Data Science
fwdays

Shadows Generation in the Wild

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Rails Reactor

Who am I

ML Engineer @ Rails Reactor

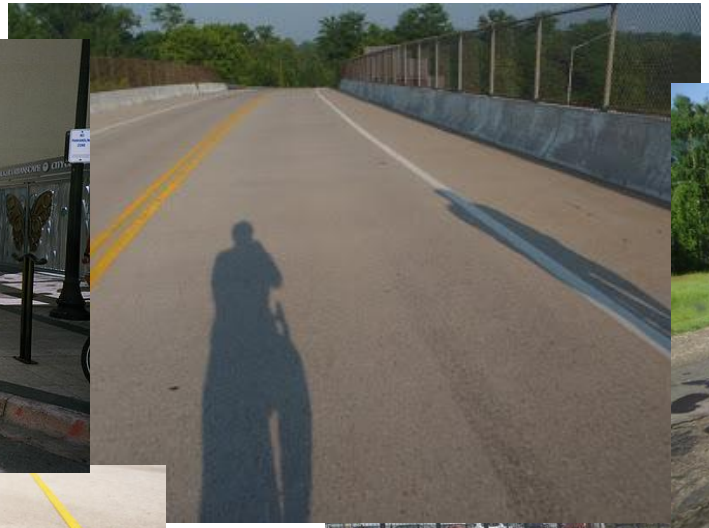
ML Engineer @ [redacted] (censored)

Disclaimer!
All the provided information based on open publication and datasets

Agenda

- Motivation
- Generative Adversarial Networks
- Cycle GAN
- MaskShadowGAN
- U-GAT-IT
- Summary

What's wrong with shadows?



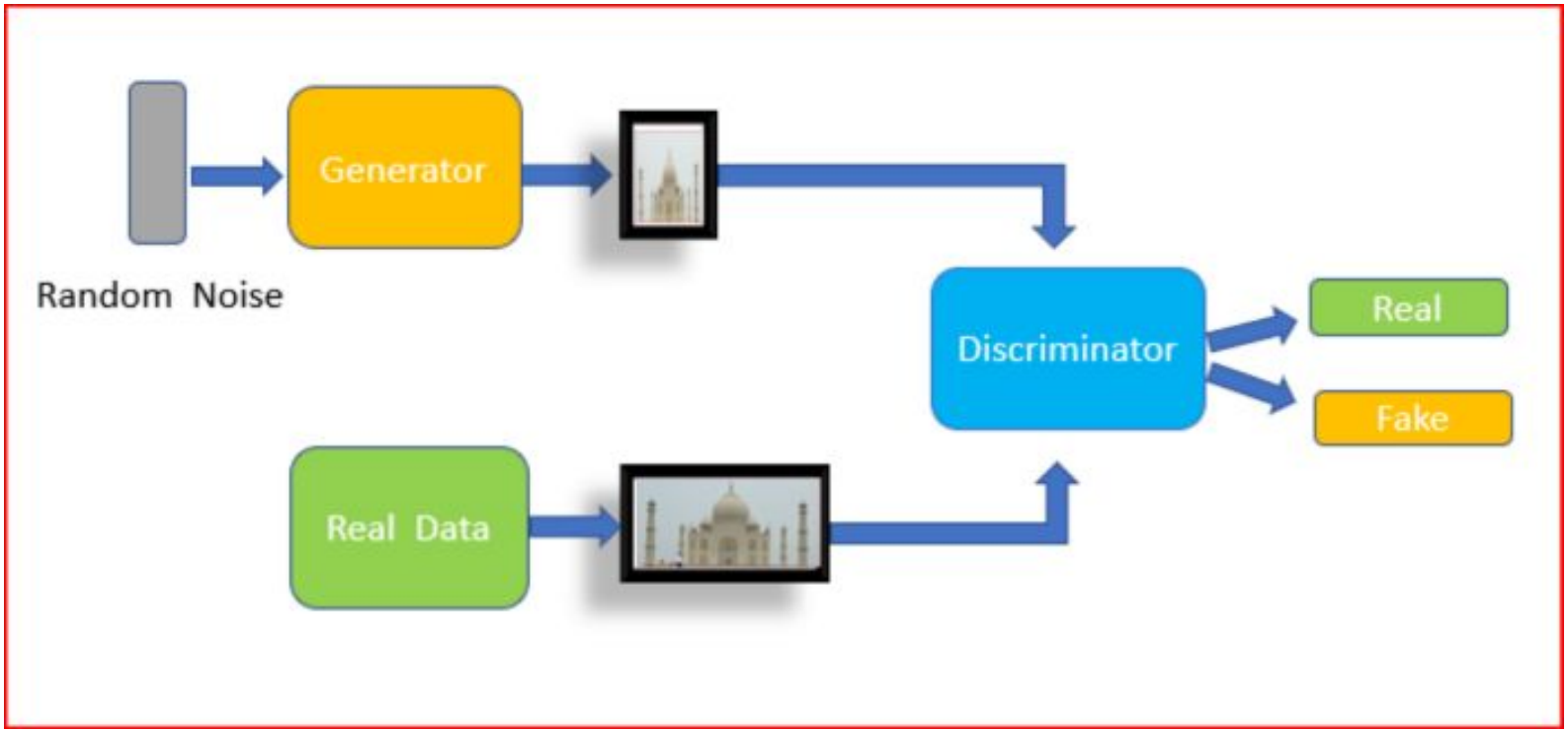
What do we want?

Datasets

SBU Dataset (link) - this new dataset contains 4,727 images (4,089 train images and 638 test images) with pixel based ground truth.

ISTD Dataset (link) - it contains 1870 triplets of shadow, shadow mask and shadow-free image under 135 different scenarios.

Generative Adversarial Networks



https://medium.com/datadriveninvestor/generative-adversarial-network-gan-using-keras-ce1c05cfdfd3

GAN objective

$$\min_G \max_D V(D,G) = \mathbb{E}_{\boldsymbol{x} \in p_{\text{data}}(\boldsymbol{x})}[\log D(\boldsymbol{x})] + \mathbb{E}_{\boldsymbol{z} \in p_{\boldsymbol{z}}(\boldsymbol{z})}[\log(1 - D(G(\boldsymbol{z}))]$$

