CVPR 2017

Image-to-Image Translation with Conditional Adversarial Nets

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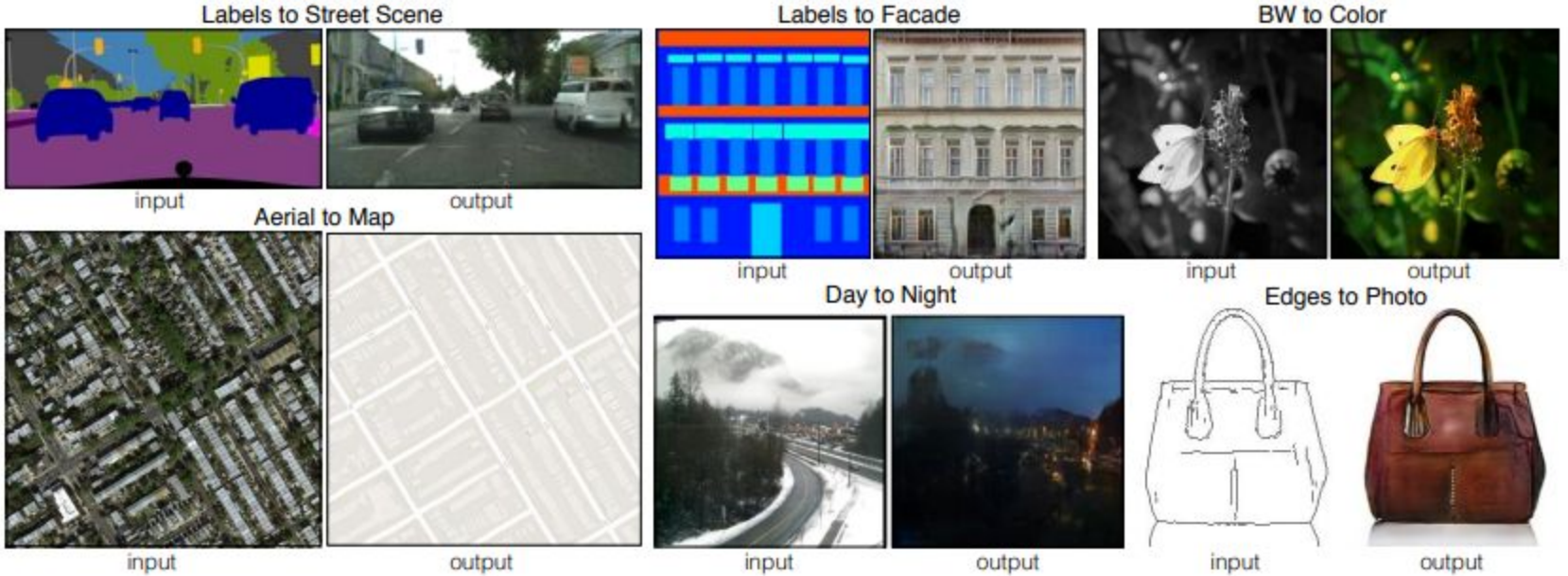
github.com/terra2007

Pix2Pix

CGAN을 사용한 image-to-image translation 메서드 제안 (논문 제목)

