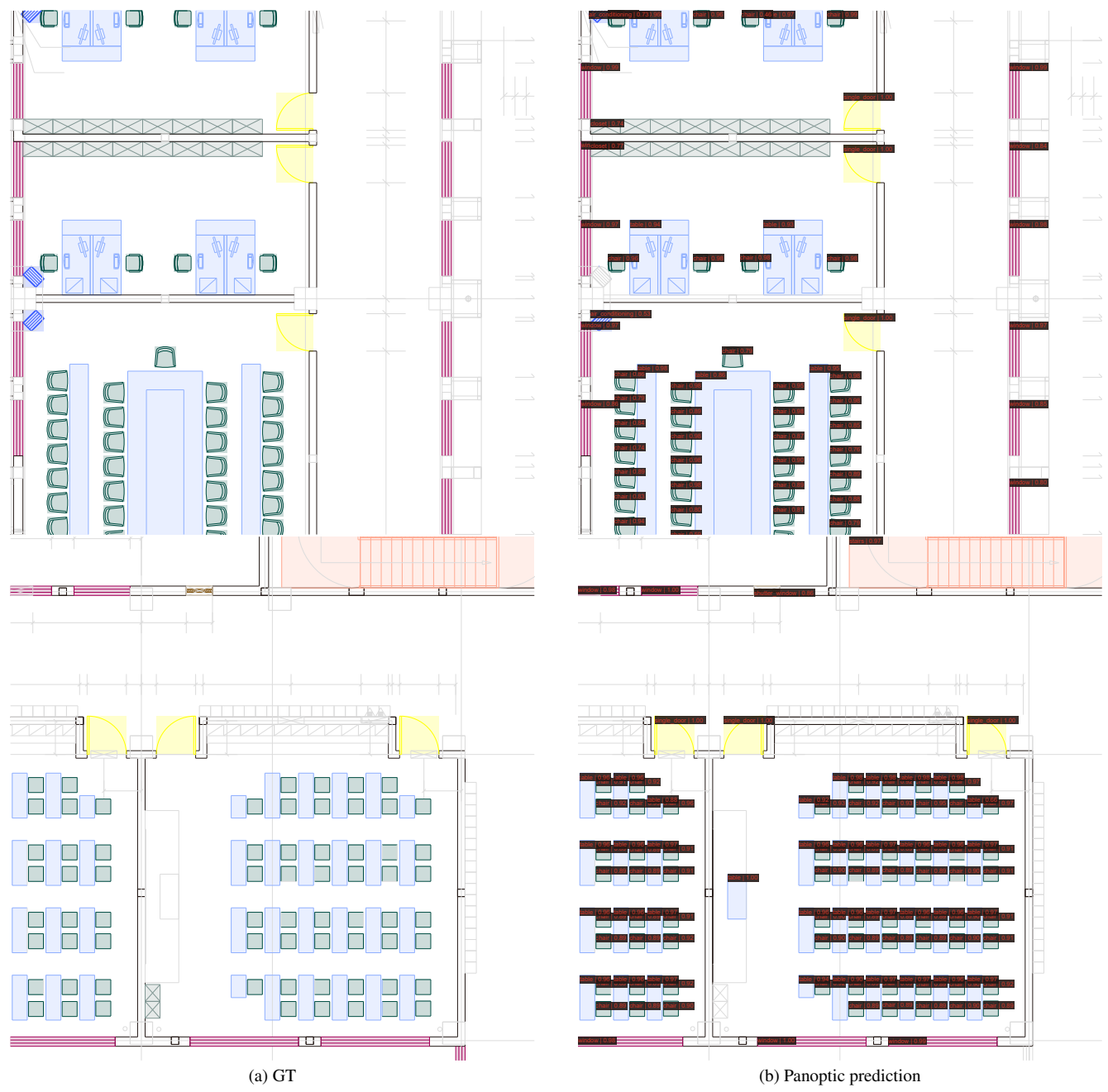


Figure 16. Results of GAT-CADNet on FloorPlanCAD, see the main body for annotation details. The images are part of our test split of school CAD drawings.

