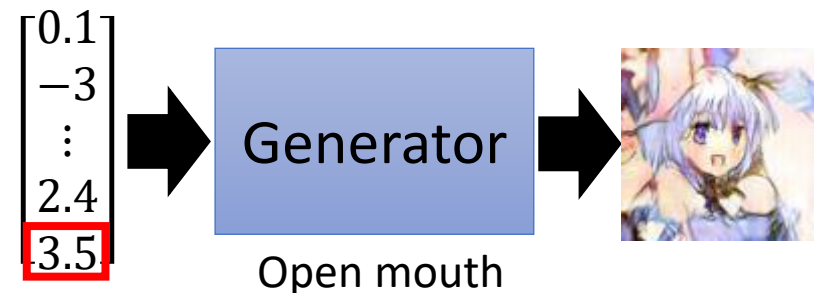
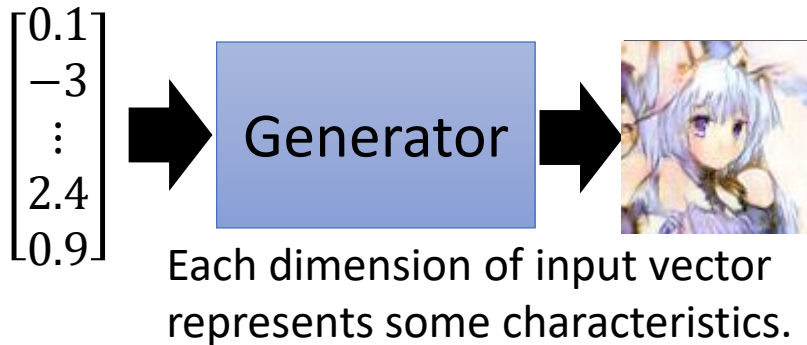


Intelligent Photo Editing

Modifying Input Code



- The input code determines the generator output.
- Understand the meaning of each dimension to control the output.