다양한 task에 공통적으로 활용할 수 있는 generic approach로 사용 가능



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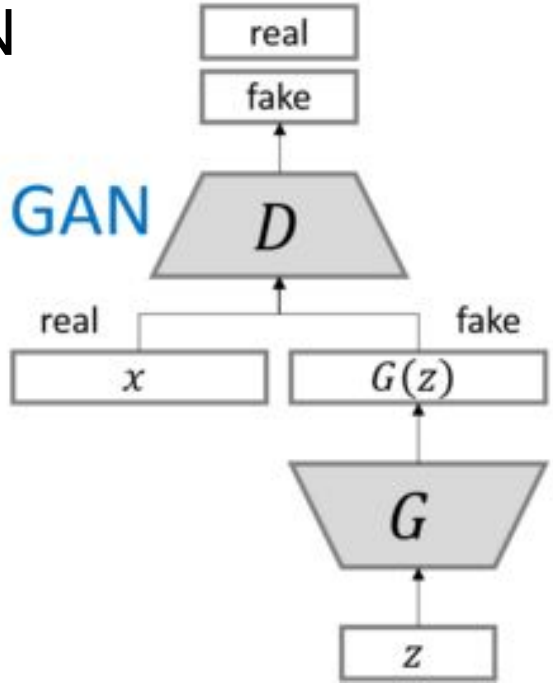
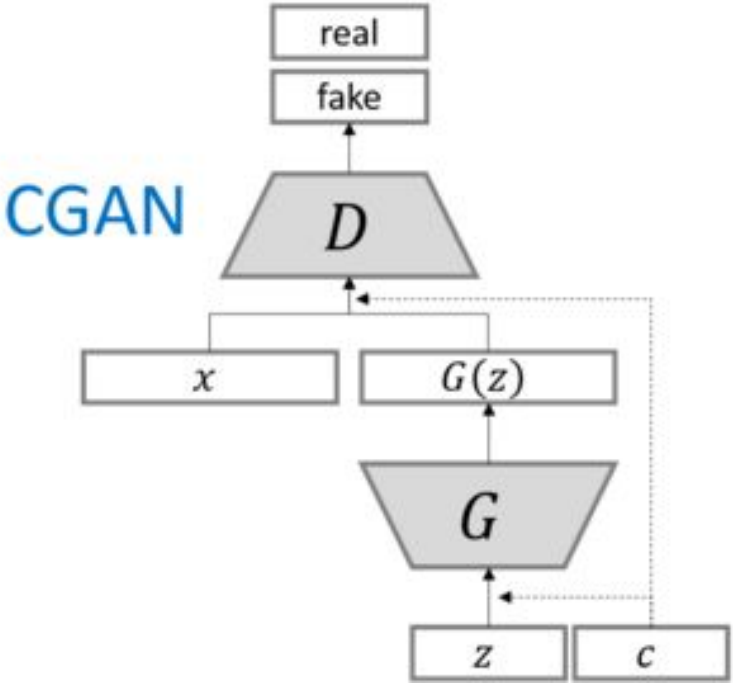
CGAN