Conditional GAN

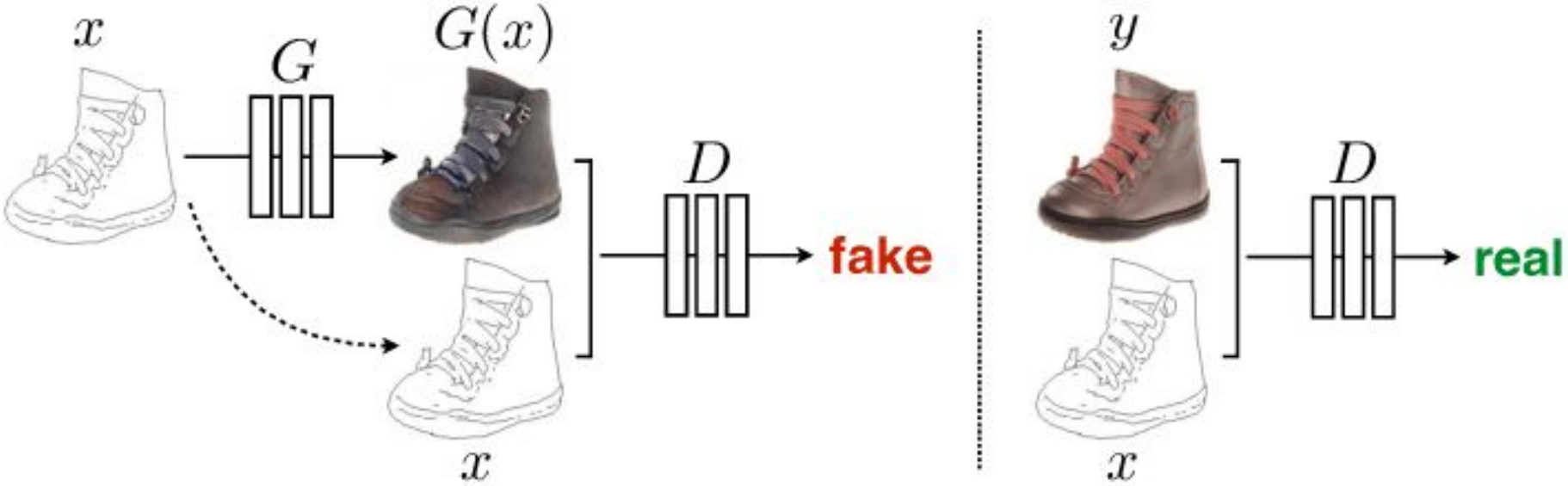


Image-to-Image Translation with Conditional Adversarial Networks

Conditional GAN

$$\min_G \max_D V(D,G) = \mathbb{E}_{\boldsymbol{x} \in p_{\text{data}}(\boldsymbol{x})}[\log D(\boldsymbol{x})] + \mathbb{E}_{\boldsymbol{z} \in p_{\boldsymbol{z}}(\boldsymbol{z})}[\log(1 - D(G(\boldsymbol{z}))]$$

x|y

z|y

Image-to-Image Translation with Conditional Adversarial Networks

Shadow Detection

[Fast Shadow Detection from a Single Image Using a Patched Convolutional Neural Network (2018)]

