Weak-shot Semantic Segmentation By Transferring Semantic Affinity and Boundary Siyuan Zhou¹, Li Niu¹*, Jianlou Si², Chen Qian², Liqing Zhang¹

Abstract

- We study a novel paradigm called weak-shot semantic segmentation that utilizes full annotations of base categories to benefit segmenting objects of novel categories with only image-level labels.
- We propose a simple yet effective method called RETAB to transfer class-agnostic semantic affinity and semantic boundary from base to novel categories under the typical WSSS framework, together with a novel boundary-aware two-stage propagation (BTP) strategy. Our method can be integrated into any WSSS method under this framework.
- The effectiveness of RETAB is verified on PASCAL VOC 2012 dataset. RETAB significantly outperforms WSSS baselines and naive weak-shot segmentation baselines on novel categories.

Released Code and Model

https://github.com/bcmi/RETAB-Weak-Shot-Semantic-Segmentation

Experimental Results

	CAM			CAM+RW			CAM+RW(affgt)			CAM+RETAB			
fold	all	base	novel	all	base	novel	all	base	novel	all	base	novel	
0	48.0	51.4	37.4	61.0	63.8	52.3	69.7	73.1	58.7	71.2	74.0	62.5	
1	48.0	47.8	48.8	61.0	61.0	61.2	70.0	71.0	66.6	71.3	71.2	71.6	
2	48.0	47.2	50.7	61.0	58.9	67.9	69.7	69.6	70.0	70.9	70.2	73.3	
3	48.0	47.6	49.4	61.0	62.0	57.9	69.0	71.9	59.8	70.1	72.4	62.8	
	SEAM			SEAM+RW			SEAM+RW(affgt)			SEAM+RETAB			
fold	all	base	novel	all	base	novel	all	base	novel	all	base	nove	
0	55.4	58.8	44.6	63.6	66.4	54.8	67.5	71.1	56.1	68.2	71.2	58.4	
1	55.4	55.3	55.7	63.6	63.1	65.2	67.2	67.1	67.7	68.1	67.6	69.7	
2	55.4	53.2	62.3	63.6	60.9	72.4	67.0	65.1	73.2	67.9	65.7	74.8	
3	55.4	56.0	53.6	63.6	65.5	57.6	66.7	69.4	58.2	67.5	69.7	60.7	
	CPN			CPN+RW			CPN+RW(affgt)			CPN+RETAB			
fold	all	base	novel	all	base	novel	all	base	novel	all	base	nove	
0	57.4	60.5	47.5	67.8	70.5	59.3	70.5	73.0	62.3	71.5	73.3	65.9	
1	57.4	55.9	62.3	67.8	66.6	71.6	71.2	70.7	72.9	72.1	71.3	74.6	
2	57.4	56.3	61.0	67.8	66.3	72.7	71.6	70.9	74.0	72.3	71.5	75.0	
3	57.4	58.6	53.8	67.8	69.3	62.9	70.2	72.2	64.0	70.7	72.4	65.1	

Evalution on Segmentation Results												
Mathad	fold 0			fold 1			fold 2			fold 3		
Method	\mathcal{C}	\mathcal{C}^b	\mathcal{C}^n									
SSDD	65.5	67.6	58.8	65.5	64.5	68.7	65.5	63.5	72.1	65.5	68.0	57.7
BES	66.6	68.8	59.6	66.6	64.9	71.9	66.6	64.7	72.6	66.6	69.3	57.8
SvM	66.7	67.5	64.2	66.7	65.8	69.7	66.7	65.6	70.6	66.7	69.6	57.7
CAM+RW	63.7	65.4	58.1	63.7	63.7	63.8	63.7	61.4	71.0	63.7	65.8	56.8
CAM+RW(seggt)	73.8	78.5	58.6	74.8	76.5	69.5	73.7	74.4	71.5	73.9	79.2	56.9
CAM+RW(affgt+seggt)	75.2	78.7	64.0	75.3	76.5	71.5	74.6	75.2	72.7	74.1	79.3	57.5
CAM+RETAB	76.3	78.8	68.0	76.0	76.1	75.9	75.4	75.4	75.6	74.8	79.2	60.8
SEAM+RW	65.7	67.8	59.0	65.7	64.7	68.9	65.7	63.7	72.3	65.7	68.2	57.9
SEAM+RW(seggt)	74.0	78.7	59.1	74.5	75.6	71.1	73.5	73.3	74.0	73.7	78.1	59.6
SEAM+RW(affgt+seggt)	74.9	78.9	62.1	75.2	76.4	71.4	74.3	74.3	74.3	74.2	78.7	59.8
SEAM+RETAB	75.5	78.9	64.6	76.0	76.6	74.0	75.1	75.0	75.6	74.8	79.0	61.5
CPN+RW	68.5	70.7	61.5	68.5	66.8	73.8	68.5	66.6	74.5	68.5	71.2	59.7
CPN+RW(seggt)	74.7	78.6	62.4	75.5	76.0	74.0	75.5	75.7	74.8	74.4	78.8	60.2
CPN+RW(affgt+seggt)	76.1	79.0	66.8	76.5	76.8	75.7	75.6	75.6	75.5	74.9	79.3	60.7
CPN+RETAB	76.6	79.1	68.8	76.7	76.7	76.7	75.9	75.8	76.2	75.3	79.3	62.4
Fully Oracle	77.9	79.1	74.4	77.9	77.7	78.7	77.9	76.4	82.9	77.9	79.6	72.6

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Visualized pseudo labels on VOC12 train set. Examples from top to bottom belong to novel samples in fold 0,1,2,3, respectively. (a) image. (b) GT. (c) CAM. (d)(e) CAM+RW and pesudo labels. (f) boundary prediction. (g)(h) CAM+RETAB and pesudo labels.

Methodology

Visualizations

Qualitative semantic segmentation results for novel categories on PASCAL VOC 2012 val set. (a) image. (b) GT label. (c) "CAM+RW". (d) "CAM+RETAB". (e) "SEAM+RW". (f) "SEAM+RETAB". (g) "CPN+RW". (h) "CPN+RETAB".



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