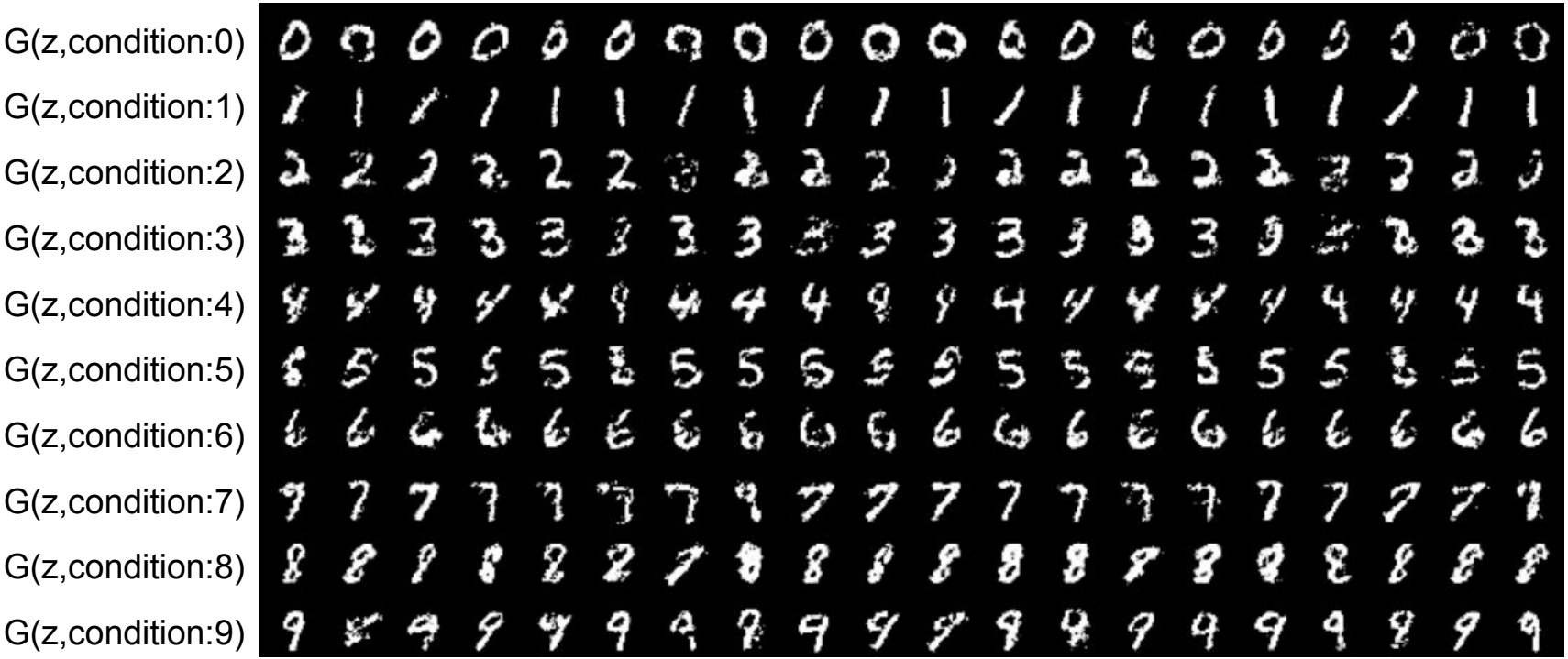




GAN loss: $\min_G \max_D V(D,G) = \mathbb{E}_{\boldsymbol{x}\sim p_{\text{data}}(\boldsymbol{x})}[\log D(\boldsymbol{x})] + \mathbb{E}_{\boldsymbol{z}\sim p_z(\boldsymbol{z})}[\log(1 - D(G(\boldsymbol{z})))]$.

CGAN loss: $\min_G \max_D V(D,G) = \mathbb{E}_{\boldsymbol{x}\sim p_{\text{data}}(\boldsymbol{x})}[\log D(\boldsymbol{x}|\boldsymbol{y})] + \mathbb{E}_{\boldsymbol{z}\sim p_z(\boldsymbol{z})}[\log(1 - D(G(\boldsymbol{z}|\boldsymbol{y})))]$.

CGAN



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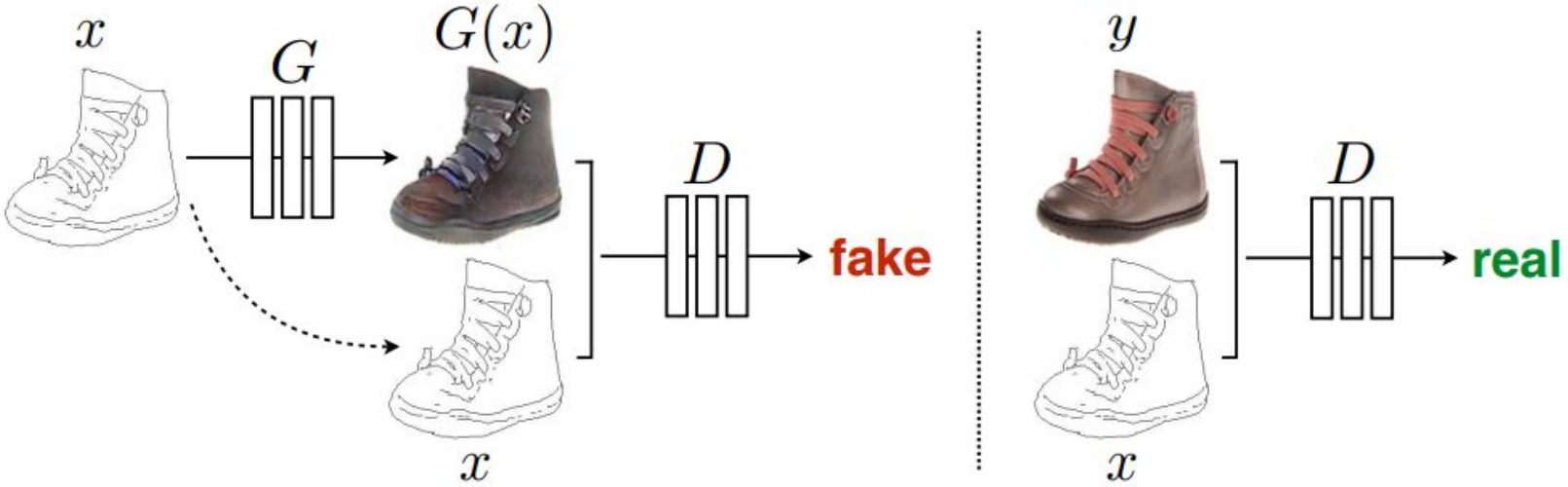
Pix2Pix