Connecting Code and Attribute





(c) Hair style



(d) Emotion

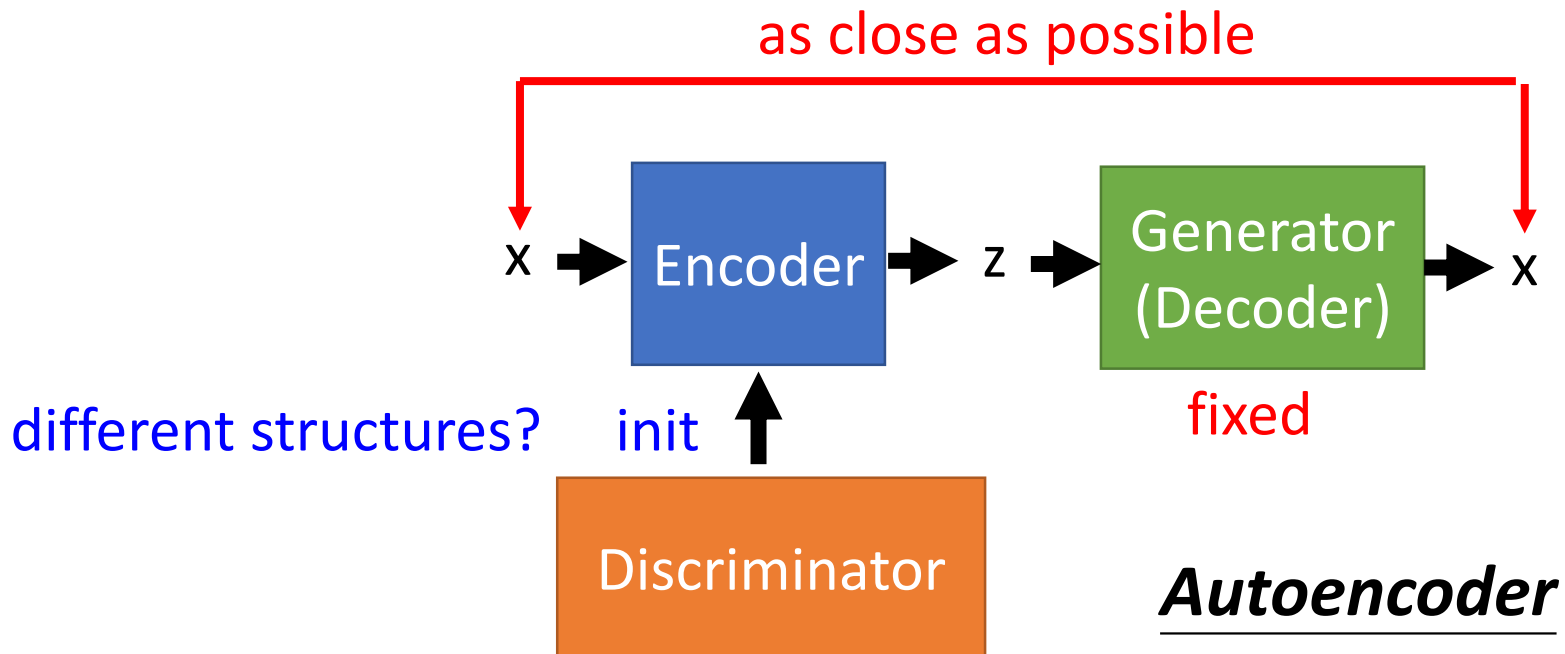
CelebA

Image	Attributes
	Arched eyebrows, attractive, brown hair, heavy makeup, high cheekbones, mouth slightly open, no beard, pointy nose, smiling, straight hair, wearing earrings, wearing lipstick, young.
	5 o'clock shadows, attractive, bags under eyes, big lips, big nose, black hair, bushy eyebrows, male, no beard, pointy nose, straight hair, young.

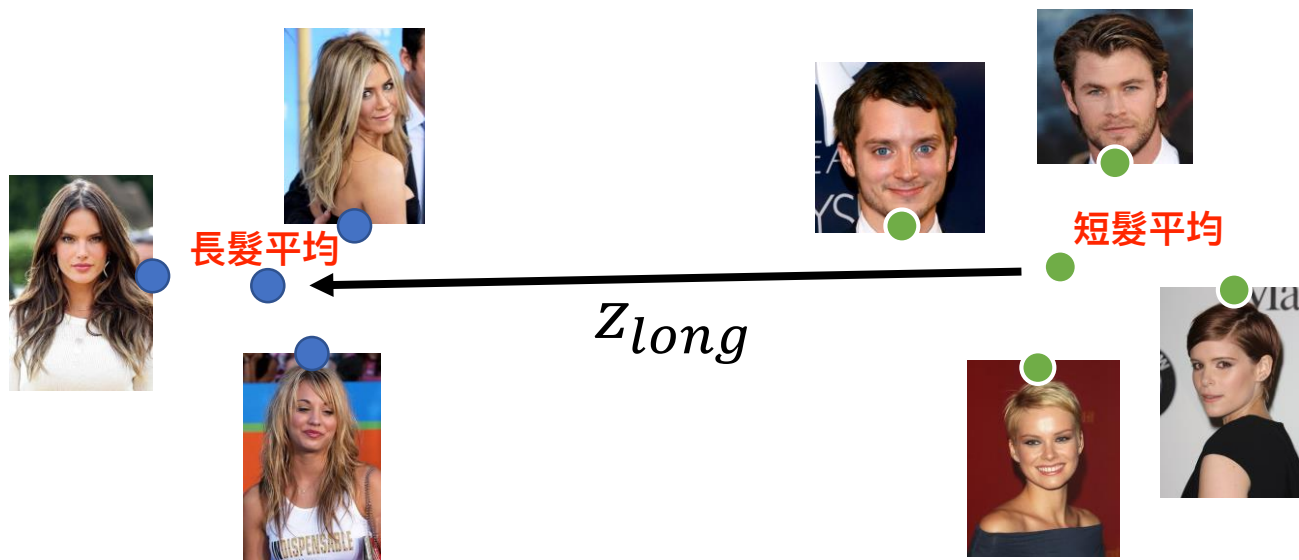
GAN+Autoencoder

逆向工程，给定image x ，反推他input的vector z

- We have a generator (input z , output x)
- However, given x , how can we find z ?
 - Learn an encoder (input x , output z)



