CycleGAN with Better Cycles

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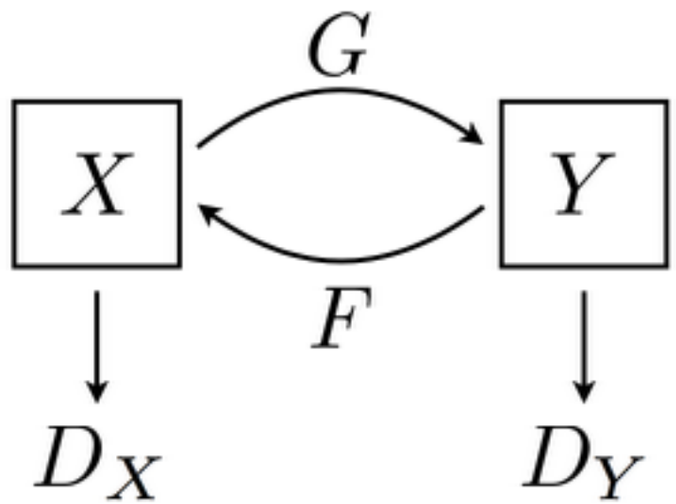
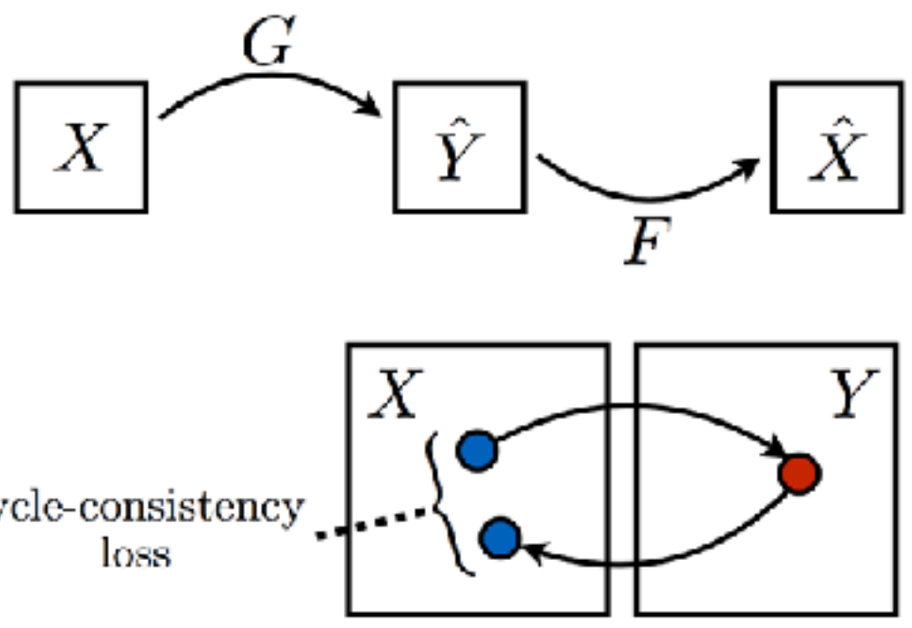
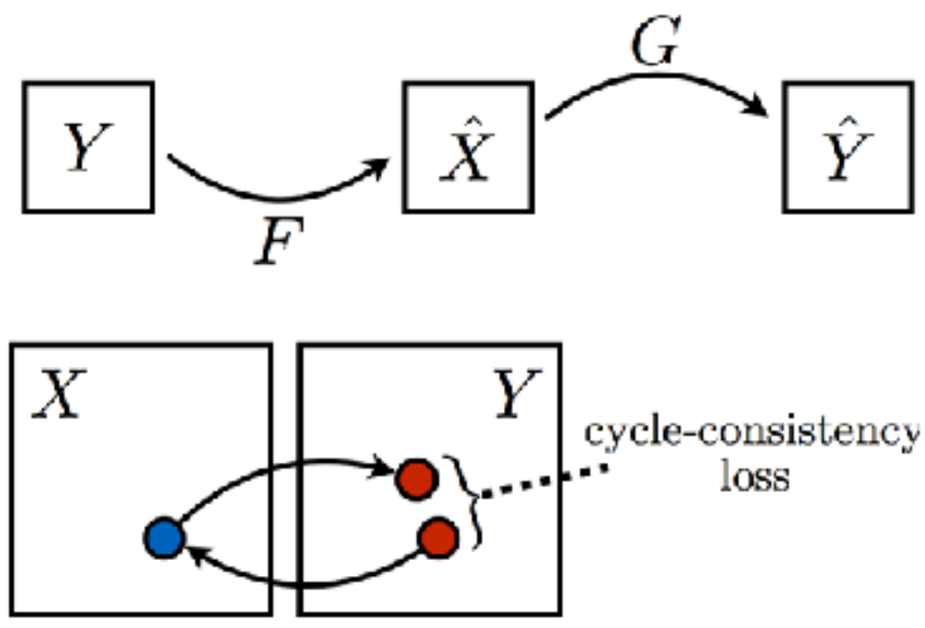
CycleGAN