Pix2Pix는 학습 과정에서 이미지 x를 Condition으로 입력받는 CGAN의 유형

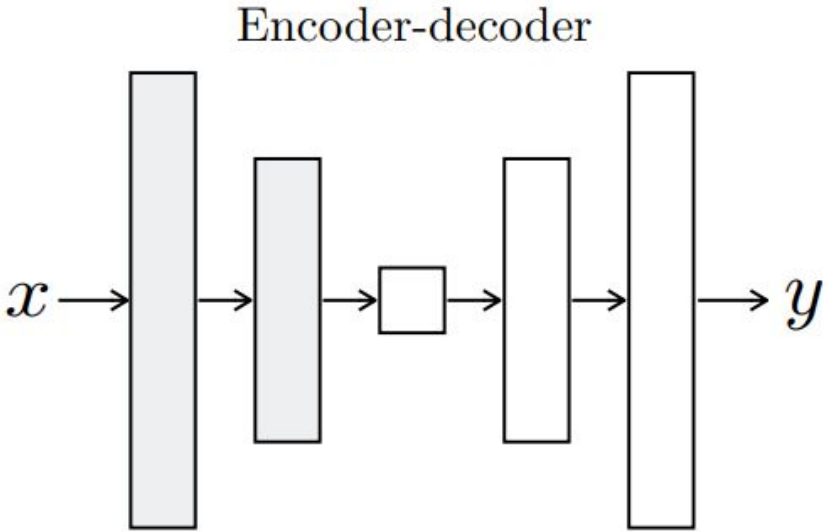
노이즈 z를 사용하지 않기 때문에 deterministic outputs

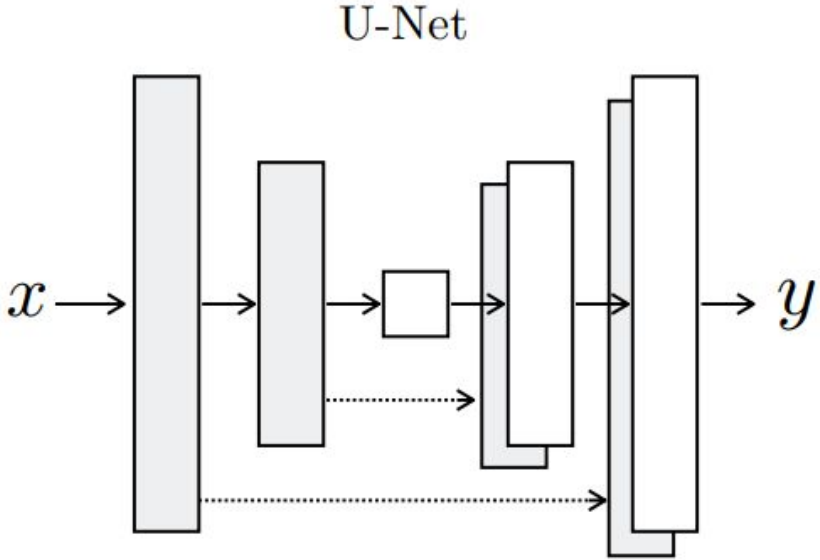


Pix2Pix architecture

Pix2Pix는 이미지를 Condition으로 입력받아, 이미지를 출력

이를 효과적으로 처리할 수 있는 U-Net 기반 architecture 사용





Objective function

GAN은 VAE같은 다른 생성 모델에 비해 blurry 한 결과가 적음

성능 향상을 위해 L1 loss를 사용

$$G^* = \arg\min_G \max_D \mathcal{L}_{cGAN}(G, D) + \lambda \mathcal{L}_{L1}(G).$$

$$\mathcal{L}_{cGAN}(G, D) = \mathbb{E}_{x,y}[\log D(x, y)] + \mathbb{E}_{x,z}[\log(1 - D(x, G(x, z)))]$$