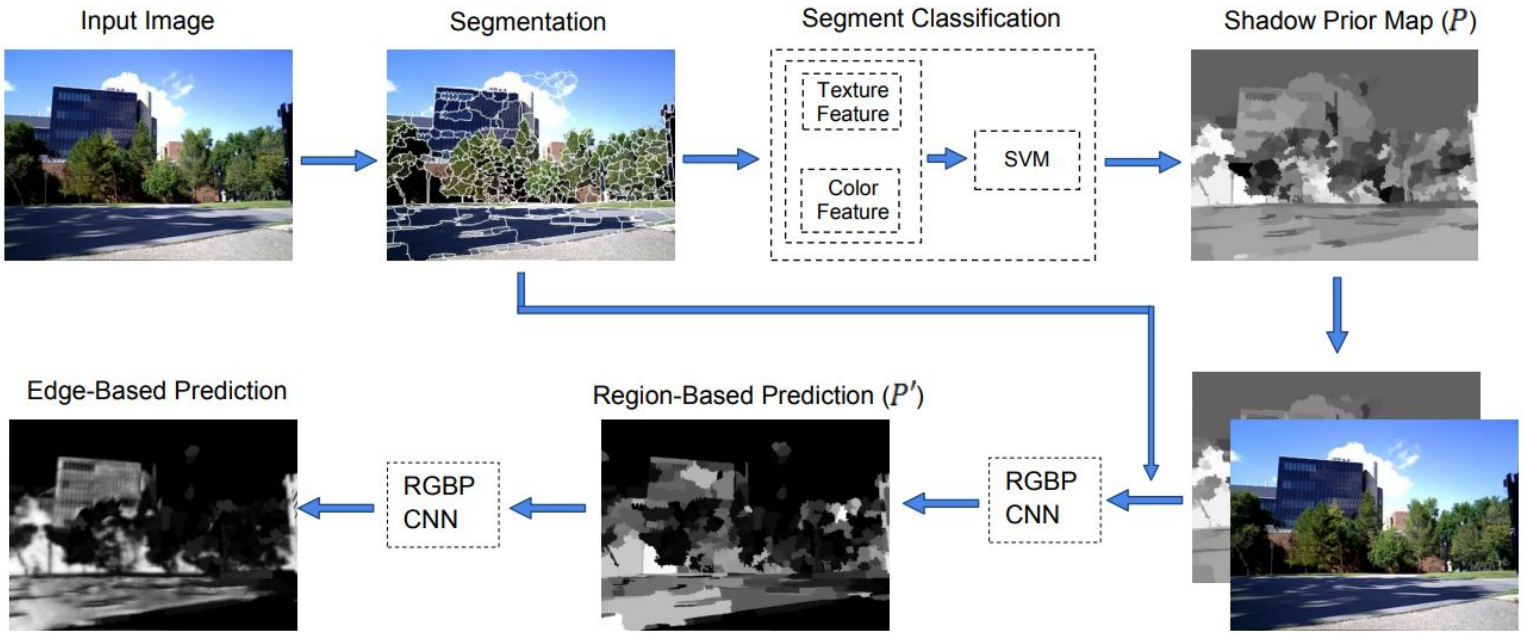


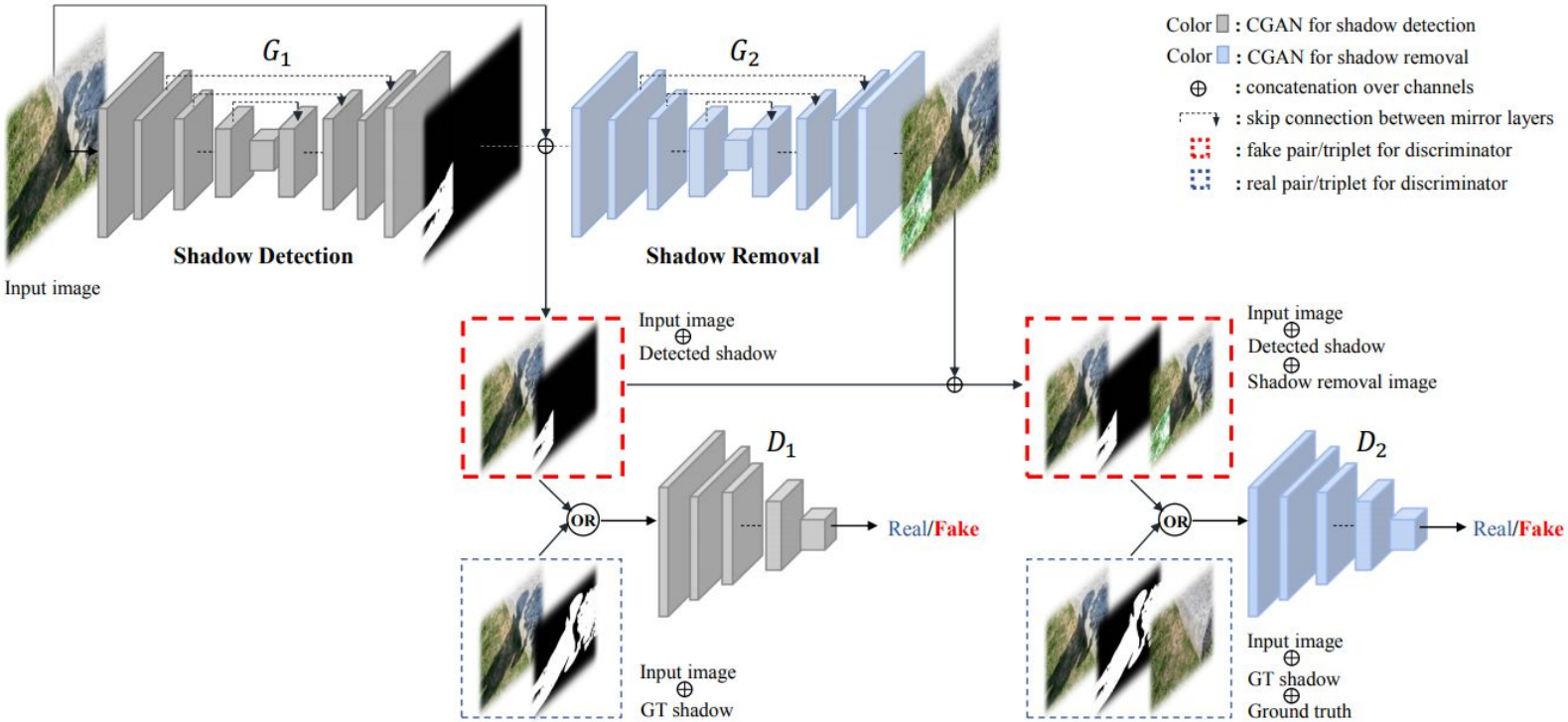
Fig. 2. Comparison of our qualitative results with the results of other methods. Rows from top to bottom: input images, ground truths, results of unary-pairwise method, results of stacked-CNN, obtained probanility map of our method, binary mask of shadows based on the probability map of our method.

Fast Shadow Detection from a Single Image Using a Patched Convolutional Neural Network (2018)

Shadow detected

What next?

Approach #2 - Shadow Detection & Removing



Stacked Conditional Generative Adversarial Networks for Jointly Learning Shadow Detection and Shadow Removal (2017)

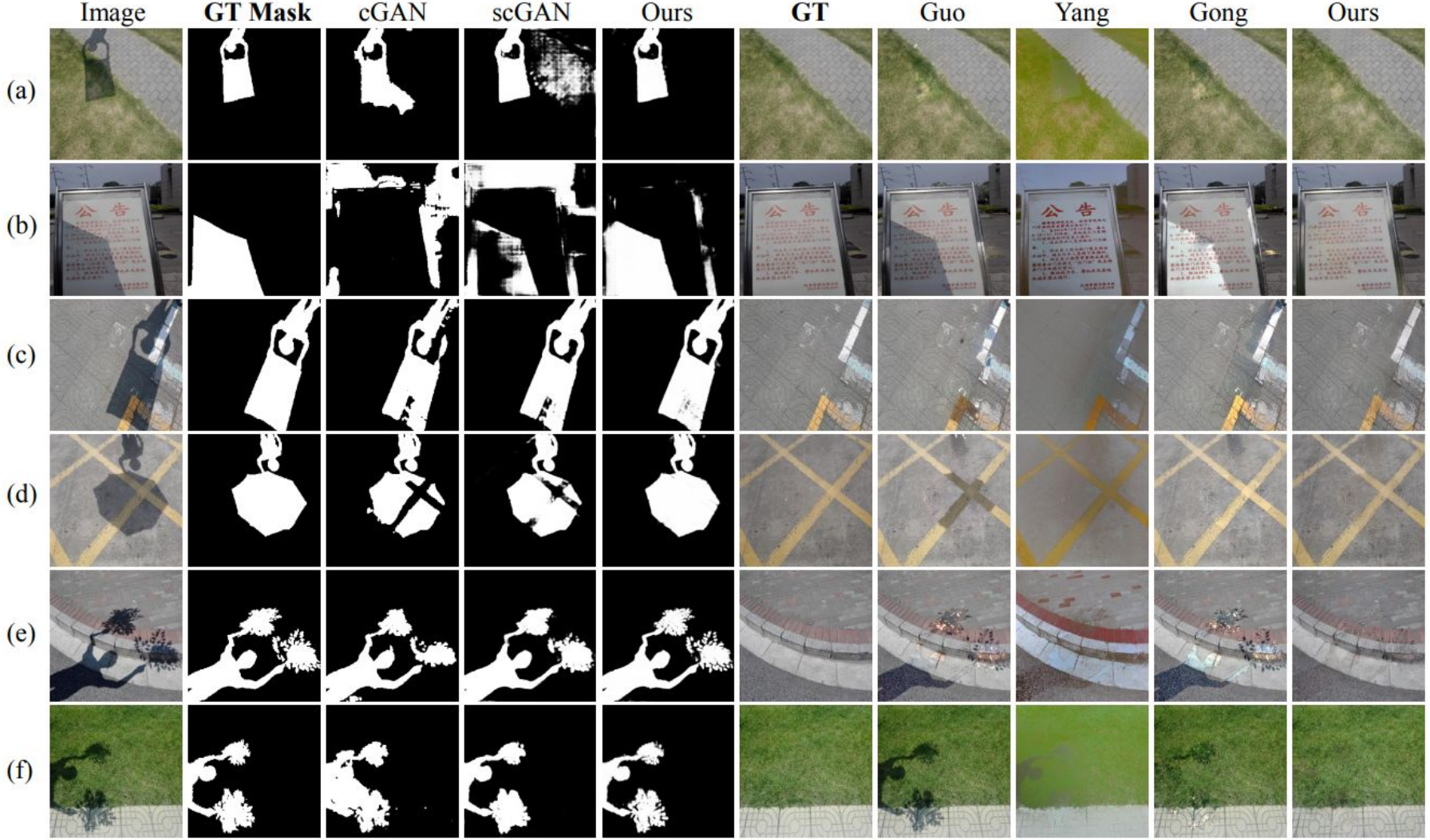
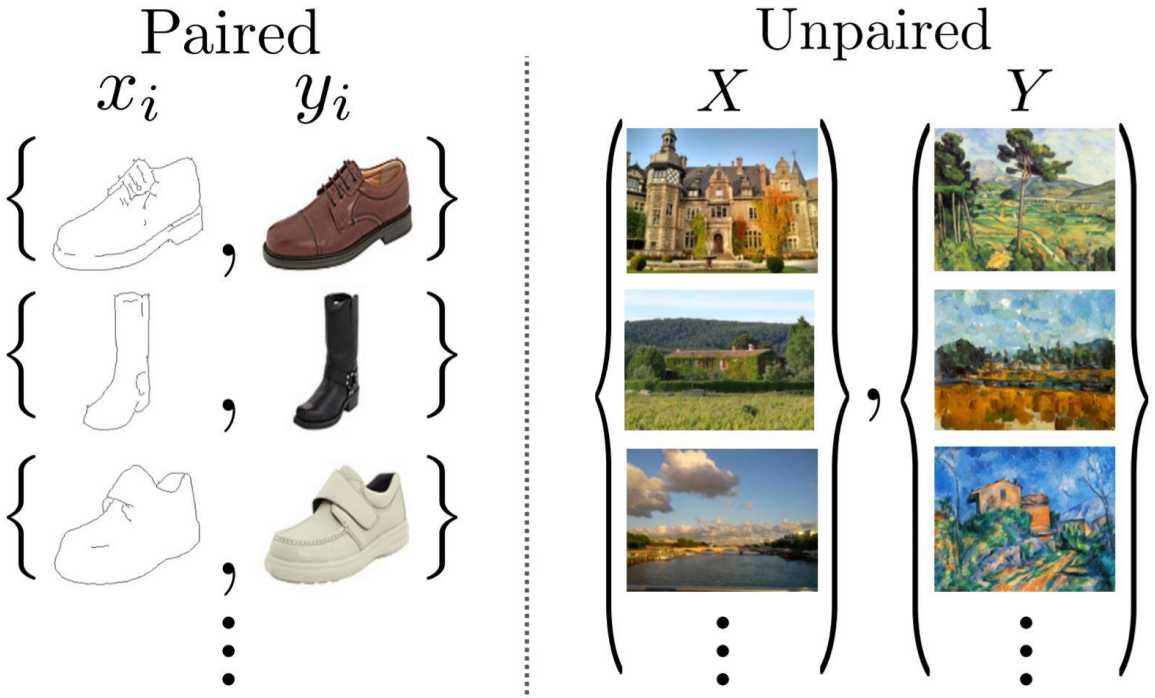


