Domain Bridge for Unpaired Image-to-Image Translation and Unsupervised Domain Adaptation

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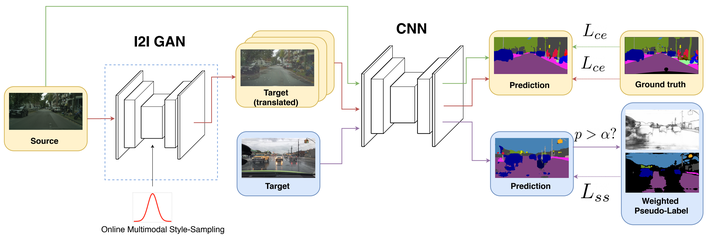
Motivation

The common practice to transfer learning to unseen weather scenario is to apply image-to-image translation and unsupervised domain adaptation. Yet, this relies on the ability to learn correct weather translation.

How to learn i2i with limited data and transfer learning to new domain ?

Pipeline overview

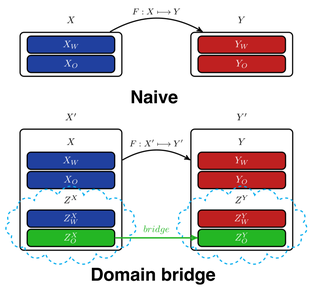


Main contributions:

- Domain Bridge (DB)
- Online Multimodal Style-sampling (OMS)
- Weighted Pseudo Labels (WPL)

[1] Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks, Jun-Yan Zhu et al., ICCV 2017
[2] Multimodal Unsupervised Image-to-Image translation, Xun Huang et al., ECCV 2018
[3] Learning to Adapt Structured Output Space for Semantic Segmentation, Yi-Hsuan Tsai et al., CVPR 2018
[4] Bidirectional Learning for Domain Adaptation of Semantic Segmentation, Yusheng Li et al., CVPR 2019

Domain bridge



Youtube video for bridging domains

$$X = \{X_W, X_O\}$$
$$Z^x = \{Z^x_W, Z^x_O\}$$

combine

$$Y = \{Y_W, Y_O\}$$
$$Z^y = \{Z^y_W, Z^y_O\}$$

combine

$$max\,|Z^x_W \cap X_W|\,,$$
$$max\,|Z^y_W \cap Y_W|\,,$$
$$max\,|Z^x_O \cap Z^y_O|$$

How to select frames?

Weighted Pseudo Labels

Regress pseudo labels threshold through training

$$w_u = \begin{cases} \frac{\max(f_u(x)) - \alpha}{1-\alpha} & \text{if } \max(f_u(x)) \geq \alpha \\ 0 & \text{otherwise} \end{cases},$$

$$L_w = -\sum_{q \in Q} w_u \hat{x}_{u,q} log(p_u),$$

PL — Weighted CE Loss

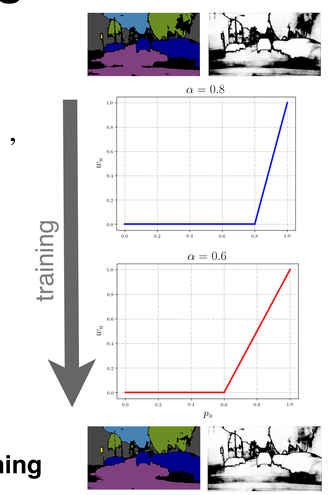
$$L_b = log^2(1-\alpha),$$

Balancing Loss

$$L_{ss} = \sigma L_w + \gamma L_b$$

$\alpha \mapsto 0$

$\alpha \mapsto 1$

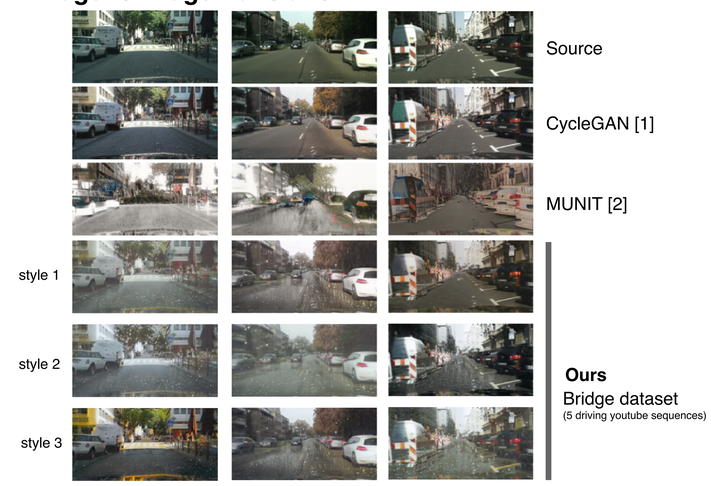


Act as a region growing self-supervised learning

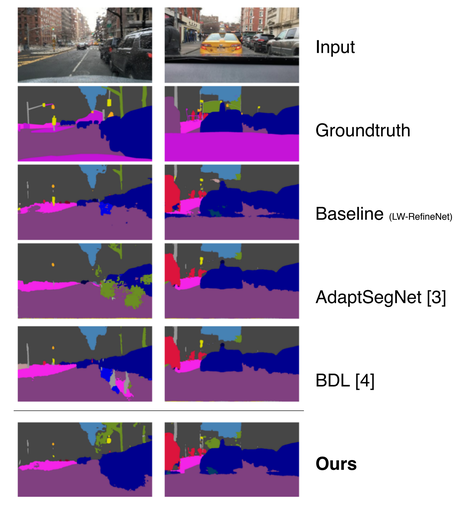
Experiments (clear → rain)

Evaluation on Cityscapes (*clear*) to Berkeley DeepDrive (*rain*)

Image to image translation



Unsupervised Domain Adaptation



Method	mIoU
Baseline	31.67
AdaptSegNet	33.44
BDL	39.60
w/o OMS & WPL	35.18
w/o WPL	39.72
Ours	**40.04**

mIoU on BDD-rainy

Pseudo-labels	mIoU target
None	39.77
Batch-wise	38.23
WPL (Ours)	**40.04**

Varying pseudo labels strategies