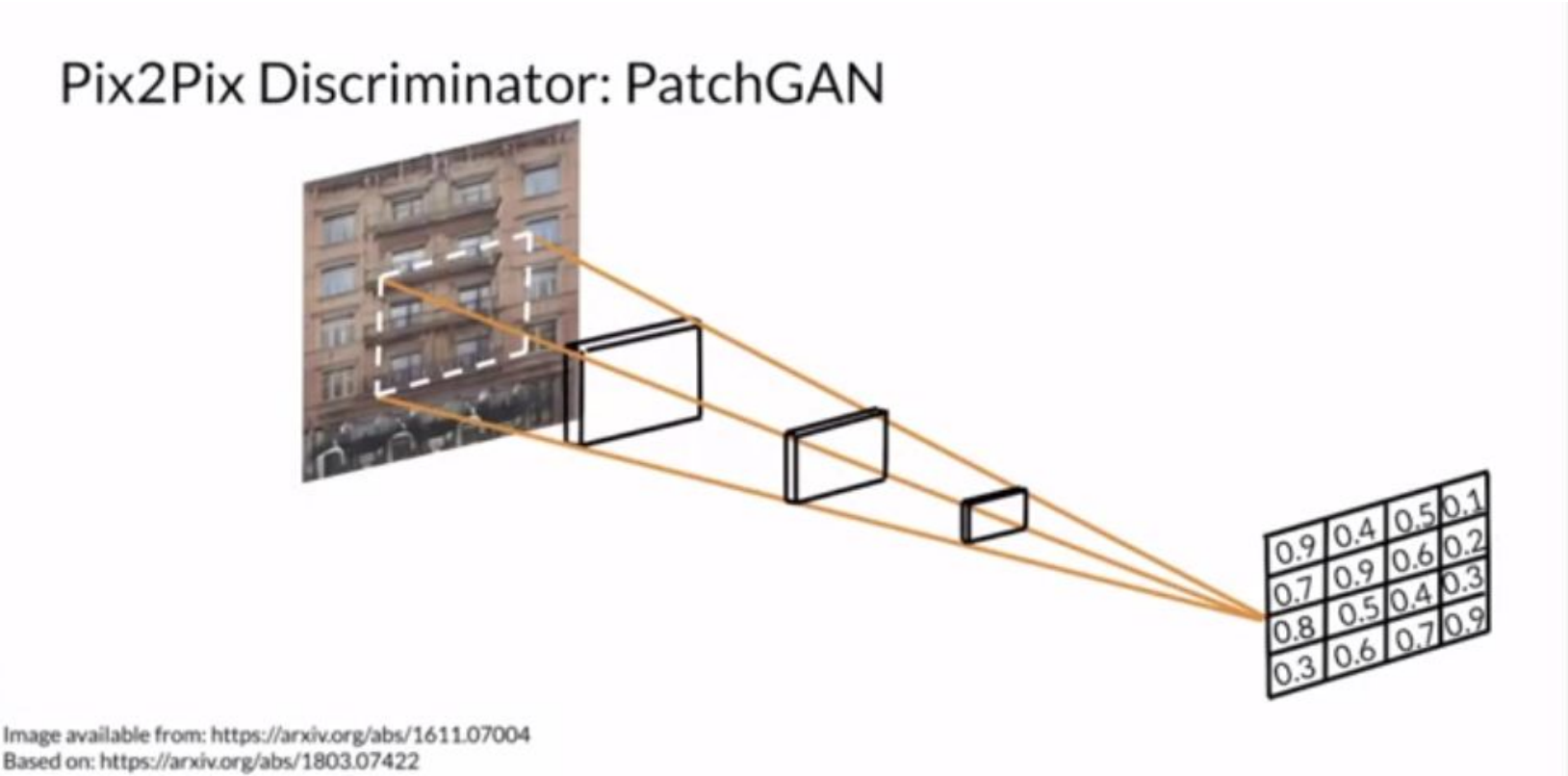
$$\mathcal{L}_{L1}(G) = \mathbb{E}_{x,y,z}[\|y - G(x, z)\|_1].$$

