Augmented Cyclic Consistency Regularization for Unpaired Image-to-Image Translation

ICPR2020

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*This work was done when the first author was in Tokyo Institute of Technology

Image-to-Image Translation

Mapping images from one domain to another

- Generator: X → Y
- Discriminator: Y → R (real/fake)
- Applicable to several downstream tasks

  → Domain Adaptation, Person Re-identification
- Focus: Stabilizing the training of I2I translation

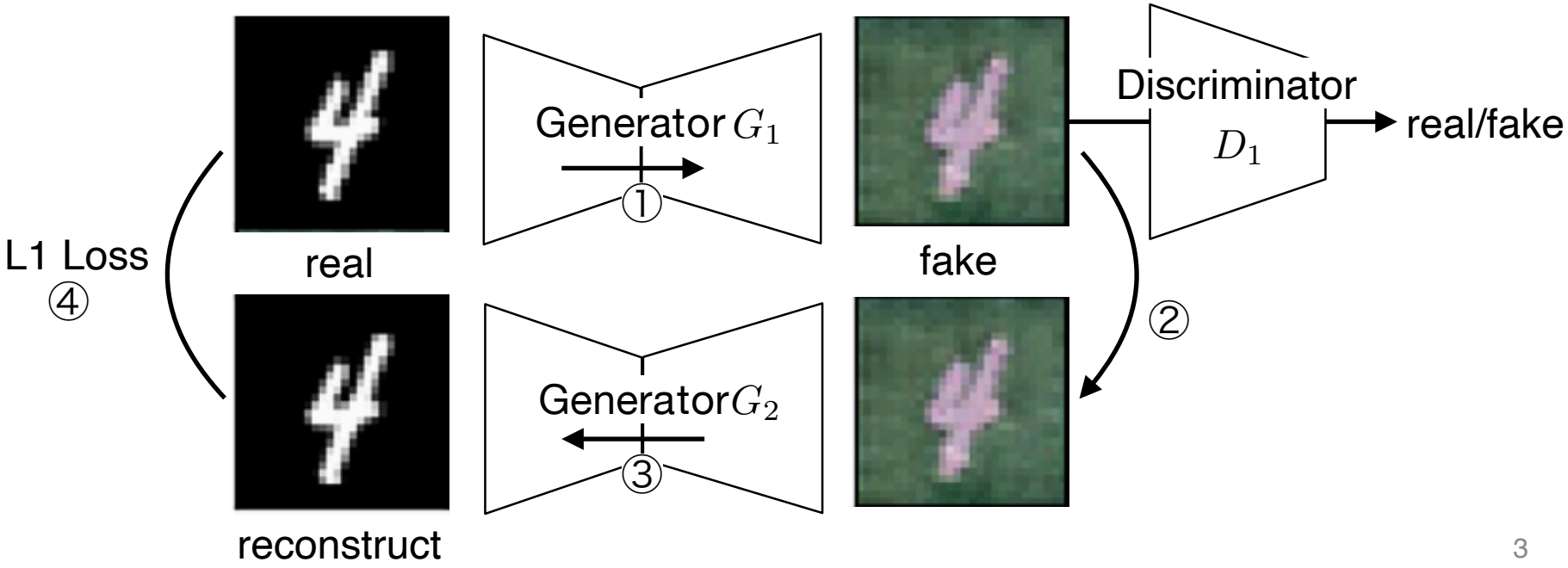
CycleGAN [J.Y Zhu+, ICCV'17]

Unpaired I2I translation with two generators

- Cycle-consistency constraint

Pixel-level regularization b/w real and reconstructed images

$$\mathcal{L}_{\text{cyc}}(G_1, G_2) = \mathbb{E}_{x_1 \sim p_{\text{data}}(x_1)}\left[\|G_2(G_1(x_1)) - x_1\|_1\right] + \mathbb{E}_{x_2 \sim p_{\text{data}}(x_2)}\left[\|G_1(G_2(x_2)) - x_2\|_1\right]$$



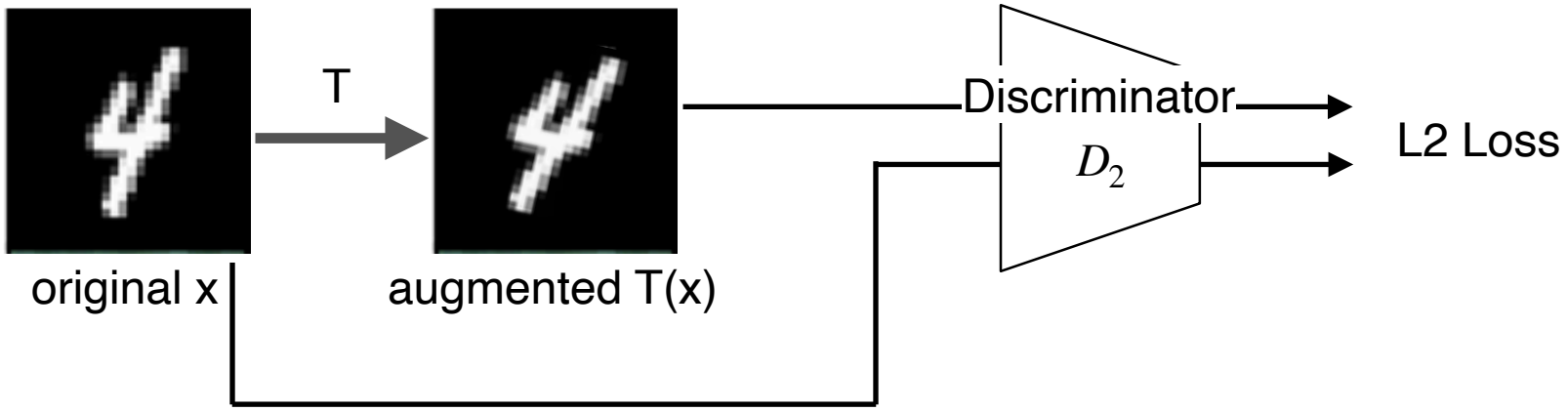
Consistency Regularization (CR) [M.Sajjadi+, NeurIPS'16]