Image
GT Mask
cGAN
scGAN
Ours
GT
Guo
Yang
Gong
Ours
(a)
(b)
(c)
(d)
(e)
(f)

Shadow Detection & Removing

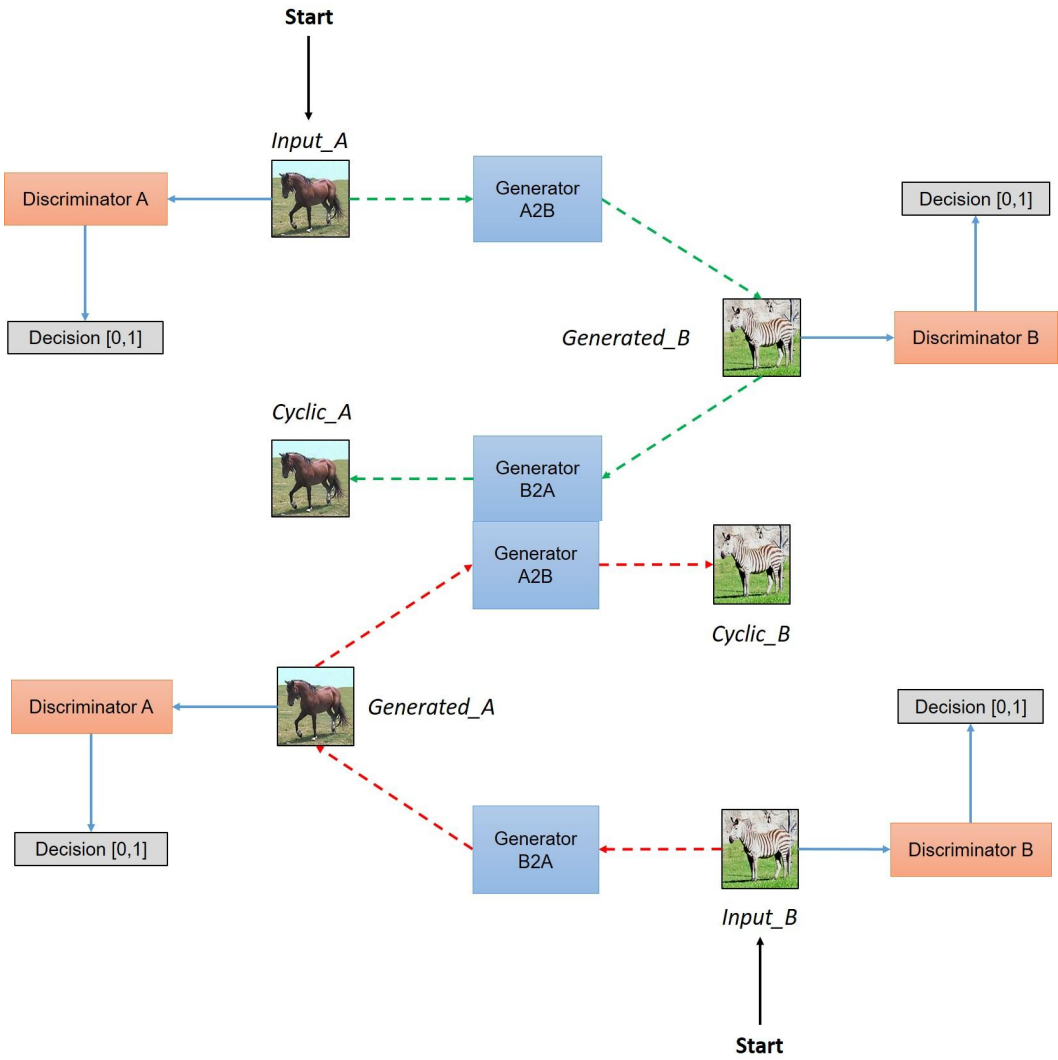
Approach #3 - Shadow Generation/Augmentation

