

Towards Open-World Segmentation of Parts

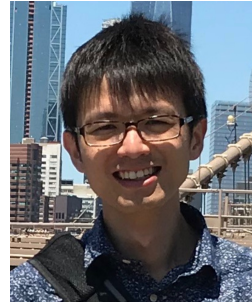
Tai-Yu Daniel Pan



Qing Liu



Wei-Lun Chao



Brian Price



<https://github.com/tydpan/OpenPartSeg>



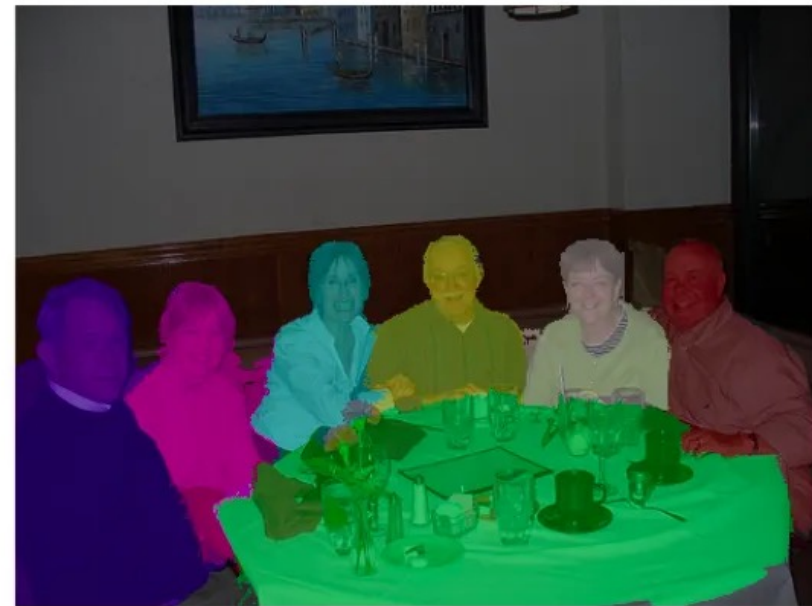
THE OHIO STATE UNIVERSITY



Segmentation



Semantic segmentation



Instance segmentation

Part Segmentation



Current approaches:
semantic segmentation



Our approach:
instance segmentation

Challenges of Part Instance Segmentation



instance-level

coarse



fine

- Annotation is expensive
- Applications in the wild

Learning with unlabeled data!

