Rethinking Interactive Image Segmentation with Low Latency, High Quality, and Diverse Prompts

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Interactive image segmentation aims to extract objects with human interactions, such as clicks and scribbles.

https://github.com/saic-vul/ritm_interactive_segmentation

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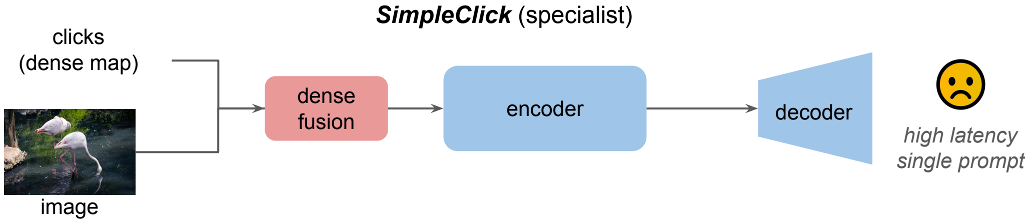

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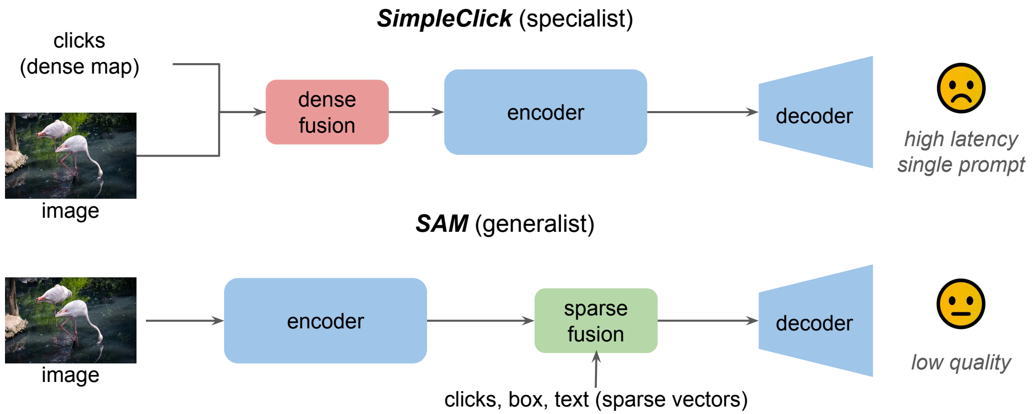