Cycle GAN - Datasets



https://hardikbansal.github.io/CycleGANBlog/

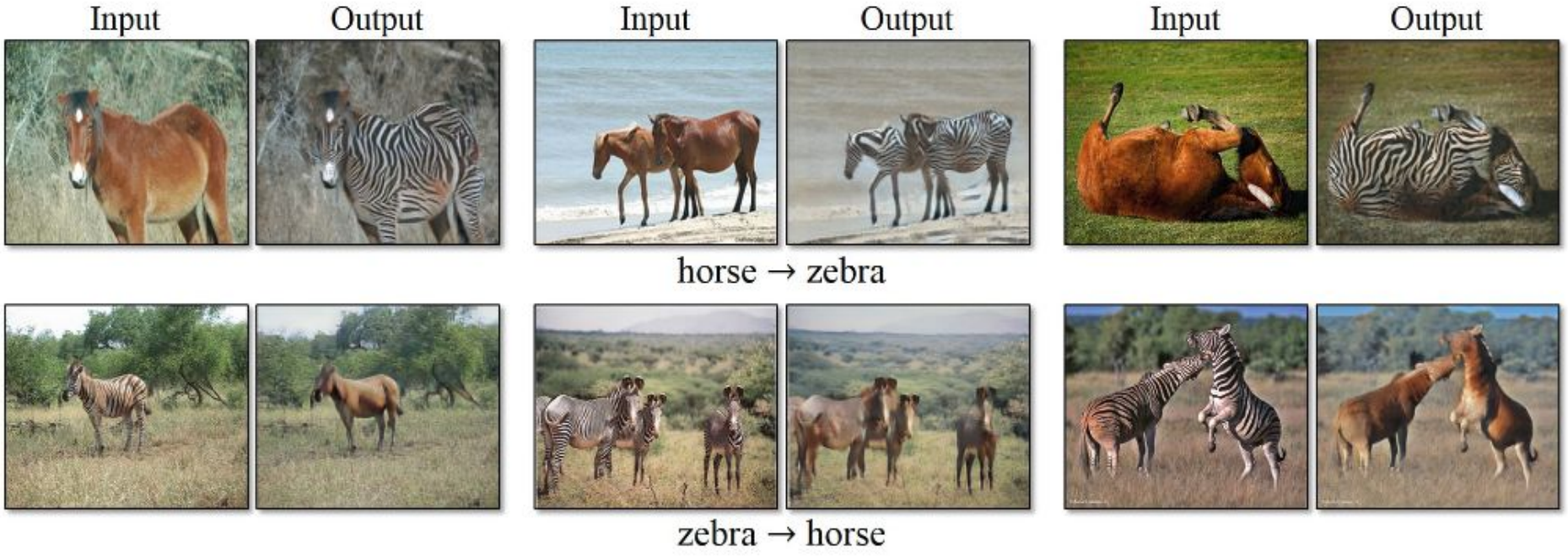
Cycle GAN



[Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks (2017)]