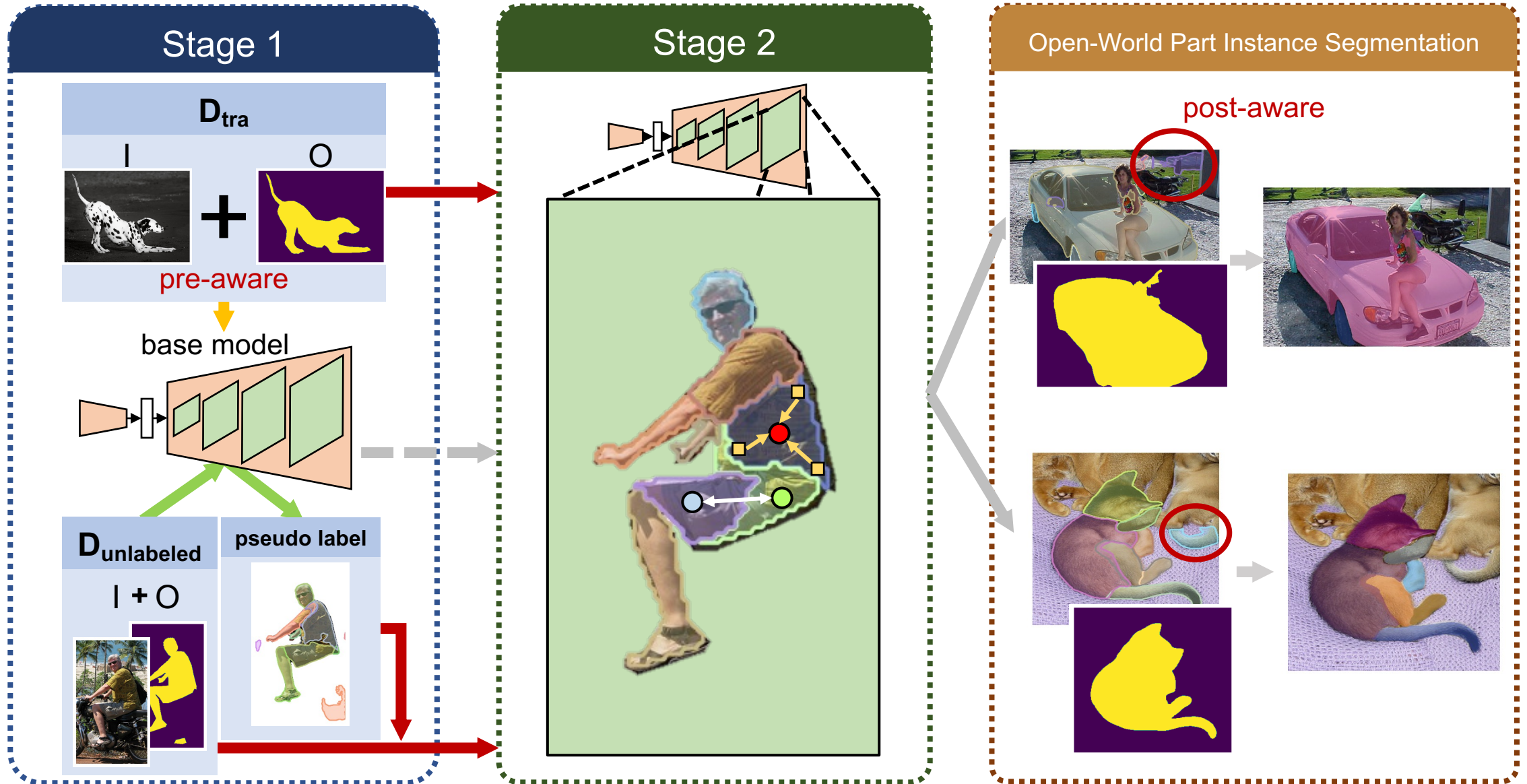
Our Key Insight

Parts are “compositions” of objects.