GAN Loss:



Cycle-consistency Loss:





Figures from Zhu, Park et al. (2017)

CycleGAN

GAN Loss:

$$\begin{aligned}\mathcal{L}_{\text{GAN}}(G, D_Y, X, Y) =& \mathbb{E}_{y \sim p_{\text{data}}(y)}[\log D_Y(y)] \\ &+ \mathbb{E}_{x \sim p_{\text{data}}(x)}[\log(1 - D_Y(G(x))]\end{aligned}$$

Cycle-consistency Loss:

$$\begin{aligned}\mathcal{L}_{\text{cyc}}(G, F) =& \mathbb{E}_{x \sim p_{\text{data}}(x)}[\|F(G(x)) - x\|_1] \\ &+ \mathbb{E}_{y \sim p_{\text{data}}(y)}[\|G(F(y)) - y\|_1]\end{aligned}$$

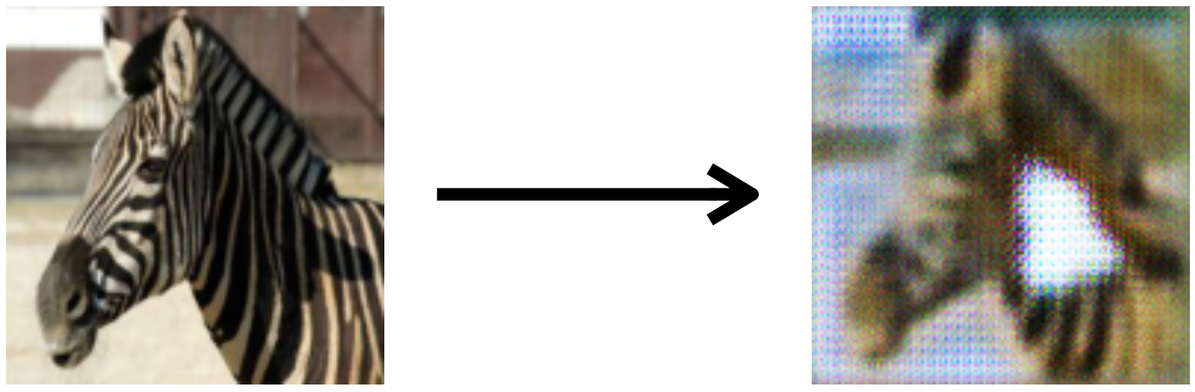
Equations from Zhu, Park et al. (2017)

Cycle-consistency

- Guide training:
  - quickly drives G output to be similar to input
  - quickly learns color/texture mapping
- Regularize:
  - prevent excessive hallucination
  - prevent mode collapse

