MARS: Model-agnostic Biased Object Removal without Additional Supervision for Weakly-Supervised Semantic Segmentation

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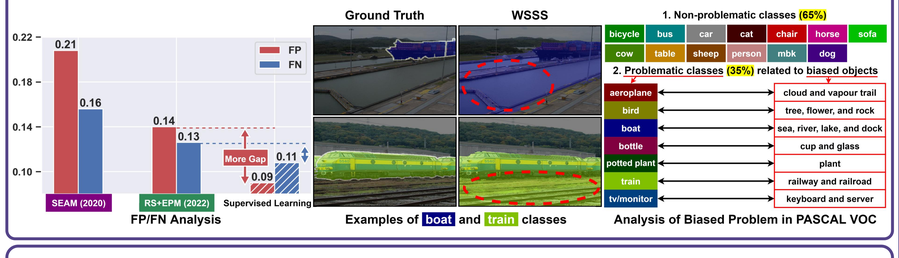
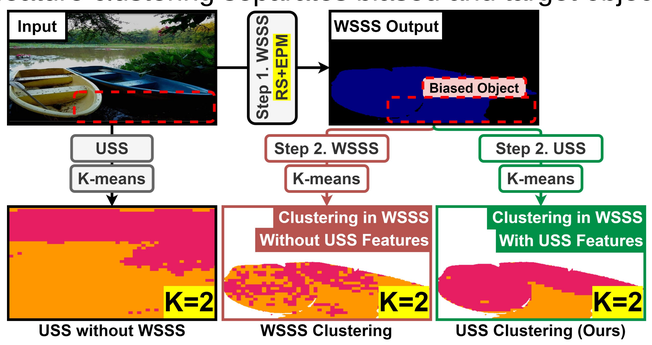
Introduction to Biased Problem

- ✓ The FP is the most crucial bottleneck for WSSS methods.
- ✓ Predicting class-related objects (e.g., sea) with target classes (e.g., boat) are factored into increasing FP.
- ✓ 35% of classes in the VOC dataset have biased objects.

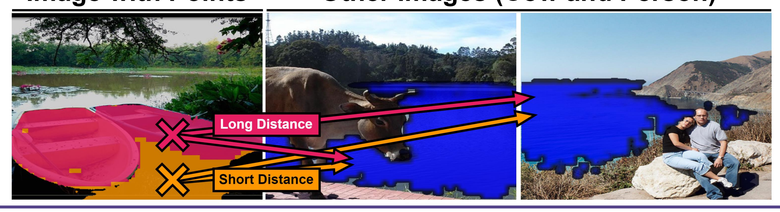


First Applying USS in WSSS

- ✓ USS feature clustering separates biased and target objects.

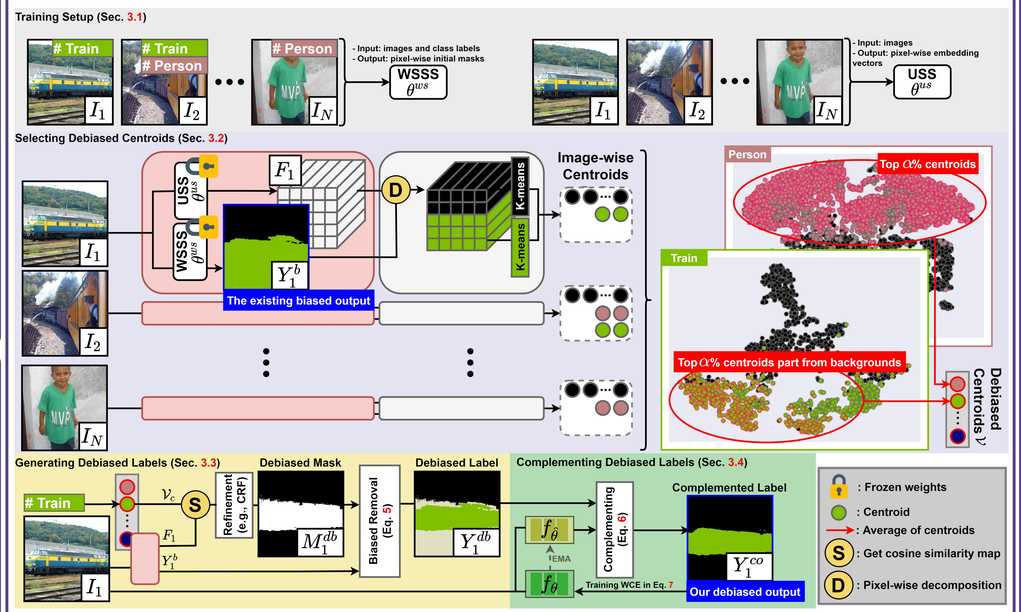


- ✓ The proposed distance metric selects the biased object among two isolated objects.