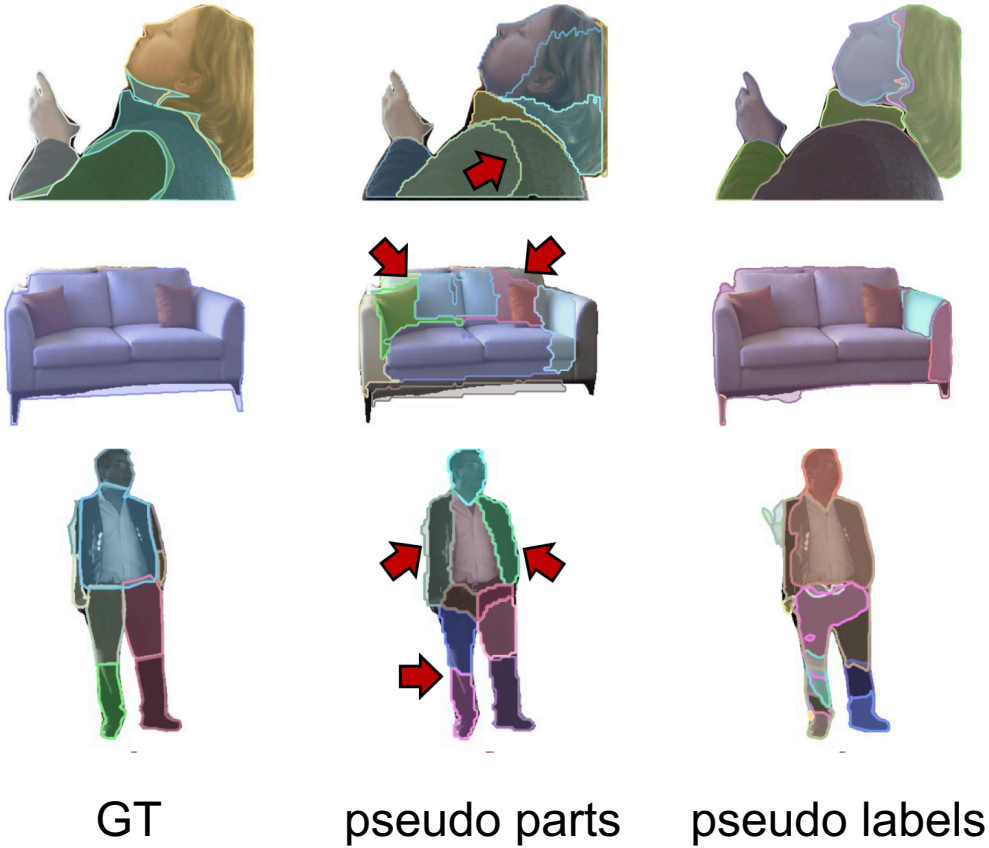


Object awareness

Approach



Pseudo Labels vs Pseudo Parts



They are complementary to each other.

Results on PartImageNet

base model -> fine-tune with PartImageNet val set

Note: val and test set are out-of-domain from the training set in PartImageNet

Results on PartImageNet

base model -> fine-tune with PartImageNet val set

method	SS	ST	fine-tune on		inference	
			AP	AP ₅₀	AP	AP ₅₀
imperf. base			41.94	73.17		
OPS	✓	✓				

with imperfect object awareness

Note: val and test set are out-of-domain from the training set in PartImageNet

Results on PartImageNet

base model -> fine-tune with PartImageNet val set

method	SS	ST	fine-tune on		inference	
			AP	AP ₅₀	AP	AP ₅₀
imperf.						
base			41.94	73.17		
	✓		42.78	74.62		
OPS	✓	✓				

with imperfect object awareness

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Results on PartImageNet

base model -> fine-tune with PartImageNet val set

method	SS	ST	fine-tune on		inference	
			AP	AP ₅₀	AP	AP ₅₀
imperf.						
base			41.94	73.17		
	✓		42.78	74.62		
		✓	43.12	75.03		
OPS	✓	✓				

with imperfect object awareness

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Results on PartImageNet

base model -> fine-tune with PartImageNet val set

method	SS	ST	fine-tune on		inference	
			AP	AP ₅₀	AP	AP ₅₀
imperf.						
base			41.94	73.17		
	✓		42.78	74.62		
		✓	43.12	75.03		
OPS	✓	✓	43.16	74.96		

with imperfect object awareness

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Results on PartImageNet

base model -> fine-tune with PartImageNet val set

method	SS	ST	fine-tune on		inference	
			AP	AP ₅₀	AP	AP ₅₀
imperf.						
base			41.94	73.17	38.96	69.07
	✓		42.78	74.62	40.17	70.70
		✓	43.12	75.03	40.38	71.10
OPS	✓	✓	43.16	74.96	40.43	71.18

with imperfect object awareness

Note: val and test set are out-of-domain from the training set in PartImageNet

Results on PartImageNet

base model -> fine-tune with PartImageNet val set

		fine-tune on		inference				fine-tune on		inference			
method	SS	ST	Val		Test		method	SS	ST	Val		Test	
			AP	AP ₅₀	AP	AP ₅₀				AP	AP ₅₀	AP	AP ₅₀
imperf.							perf.						
base			41.94	73.17	38.96	69.07	base			85.88	96.08	83.52	94.66
	✓		42.78	74.62	40.17	70.70		✓		86.09	96.35	83.81	94.94
		✓	43.12	75.03	40.38	71.10			✓	86.28	96.37	83.97	95.12
OPS	✓	✓	43.16	74.96	40.43	71.18	OPS	✓	✓	86.19	96.43	83.86	95.05