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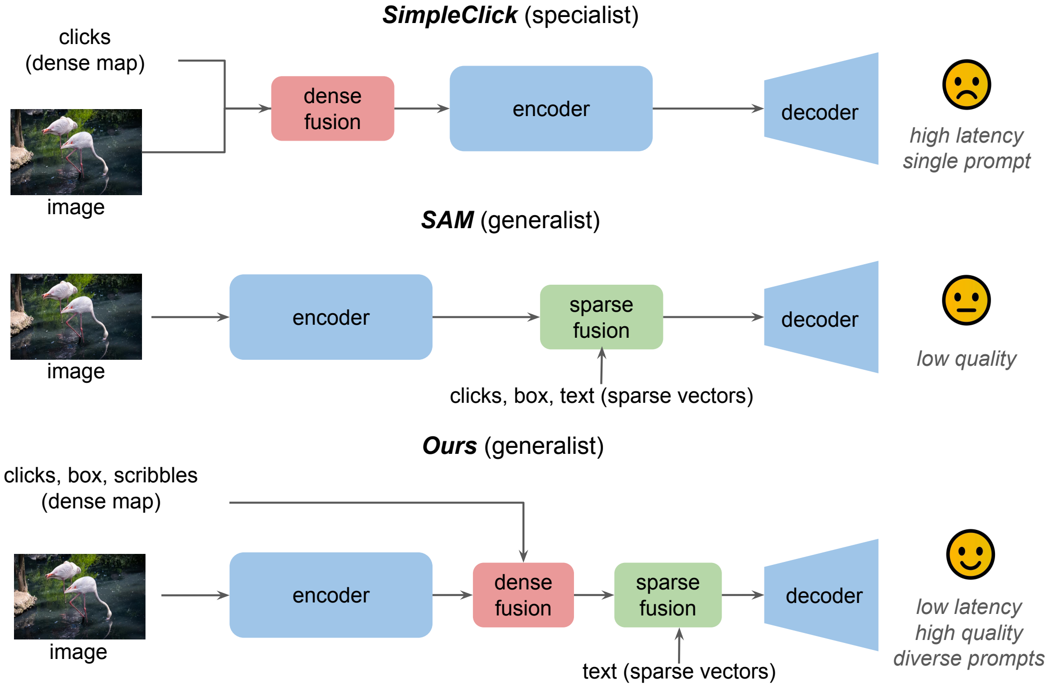
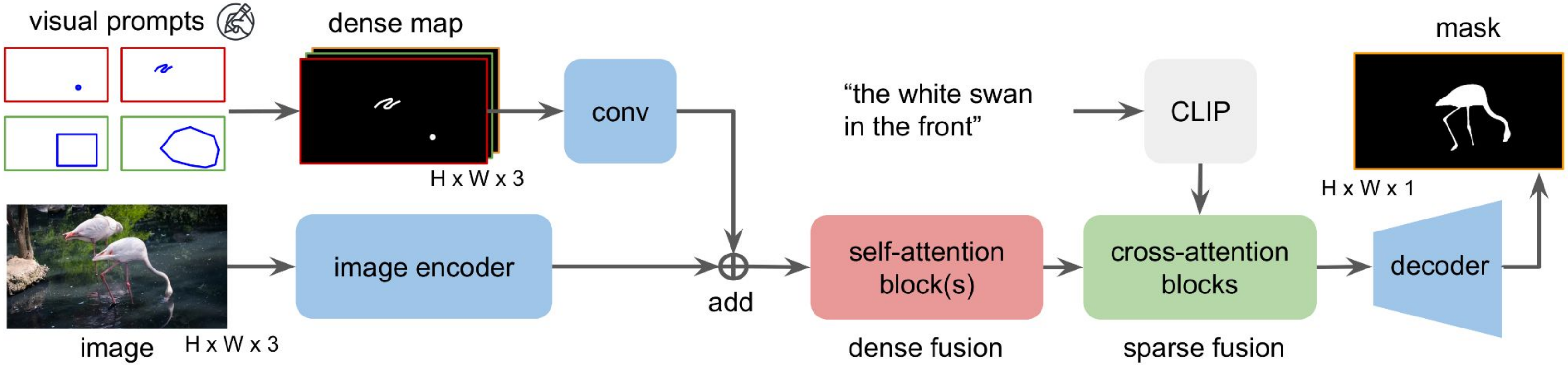