https://hardikbansal.github.io/CycleGANBlog/

Cycle GAN


Input
Output
Input
Output
Input
Output
horse → zebra
zebra → horse

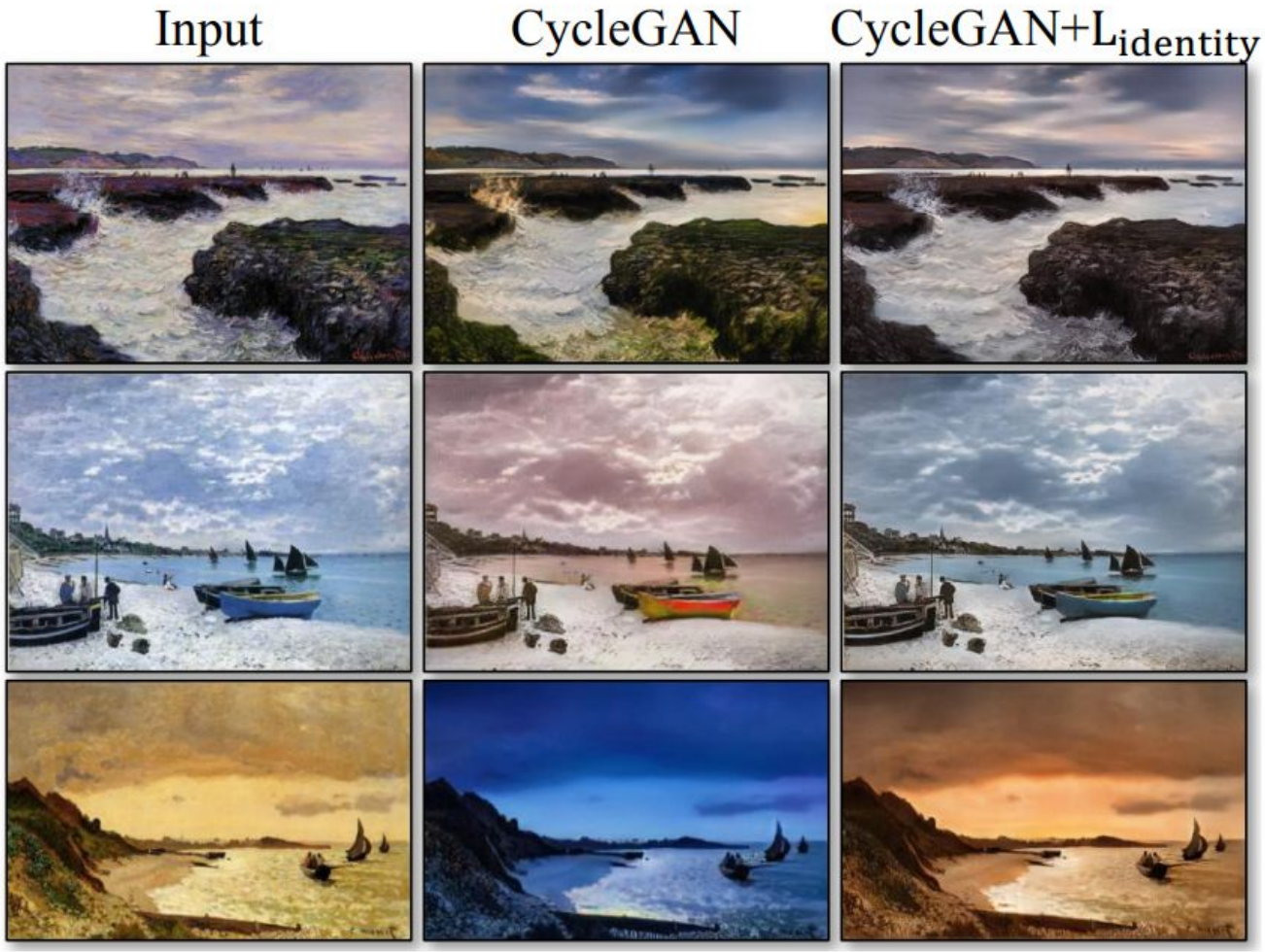
Cycle GAN

Identity Loss

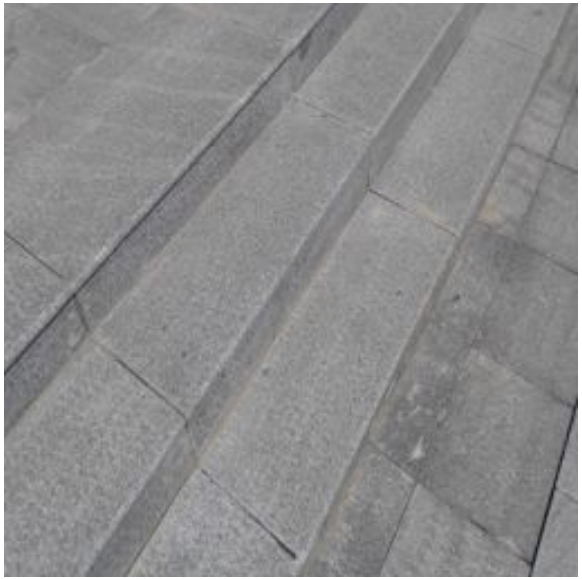
$$\mathcal{L}_{\text{identity}}(G, F) =$$

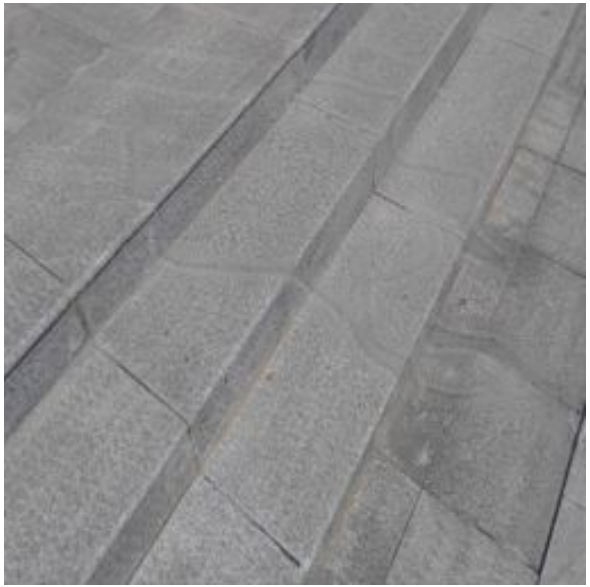
$$\mathbb{E}_{y \sim p_{\text{data}}(y)}[\|G(y) - y\|_1] +$$

$$\mathbb{E}_{x \sim p_{\text{data}}(x)}[\|F(x) - x\|_1].$$

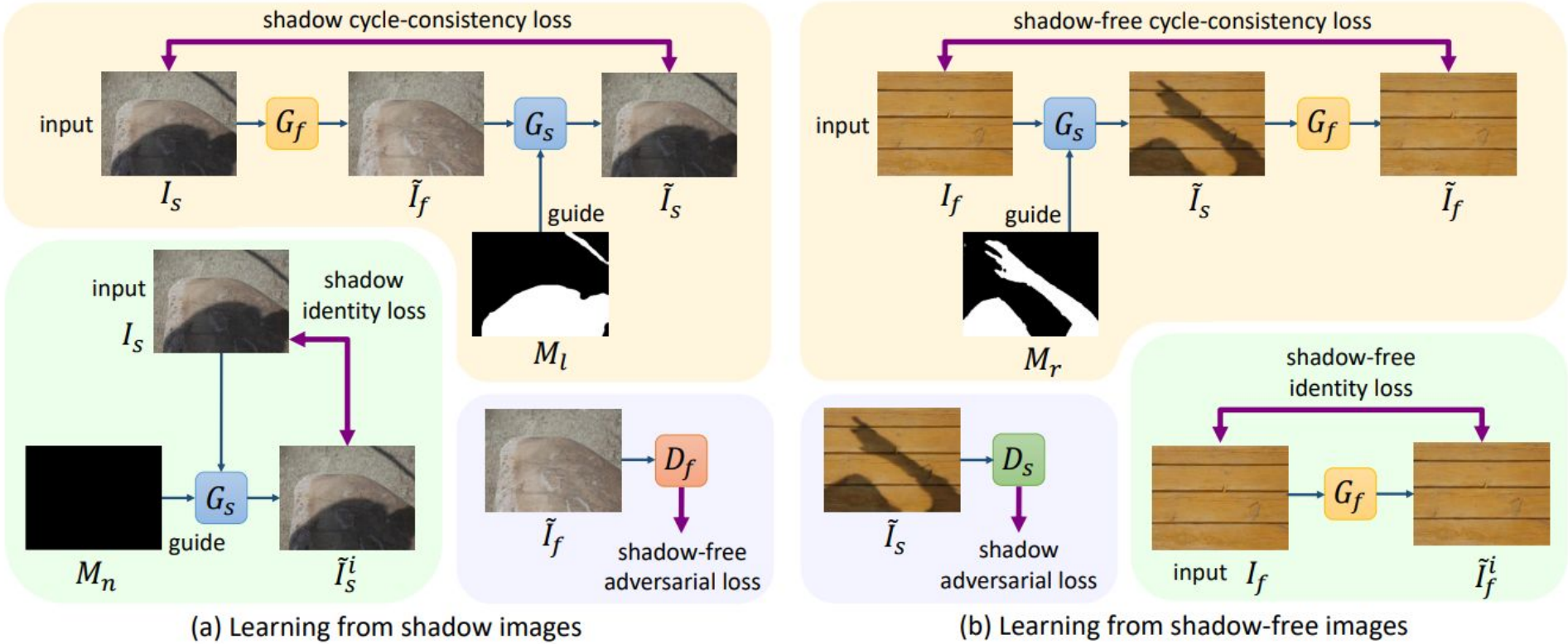


Cycle GAN





Mask-Shadow GAN



[Mask-ShadowGAN: Learning to Remove Shadows from Unpaired Data]