with imperfect object awareness

with perfect object awareness

Note: val and test set are out-of-domain from the training set in PartImageNet

Results on Pascal-Part

base model -> fine-tune with Pascal-Part train set

method	SS	ST	Part-58 val		Part-108 val	
			AP	AP ₅₀	AP	AP ₅₀
imperf.						
base			20.27	44.24	16.36	30.16
	✓		20.53	44.91	17.95	33.03
		✓	23.25	48.81	17.75	32.64
OPS	✓	✓	24.02	50.10	18.23	33.72

with imperfect object awareness

method	SS	ST	Part-58 val		Part-108 val	
			AP	AP ₅₀	AP	AP ₅₀
pert.						
base			25.24	45.62	13.40	29.32
	✓		27.13	49.08	13.75	29.76
		✓	27.23	48.58	15.85	33.66
OPS	✓	✓	27.69	49.75	16.40	34.60

with perfect object awareness

OPS

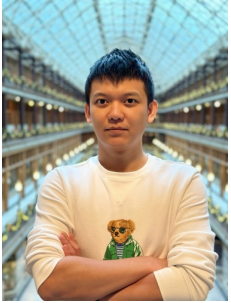
- Part instance segmentation
- Parts are compositions
- Simple and effective algorithm to learn with unlabeled data



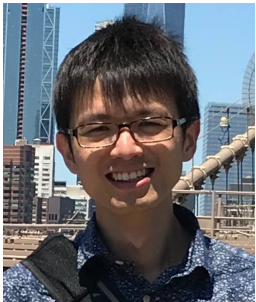
on Pascal Part

Thank you!

Tai-Yu Daniel Pan



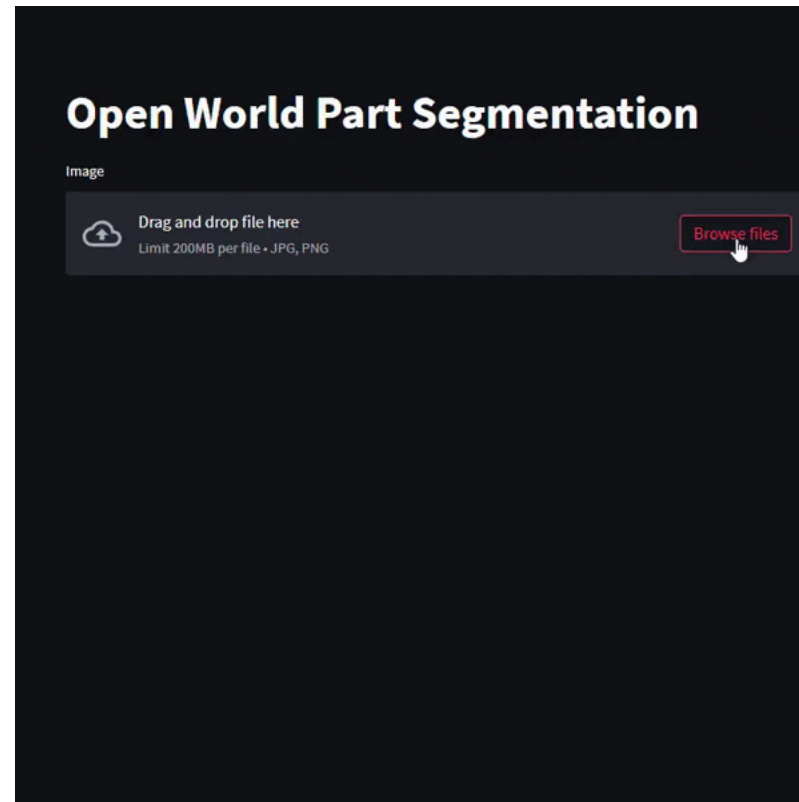
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