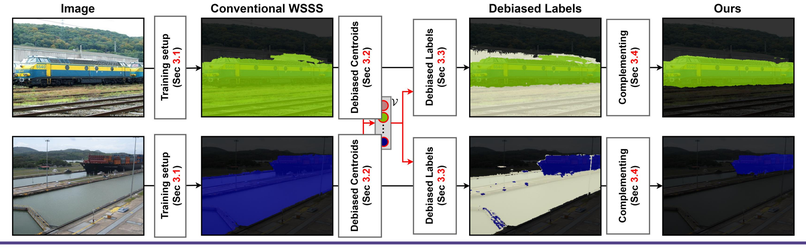


Fully-automatic Biased Object Removal

- ✓ Overview of MARS. Our method consists of three stages:



- ✓ The effect of the proposed components.



Summary & Conclusion

- ✓ We first apply USS features to address the biased problem in WSSS.
- ✓ We present MARS that removes biased objects by utilizing USS features, narrowing the performance gap of 53% between WSSS and FSSS.

Experiments and Results

- ✓ SOTA performance on WSSS benchmarks.

Method	Backbone	Sup.	VOC *val*	VOC *test*	COCO *val*
DSRG CVPR'18 [16]	R101	$\mathcal{I}$+$\mathcal{S}$	61.4	63.2	26.0*
W-OoD CVPR'22 [29]	R101	$\mathcal{I}$+$\mathcal{D}$	69.8	69.9	-
L2G CVPR'22 [19]	R101	$\mathcal{I}$+$\mathcal{S}$	72.1	71.7	44.2
RCA CVPR'22 [58]	R101	$\mathcal{I}$+$\mathcal{S}$	72.2	72.8	36.8*
PPC CVPR'22 [12]	R101	$\mathcal{I}$+$\mathcal{S}$	72.6	73.6	-
SSDD ICCV'19 [43]	R101	$\mathcal{I}$	64.9	65.5	-
OAA ICCV'19 [18]	R101	$\mathcal{I}$	63.9	65.6	-
CONTA [56]	R101	$\mathcal{I}$	66.1	66.7	32.8
AdvCAM CVPR'21 [28]	R101	$\mathcal{I}$	68.1	68.0	-
RIB NeurIPS'21 [26]	R101	$\mathcal{I}$	68.3	68.6	43.8
AMN CVPR'22 [30]	R101	$\mathcal{I}$	69.5	69.6	44.7
SANCE CVPR'22 [32]	R101	$\mathcal{I}$	70.9	72.2	44.7†
RS+EPM Arxiv'22 [21]	R101	$\mathcal{I}$	74.4	73.6	46.4
MARS (Ours)	R101	$\mathcal{I}$	**77.7**	**77.2**	**49.4**
FSSS	R101	$\mathcal{F}$	80.6	81.0	61.8

- ✓ Verify the flexibility of MARS by integrating it with various WSSS and USS methods.

Method	USS	Backbone	mIoU (*val*)	mIoU (*test*)
RS+EPM [21]	✗	R101	74.4	73.6
+ Ours	Leopart [59]	R101	75.4	75.8
+ Ours	STEGO [14]	R101	**77.7**	**77.2**

Method	Backbone	Segmentation	mIoU (*val*)	mIoU (*test*)
IRNet [1]	R50	DeepLabv2	63.5	64.8
+ Ours	R50	DeepLabv2	**69.8 (49%)**	**70.9 (52%)**
FSSS	R50	DeepLabv2	76.3	76.5
RS+EPM [21]	R101	DeepLabv3+	74.4	73.6
+ Ours	R101	DeepLabv3+	**77.7 (53%)**	**77.2 (49%)**
FSSS	R101	DeepLabv3+	80.6	81.0

- ✓ Visualization of our segmentation results.