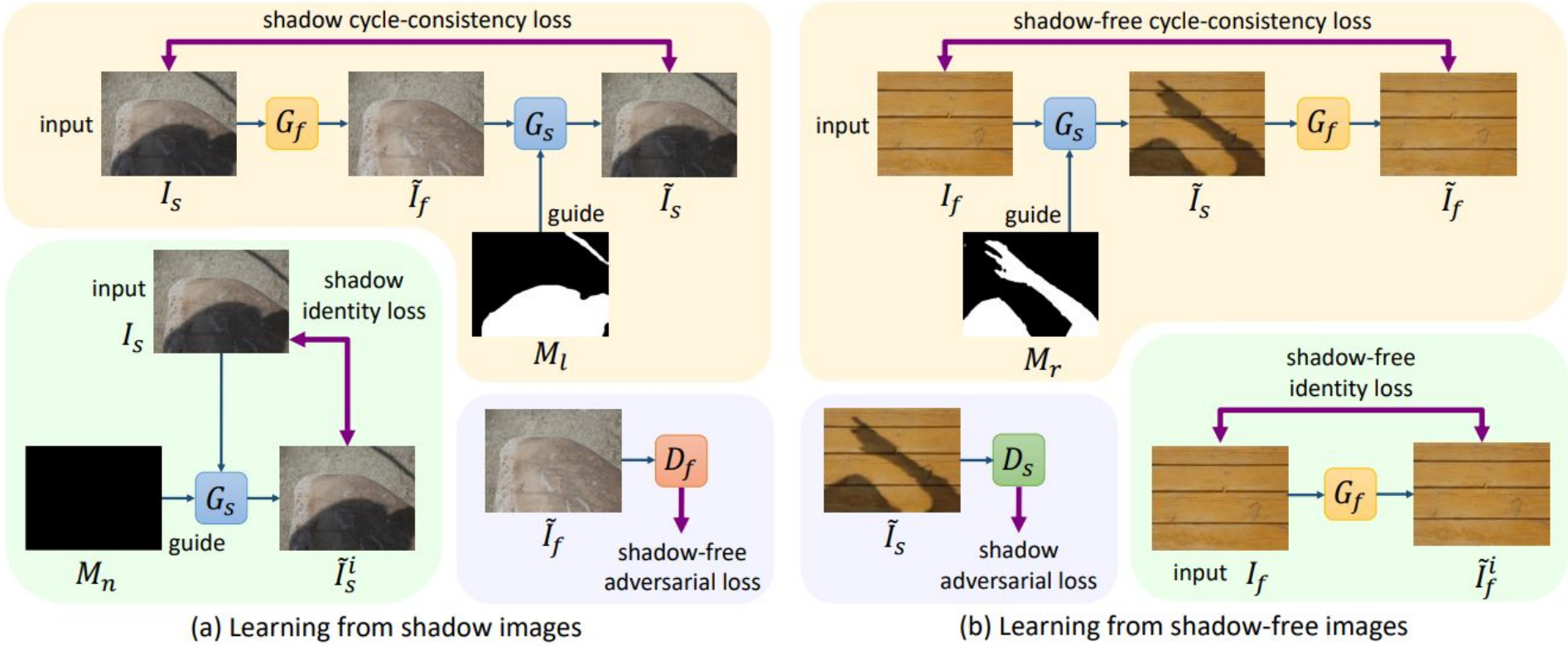
Mask-ShadowGAN



Mask-ShadowGAN

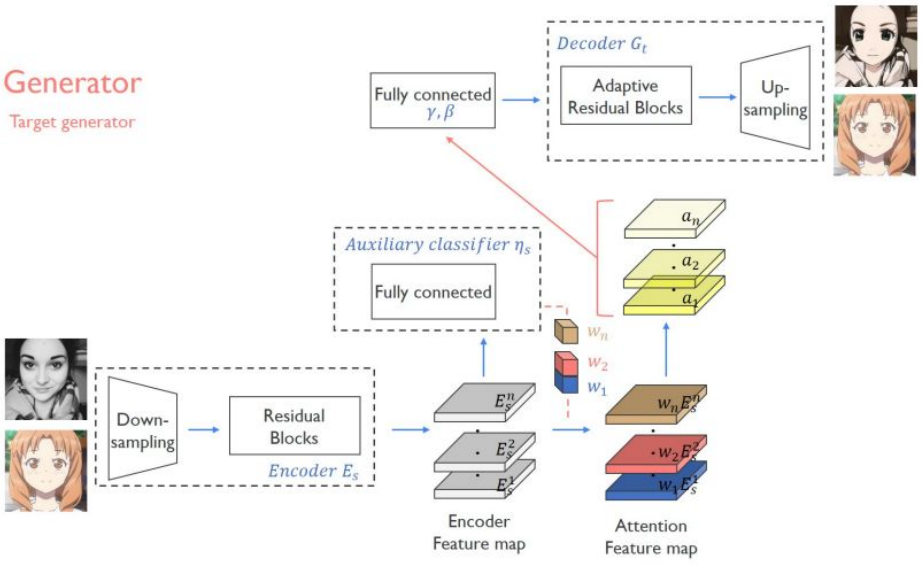


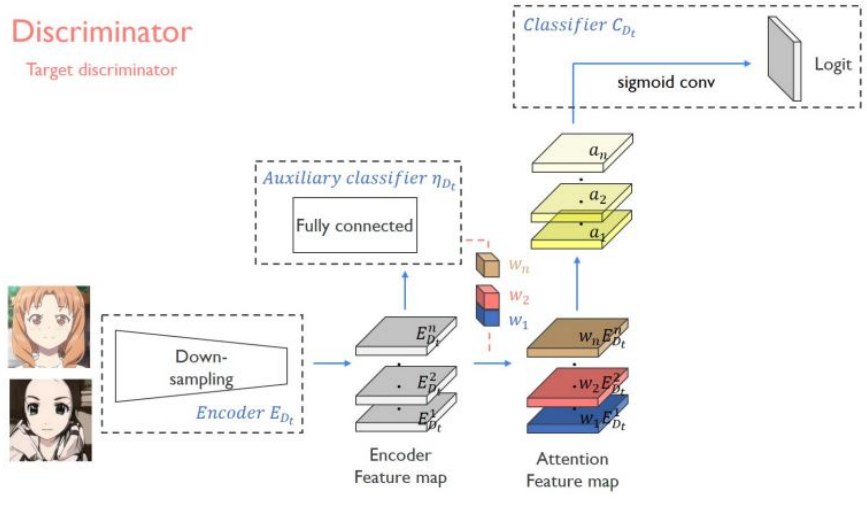
What to improve?