L1 loss, L2 loss

L1 loss $$L = \sum_{i=1}^{n} |y_i - f(x_i)|$$

L2 loss $$L = \sum_{i=1}^{n} (y_i - f(x_i))^2$$

patchGAN



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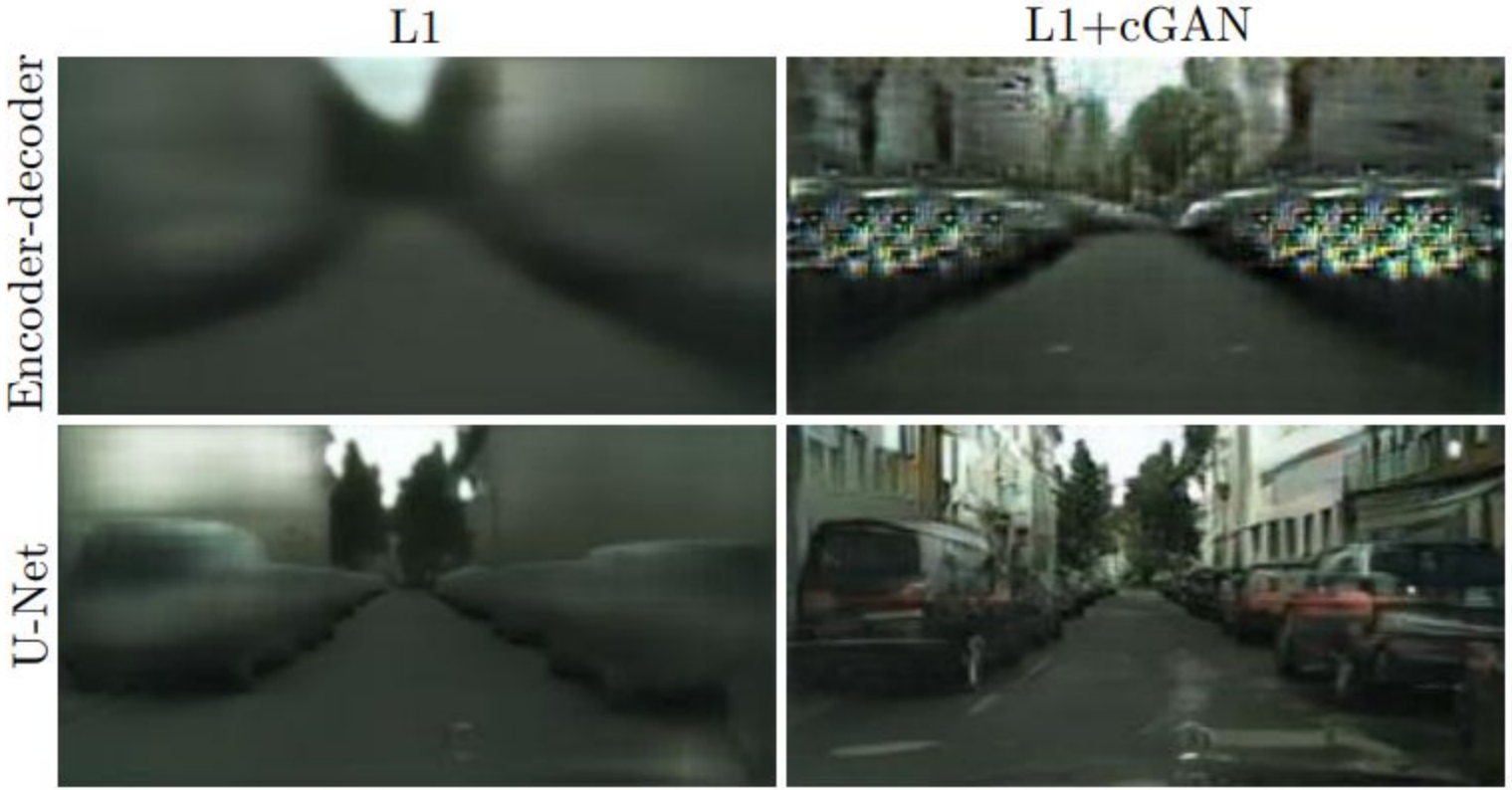

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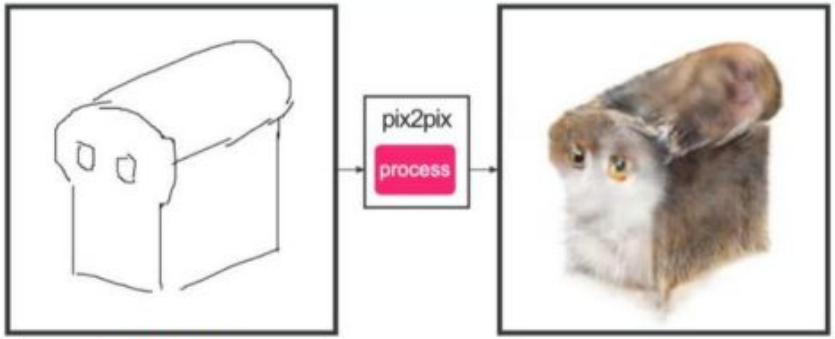
Loss	Per-pixel acc.	Per-class acc.	Class IOU
Encoder-decoder (L1)	0.35	0.12	0.08
Encoder-decoder (L1+cGAN)	0.29	0.09	0.05
U-net (L1)	0.48	0.18	0.13
U-net (L1+cGAN)	**0.55**	**0.20**	**0.14**