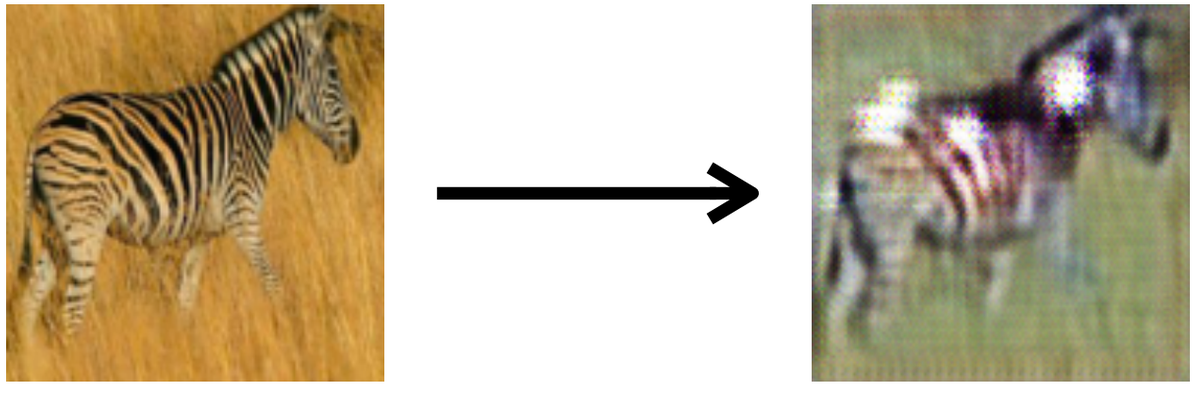
Cycle-consistency

- Quickly drives output of G to be similar to input



@ epoch 3

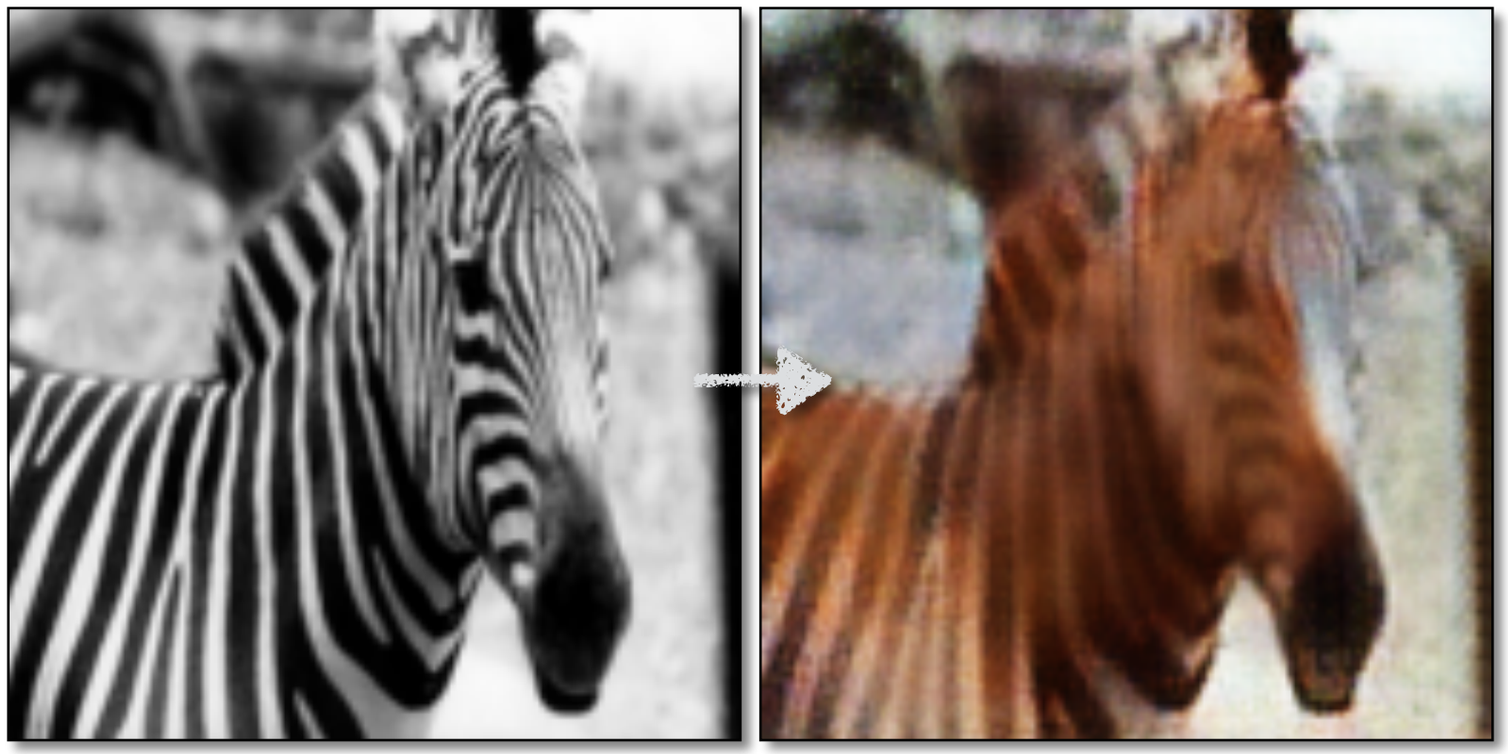
- Quickly learns color/texture mapping



@ epoch 10

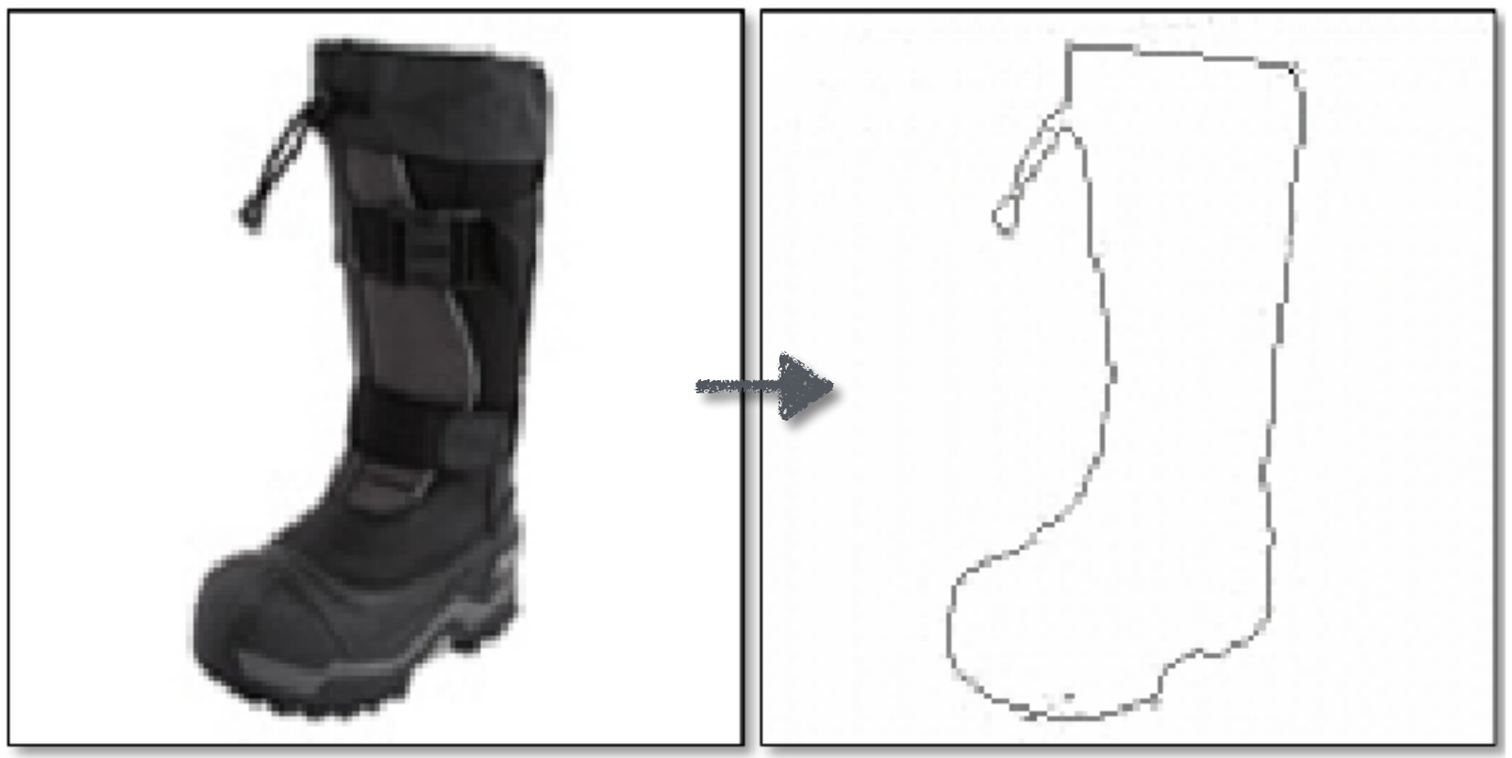