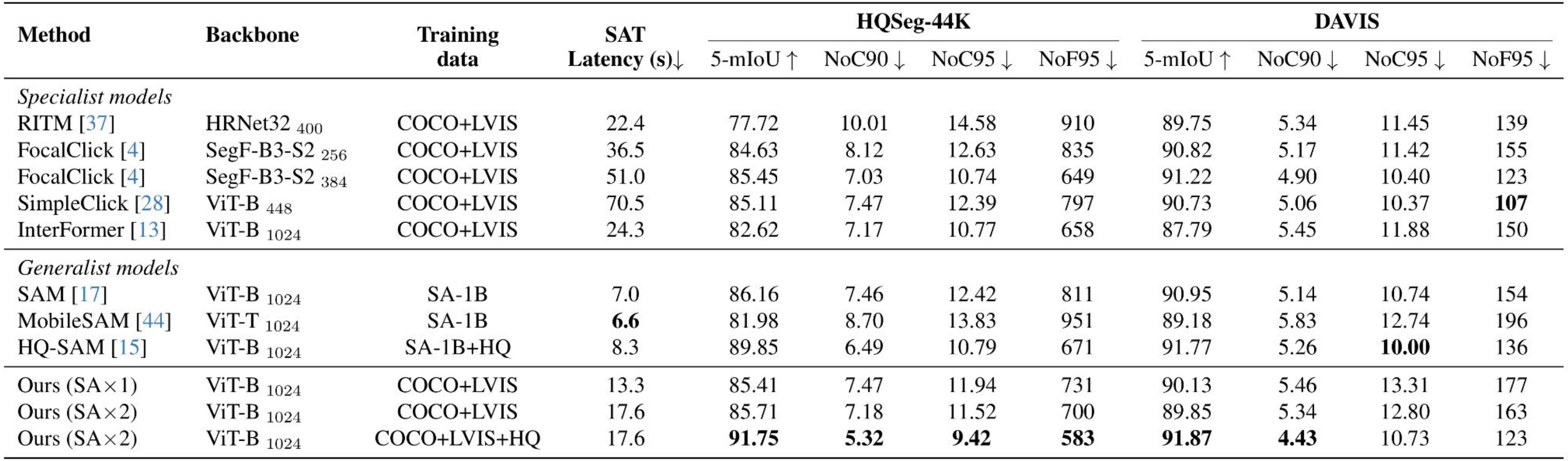
Network Architecture



Experiments

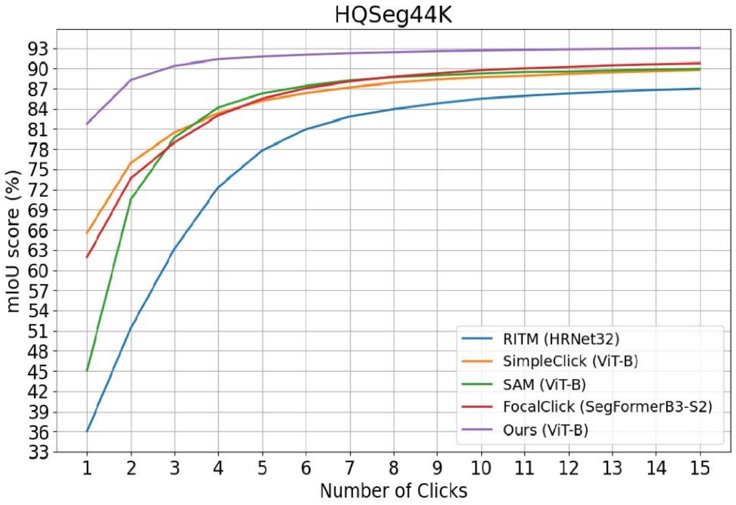
- Benchmarks
  - COCO+LVIS: 118K training images (1.2M instances)
  - HQSeg-44K: 44320 training images with extremely fine-grained image masks
  - DAVIS: 345 high-quality and high-resolution images
  - ssTEM: 20 high-resolution cell images
  - BraTS: 369 brain tumor images from 69 MRI volumes
- Baselines
  - Specialists: RITM, FocalClick, SimpleClick, InterFormer
  - Generalists: SAM, MobileSAM, HQ-SAM

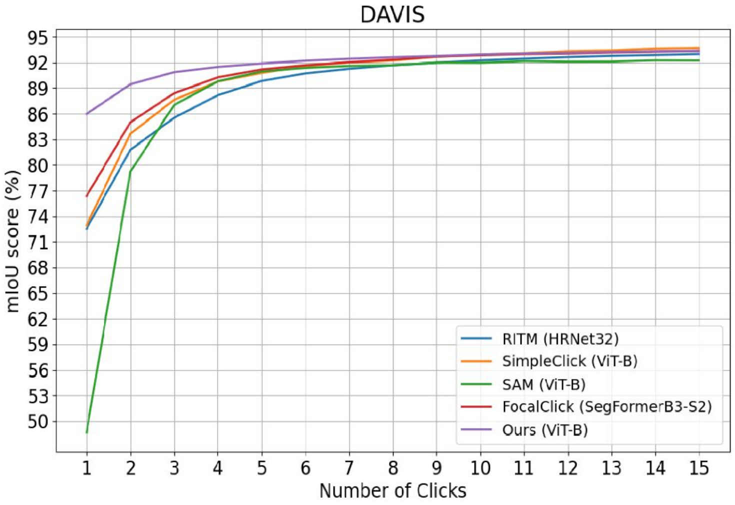
Quantitative Comparison on HQSeg-44K and DAVIS



