Multi-Target Domain Adaptation with Class-Wise Attribute Transfer in Semantic Segmentation

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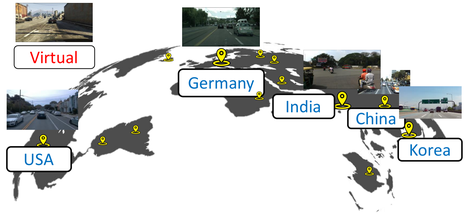
BMVC 2023

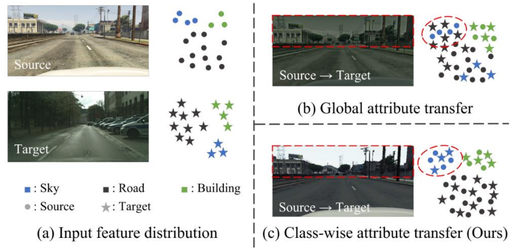
Problem

- **Multi-target domain adaptation (MTDA)** aims to adapt a single model from a labeled source domain to multiple unlabeled target domains.

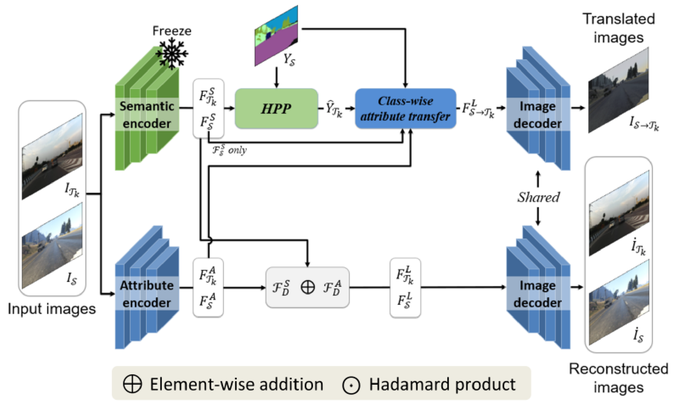


Motivation

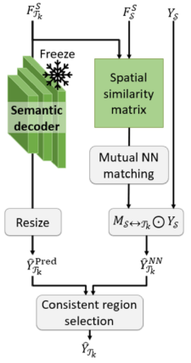
- One of the crucial aspects in Multi-Target Domain Adaptation is attribute alignment, given the varying image distribution across domains.
- However, previous methods [1, 2] only globally align attributes and do not achieve class-wise alignment, which has limited their performance.
- Therefore, we propose a method for class-wise attribute transfer from source domain to multiple target domains.



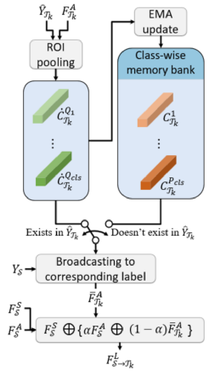
Proposed Method



(a) Overall procedure



(b) High-precision pseudo labeling (HPP)



(c) Class-wise attribute transfer

Ablation Study

Effectiveness of HPP

Attribute transfer comparison

Method	mIoU C	mIoU I	mIoU M	mIoU Avg.
Color Transfer	33.8	37.4	42.1	37.8
DRANet	37.3	39.3	43.2	39.9
MTDT-Net	41.4	40.6	44.1	42.0
Ours	**42.7**	**41.3**	**45.3**	**43.1**

HPP label accuracy

	Cityscapes	IDD	Mapillary	Avg.
$\hat{Y}^{NN}_{\mathcal{T}_k}$	0.59	0.57	0.55	0.57
$\hat{Y}^{Pred}_{\mathcal{T}_k}$ + BARS	0.72	0.66	0.73	0.70
Ours	**0.85**	**0.85**	**0.88**	**0.86**

Results

Domain Transfer Results

Multi-Target Domain Adaptation Results

	Method	mIoU C	mIoU I	mIoU M	mIoU Avg.
G→C,I	ADVENT	70.0	64.8	-	67.4
	MTKT	70.4	65.9	-	68.2
	ADAS	**75.4**	66.9	-	71.2
	Ours	74.4	**69.2**	-	**71.8**
G→C,M	ADVENT	69.1	-	68.7	68.9
	MTKT	71.1	-	70.8	70.9
	ADAS	**75.3**	-	72.6	73.9
	Ours	74.8	-	**73.8**	**74.3**
G→C,I,M	ADVENT	69.8	65.6	68.0	67.8
	MTKT	70.4	65.9	71.1	69.1
	ADAS	**74.9**	66.7	72.2	71.3
	Ours	74.0	**70.3**	**74.3**	**72.9**

	Method	mIoU C	mIoU I	mIoU M	mIoU Avg.
G→C,I	CCL	45.0	46.0	-	45.5
	ADAS	45.8	46.3	-	46.1
	Ours	**46.5**	**46.9**	-	**46.7**
G→C,M	CCL	45.1	-	48.8	46.8
	ADAS	45.8	-	**49.2**	47.5
	Ours	**47.1**	-	48.9	**48.0**
G→I,M	CCL	-	44.5	46.4	45.5
	ADAS	-	**46.1**	47.6	46.9
	Ours	-	45.7	**48.7**	**47.2**
G→C,I,M	CCL	46.7	47.0	49.9	47.9
	ADAS	46.9	47.7	**51.1**	48.6
	Ours	**49.3**	**48.8**	50.2	**49.4**

Reference

[1] Isobe, T. et al. "Multi-target domain adaptation with collaborative consistency learning." CVPR21.
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[4] Lee, S. et al., "DRANet: Disentangling Representation and Adaptation Networks for Unsupervised Cross-Domain Adaptation." CVPR21
[5] Reinhard, E. et al., "Color transfer between images." CGA00