Improve robustness using data perturbation

$$L_{cr} = \|D(x) - D(T(x))\|^2$$

x: image, T: flip, rotation, crop, color jitter

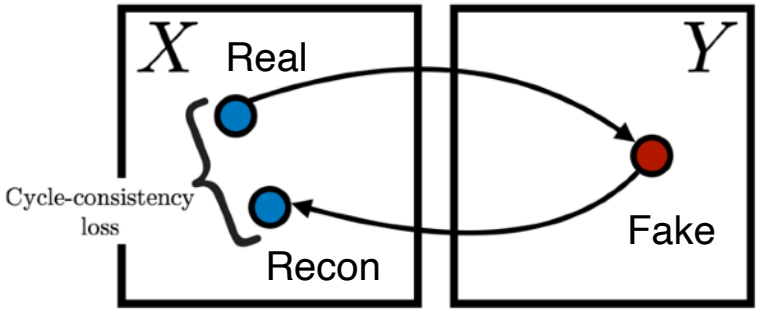
- Improve the smoothness of predictive distribution around training samples



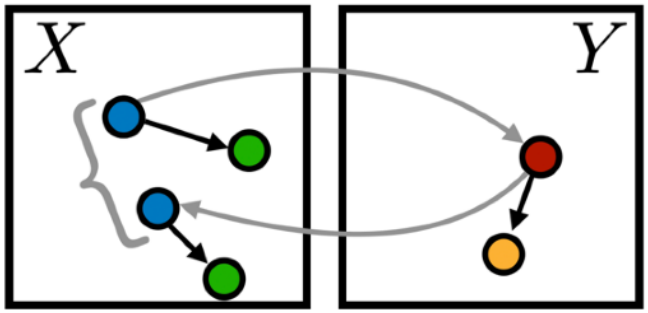
Augmented Cyclic Consistency Regularization

Consistency regularization for I2I translation

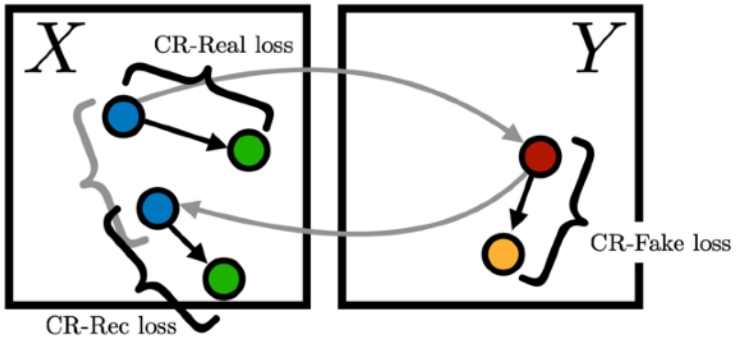
Step1: CycleGAN



Step2: Data augmentation



Step3: Consistency regularization

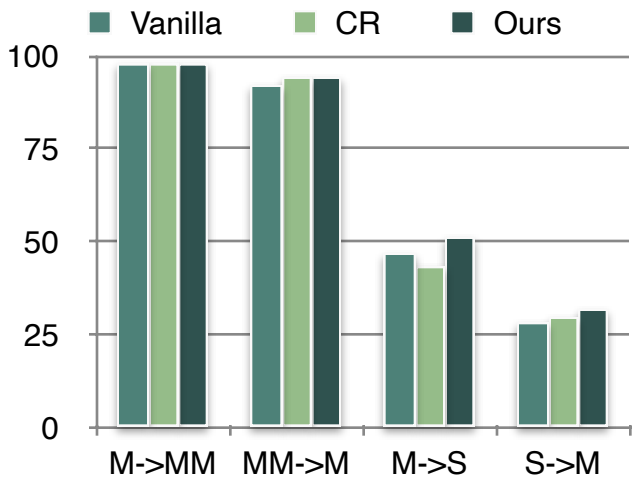


Results

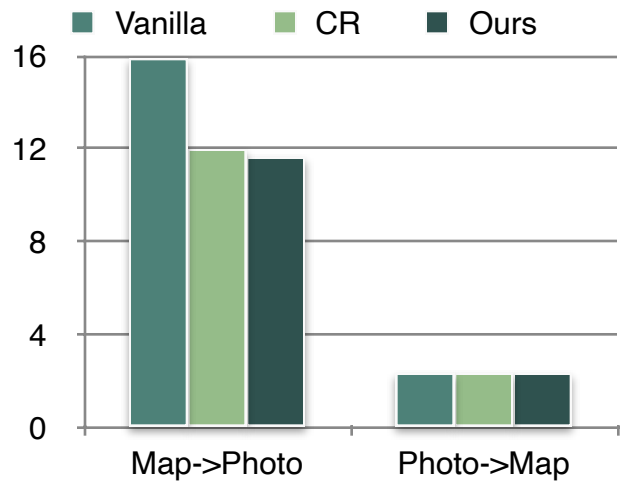
Achieved state-of-the-art performance on

1. MNSIT (M) ↔ MNIST-M (MM), MNSIT (M) <-> SVHN (S)
2. Maps ↔ Aerial photo
3. Cityscapes labels ↔ Photo

accuracy (%) ▲



MSE (with GT) * 100 ▼



MSE (with GT) * 100 ▼