Mask-ShadowGAN: Learning to Remove Shadows from Unpaired Data

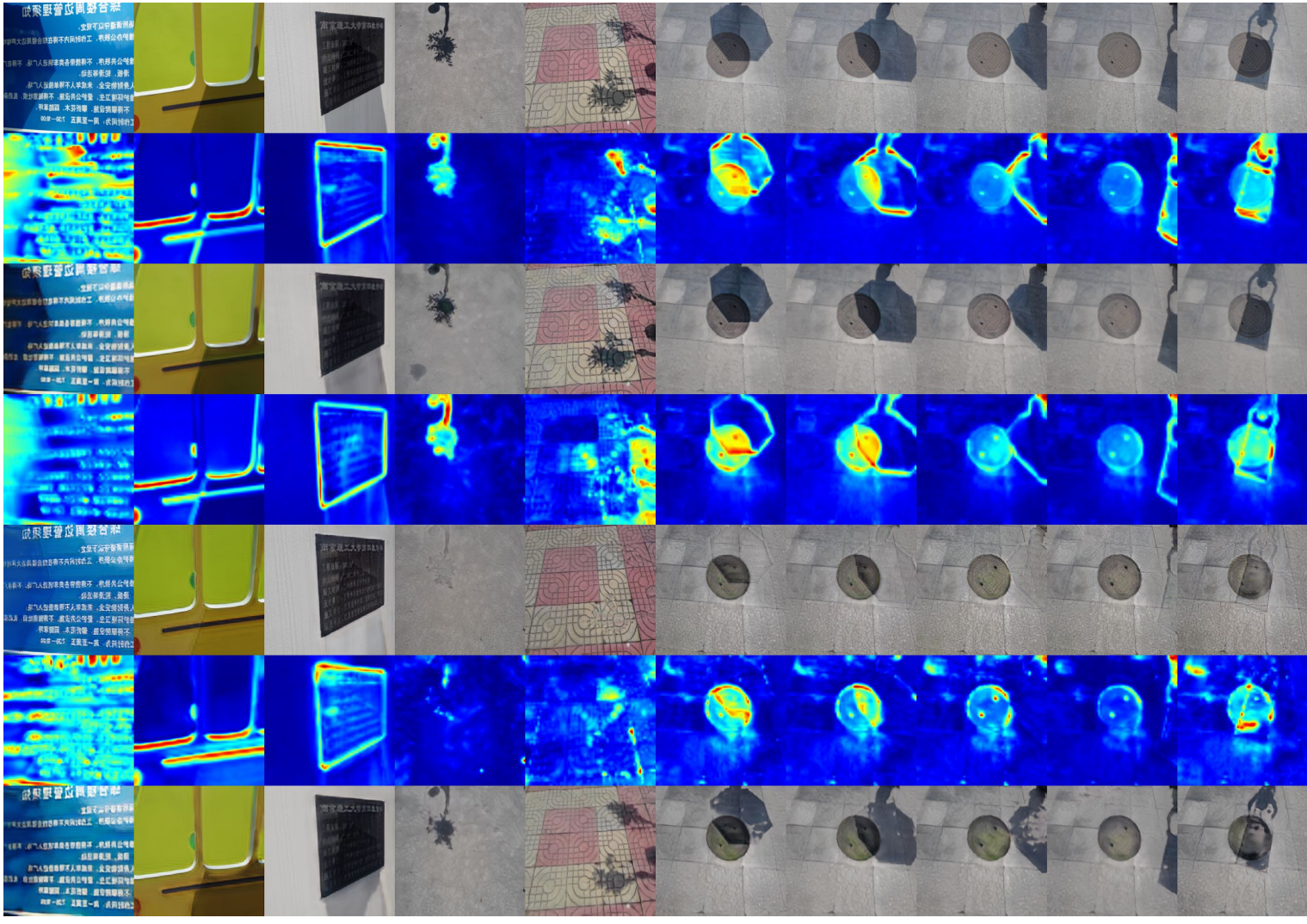
U-GAT-IT



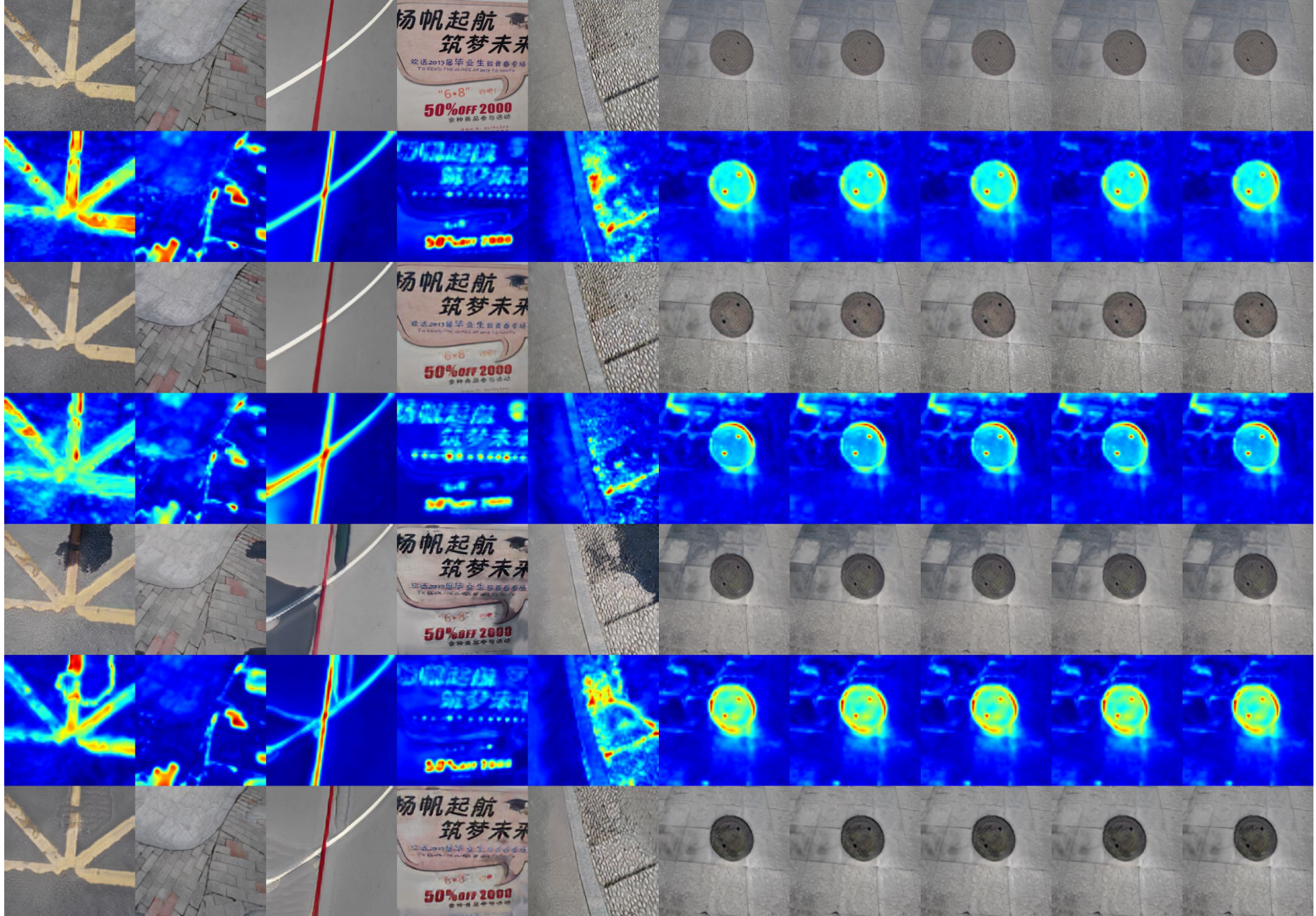


[U-GAT-IT: Unsupervised Generative Attentional Networks with Adaptive Layer-Instance Normalization for Image-to-Image Translation]

U-GAT-IT



U-GAT-IT



Summary

Thanks for your time and attention!

Questions?