Method	**Backbone**	**Training data**	**SAT Latency (s)**↓	**HQSeg-44K**				**DAVIS**			
				5-mIoU ↑	NoC90 ↓	NoC95 ↓	NoF95 ↓	5-mIoU ↑	NoC90 ↓	NoC95 ↓	NoF95 ↓
Specialist models											
RITM [37]	HRNet32 $_{400}$	COCO+LVIS	22.4	77.72	10.01	14.58	910	89.75	5.34	11.45	139
FocalClick [4]	SegF-B3-S2 $_{256}$	COCO+LVIS	36.5	84.63	8.12	12.63	835	90.82	5.17	11.42	155
FocalClick [4]	SegF-B3-S2 $_{384}$	COCO+LVIS	51.0	85.45	7.03	10.74	649	91.22	4.90	10.40	123
SimpleClick [28]	ViT-B $_{448}$	COCO+LVIS	70.5	85.11	7.47	12.39	797	90.73	5.06	10.37	**107**
InterFormer [13]	ViT-B $_{1024}$	COCO+LVIS	24.3	82.62	7.17	10.77	658	87.79	5.45	11.88	150
Generalist models											
SAM [17]	ViT-B $_{1024}$	SA-1B	7.0	86.16	7.46	12.42	811	90.95	5.14	10.74	154