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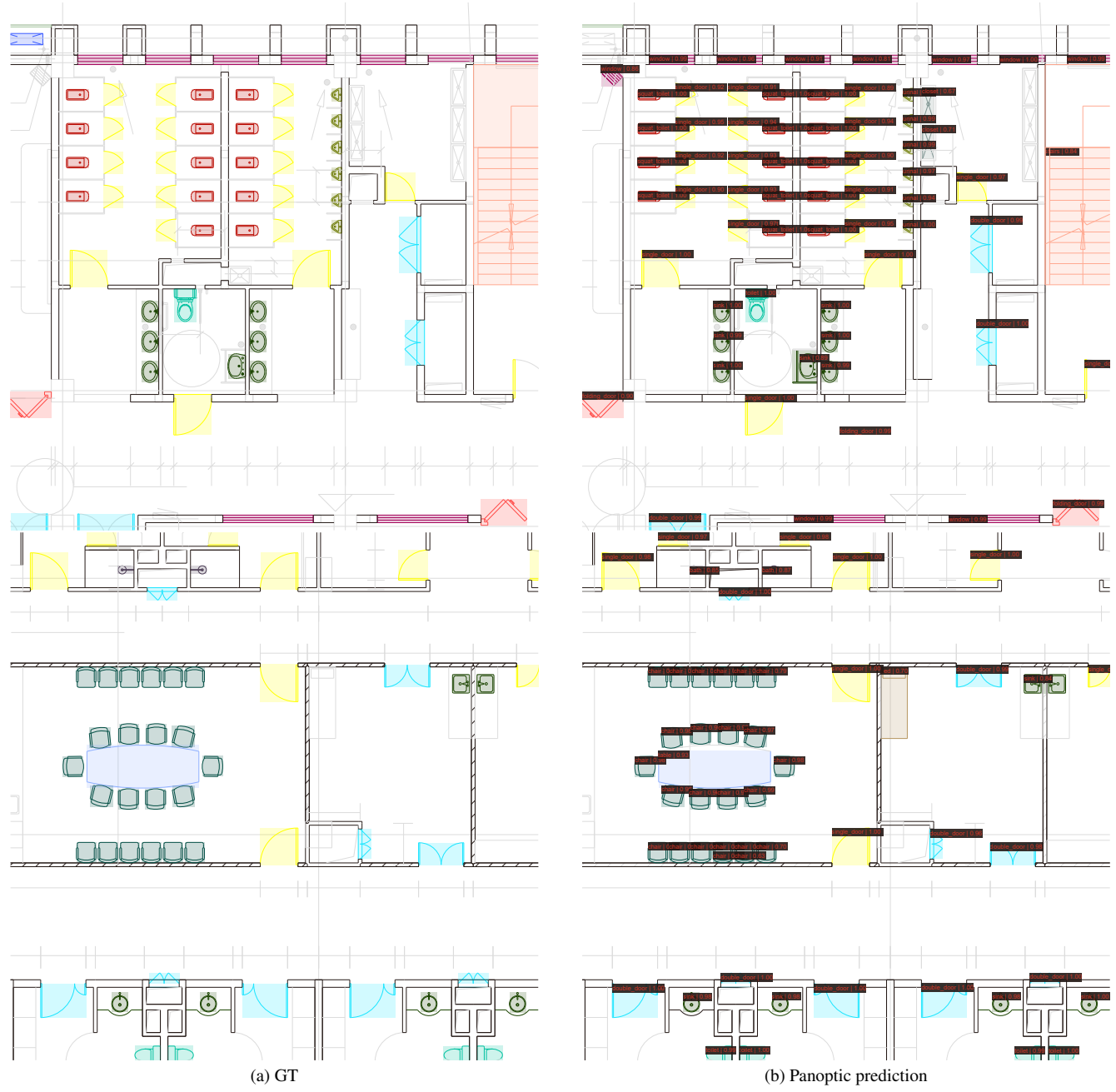


Figure 17. Results of GAT-CADNet on FloorPlanCAD, see the main body for annotation details. The images are part of our test split of public building CAD drawings