#edges2cats *by Christopher Hesse*

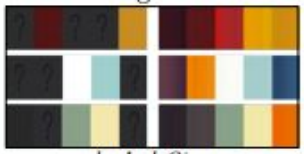


sketch by Ivy Tsai

Background removal

by Kaihu Chen

Palette generation

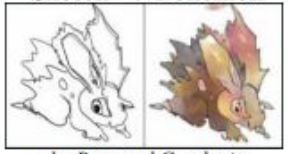


by Jack Qiao

Sketch→ Portrait

by Mario Klingemann

Sketch → Pokemon



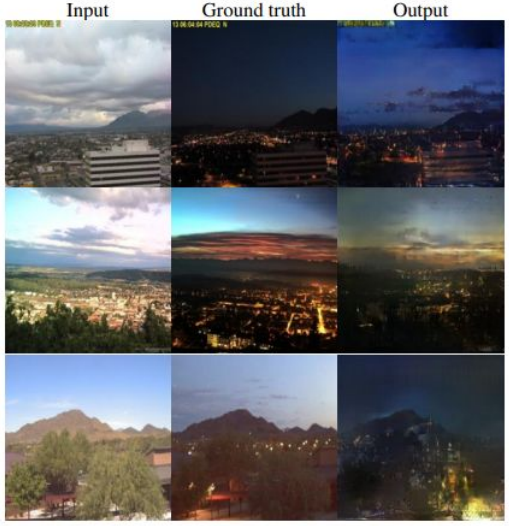
by Bertrand Gondouin

"Do as I do"

by Brannon Dorsey

#fotogenerator

sketch by Yann LeCun



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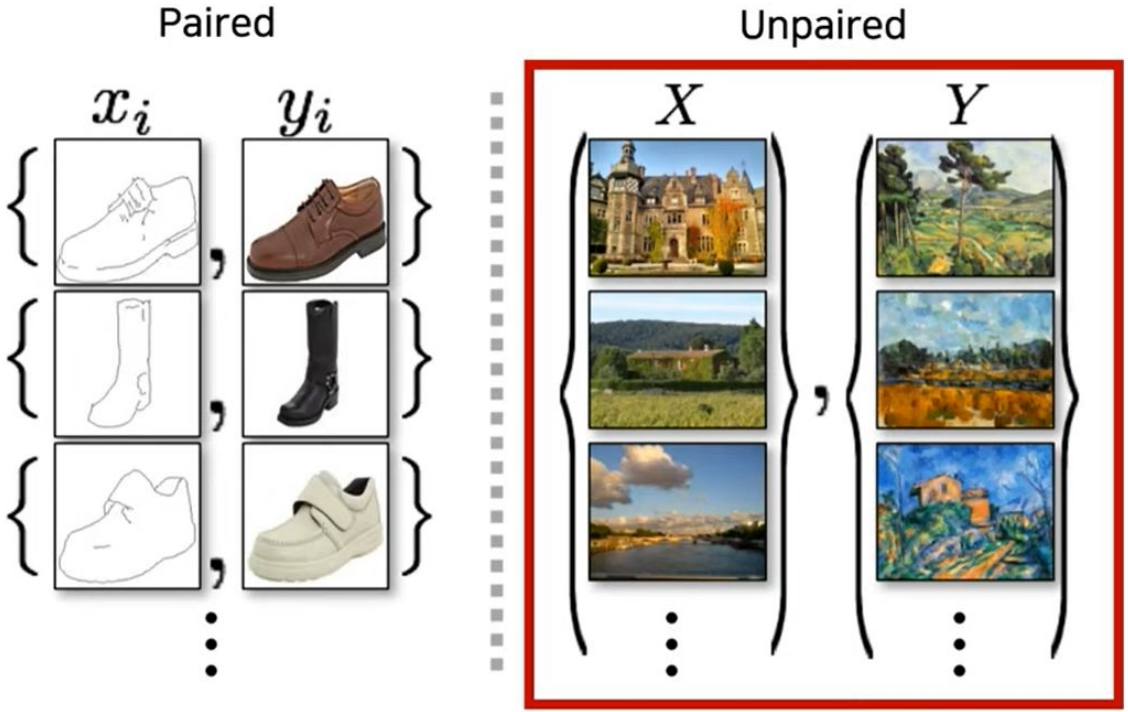
Pix2Pix의 한계점



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