MobileSAM [44]	ViT-T $_{1024}$	SA-1B	**6.6**	81.98	8.70	13.83	951	89.18	5.83	12.74	196
HQ-SAM [15]	ViT-B $_{1024}$	SA-1B+HQ	8.3	89.85	6.49	10.79	671	91.77	5.26	**10.00**	136
Ours (SA×1)	ViT-B $_{1024}$	COCO+LVIS	13.3	85.41	7.47	11.94	731	90.13	5.46	13.31	177
Ours (SA×2)	ViT-B $_{1024}$	COCO+LVIS	17.6	85.71	7.18	11.52	700	89.85	5.34	12.80	163
Ours (SA×2)	ViT-B $_{1024}$	COCO+LVIS+HQ	17.6	**91.75**	**5.32**	**9.42**	**583**	**91.87**	**4.43**	10.73	123

Quantitative Comparison on HQSeg-44K and DAVIS





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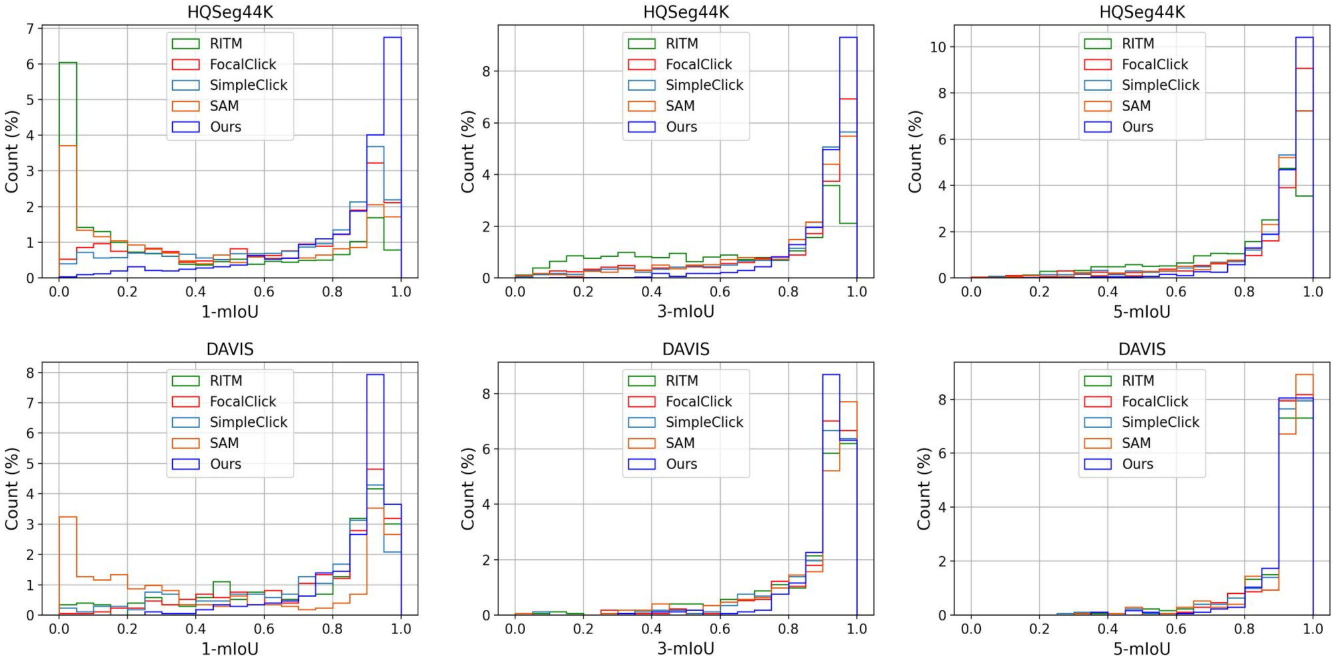
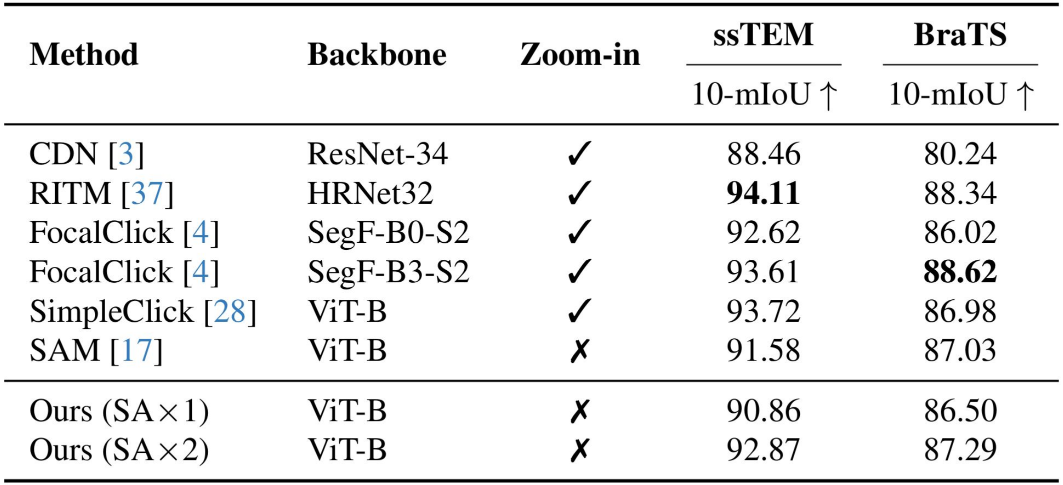
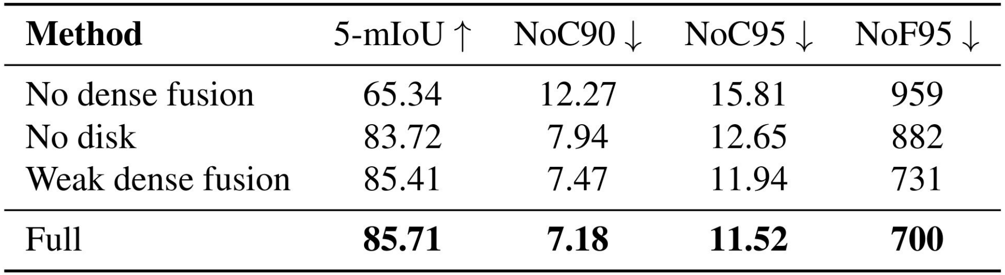