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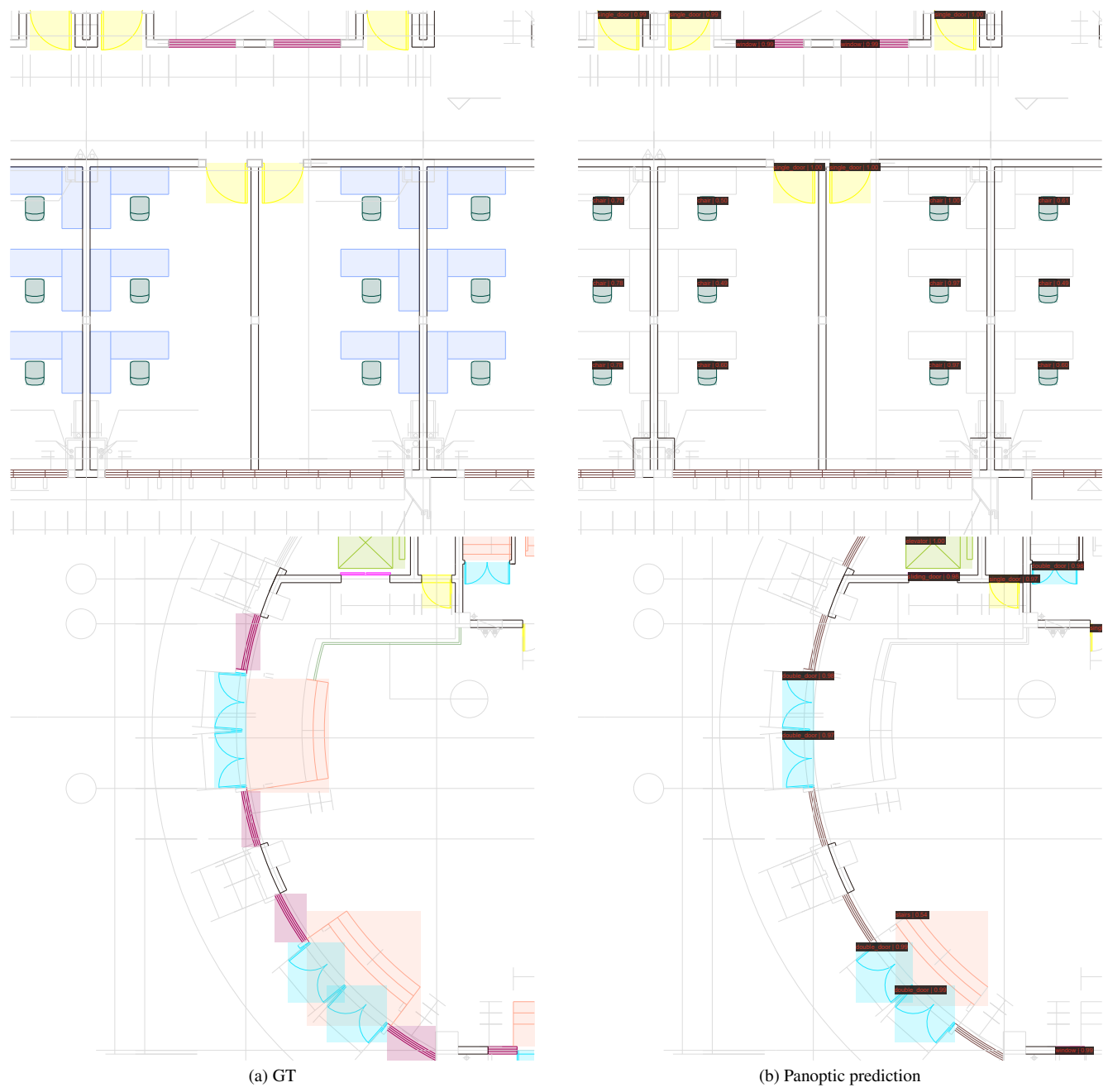


Figure 18. Two typical failed cases of GAT-CADNet. All L shape tables in upper are missing and all windows in lower are recognized as curtain wall by mistake.