Cycle-consistency

- Pixel level
- Assume one-to-one mapping and no information loss
- Unrealistic artifacts



Cycle-consistency

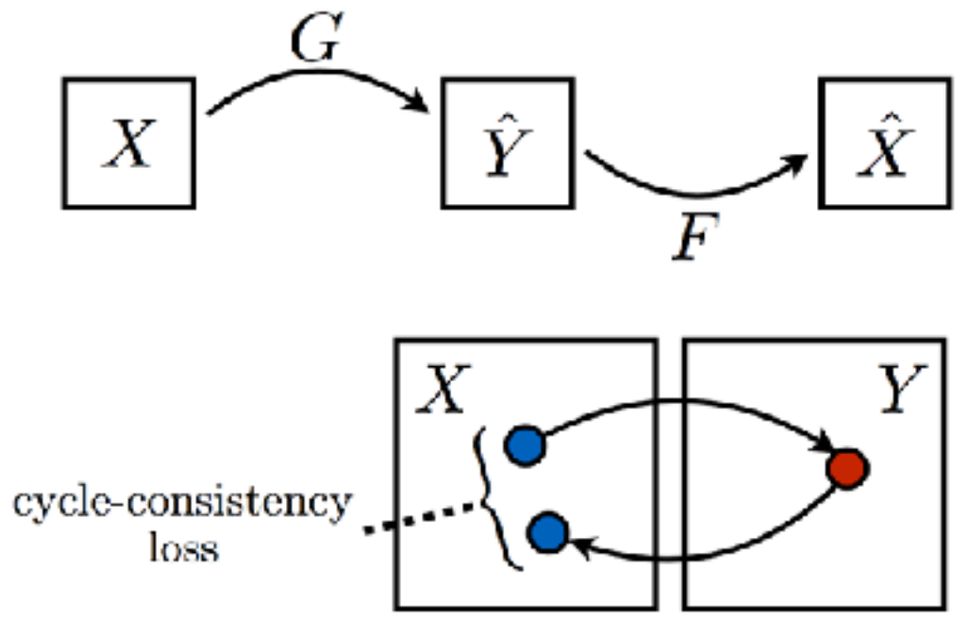
- Pixel level
- Assume one-to-one mapping and no information loss
- Unrealistic artifacts



Figures from Zhu, Park et al. (2017)

Better Cycle-consistency

- CNN feature level. Use discriminator features
- Reduce weight of cycle-consistency as training progresses
- Weight cycle-consistency by “how good the cycle is” $D(Y)$:



Results

generated reconstruct generated reconstruct

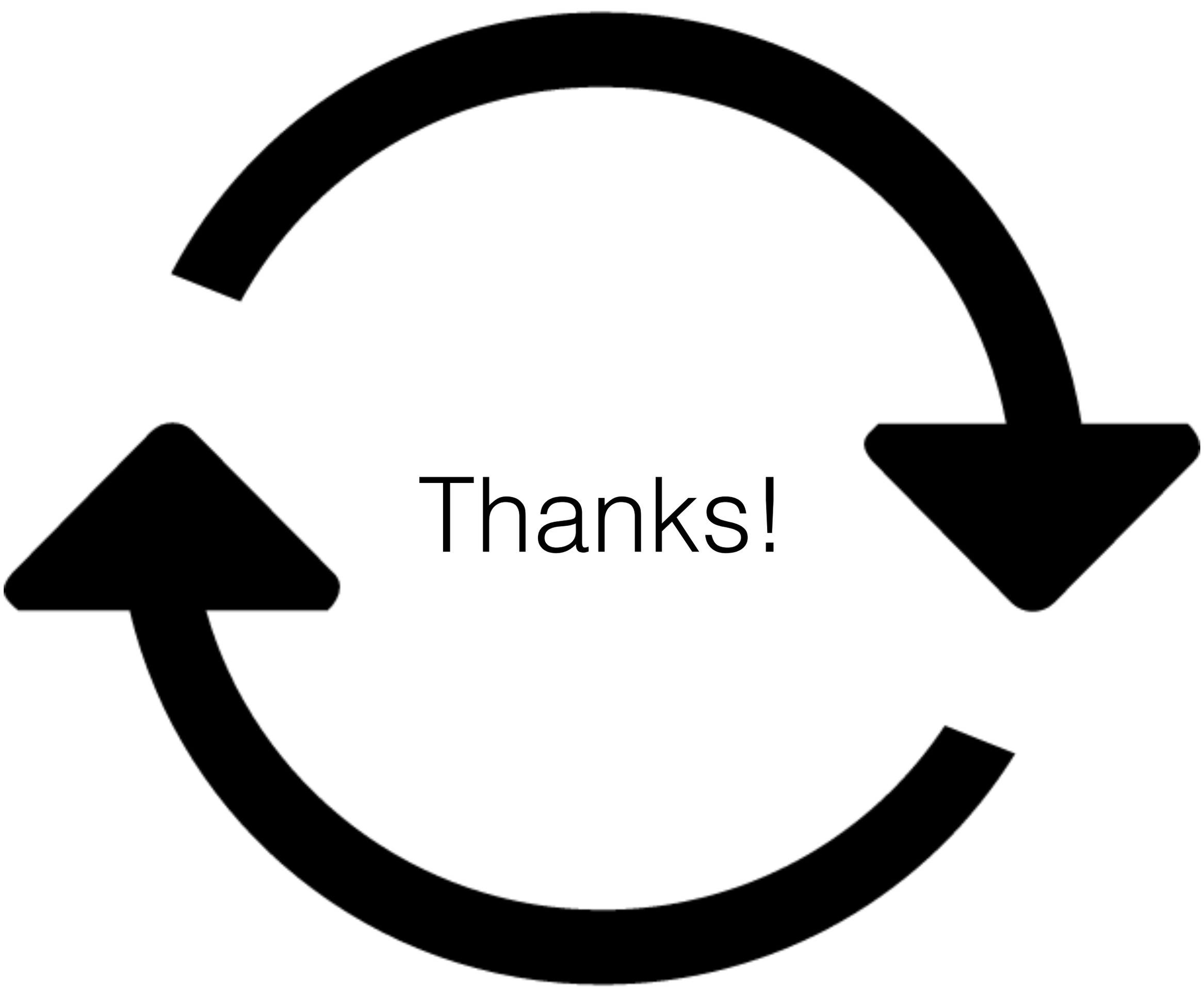
Input

Original CycleGAN

With changes

Future Work

- Tune parameters
- Pretrain+fine-tune discriminators (Least Square-GAN)
- One-to-many mapping with stochastic input
- Generators with latent variable
- Single generator/discriminator for both directions



Thanks!