Out-of-Domain Evaluation on Medical Images



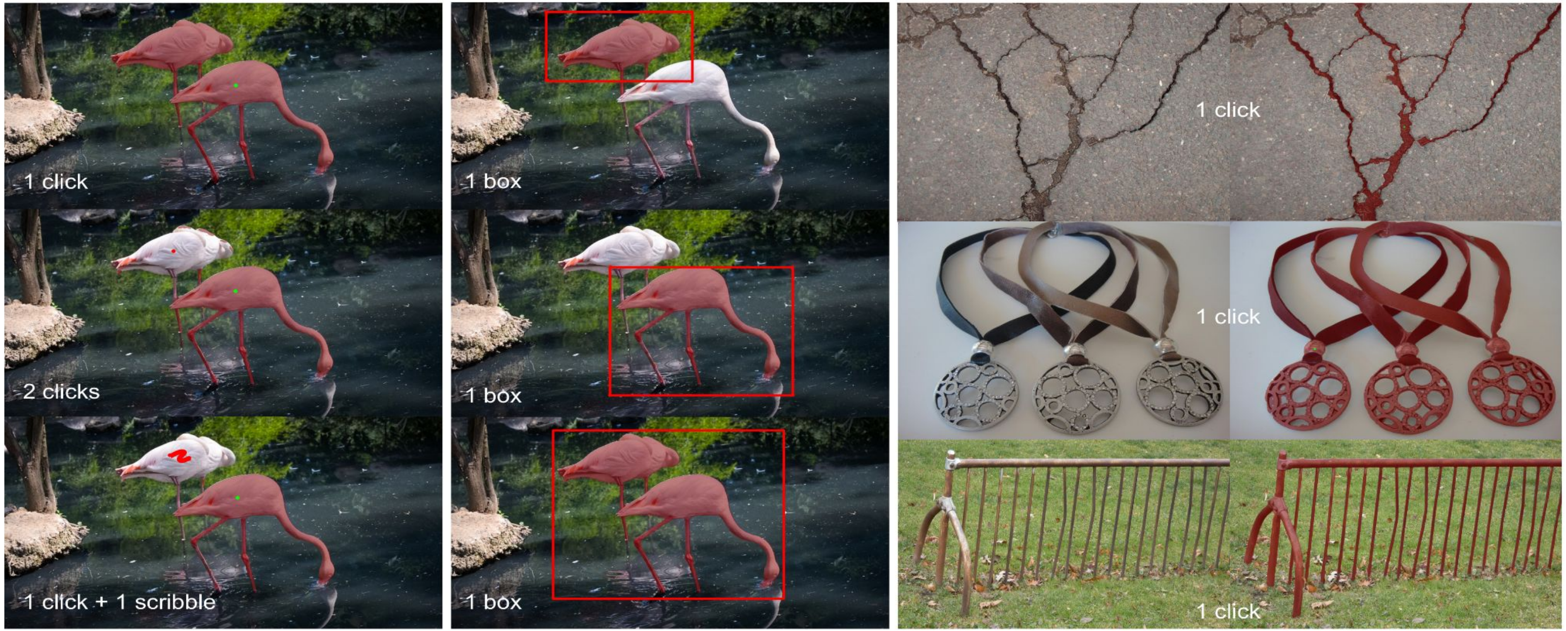
Method	**Backbone**	**Zoom-in**	**ssTEM**	**BraTS**
			10-mIoU ↑	10-mIoU ↑
CDN [3]	ResNet-34	✓	88.46	80.24
RITM [37]	HRNet32	✓	**94.11**	88.34
FocalClick [4]	SegF-B0-S2	✓	92.62	86.02
FocalClick [4]	SegF-B3-S2	✓	93.61	**88.62**
SimpleClick [28]	ViT-B	✓	93.72	86.98
SAM [17]	ViT-B	✗	91.58	87.03
Ours (SA×1)	ViT-B	✗	90.86	86.50
Ours (SA×2)	ViT-B	✗	92.87	87.29

Ablations

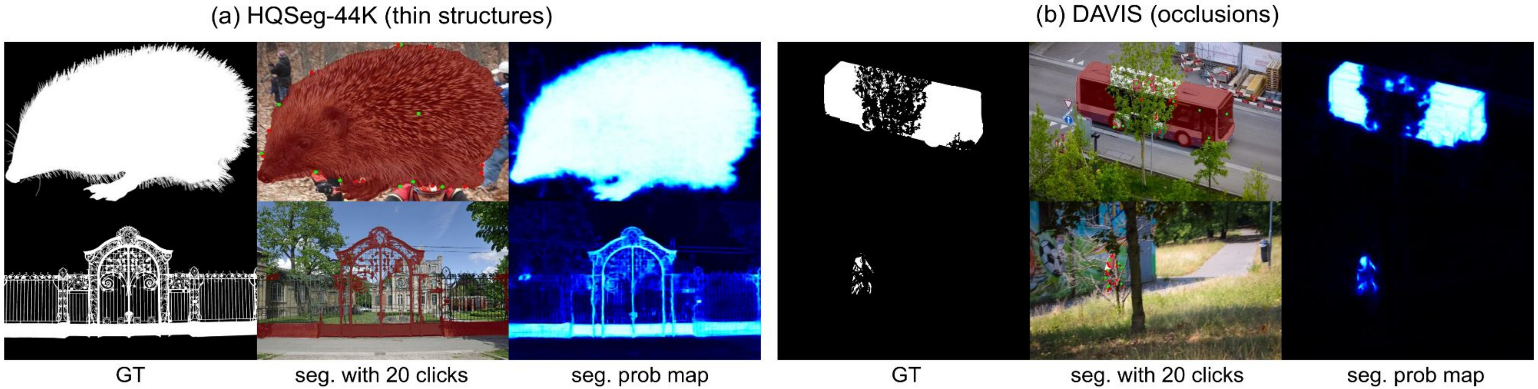


Method	5-mIoU ↑	NoC90 ↓	NoC95 ↓	NoF95 ↓
No dense fusion	65.34	12.27	15.81	959
No disk	83.72	7.94	12.65	882
Weak dense fusion	85.41	7.47	11.94	731
Full	**85.71**	**7.18**	**11.52**	**700**

Qualitative Results with Diverse Prompts



Failure Patterns and Future Work



(a) HQSeg-44K (thin structures)

(b) DAVIS (occlusions)