Attribute Representation



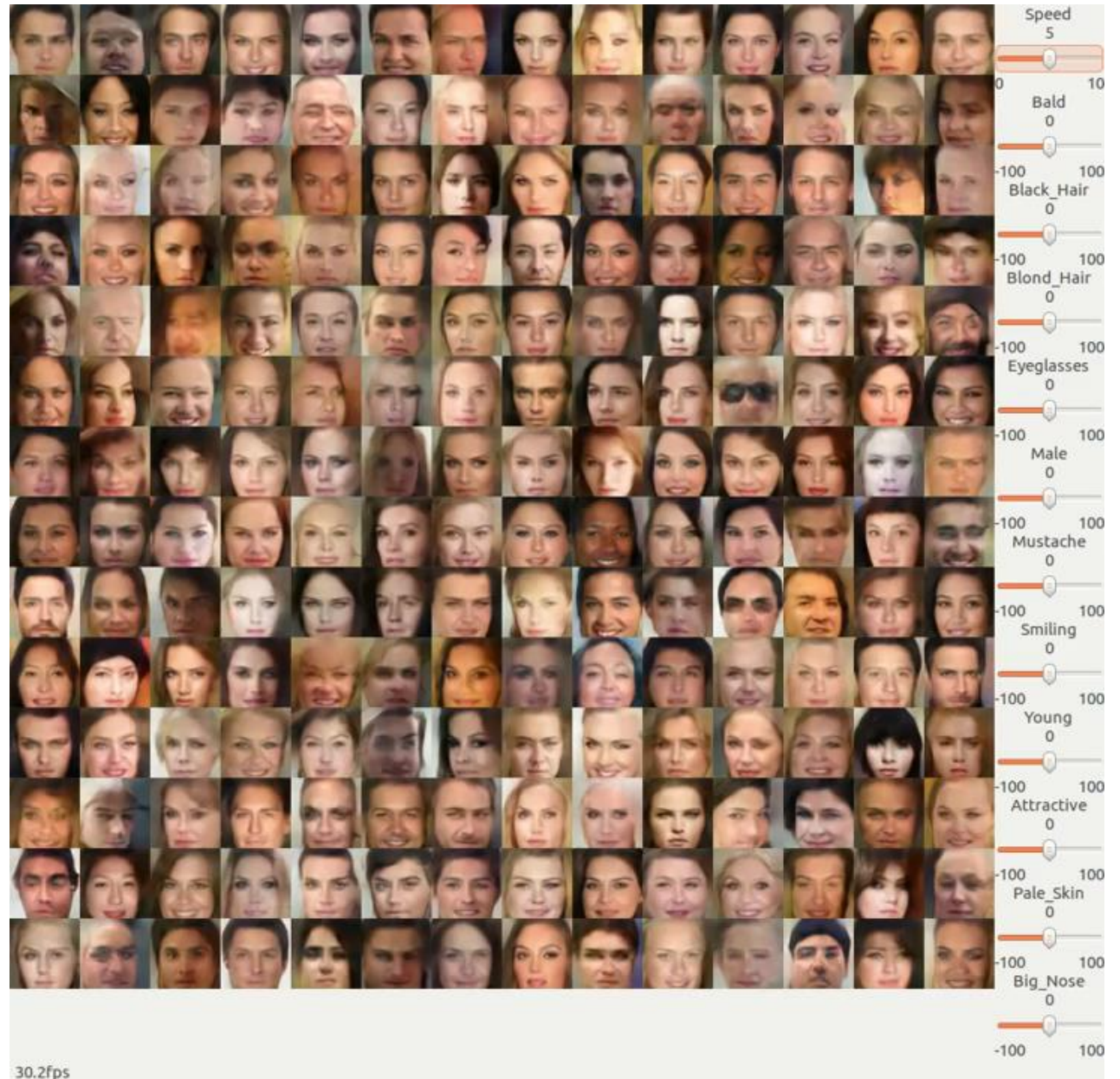
$$z_{long} = \frac{1}{N_1} \sum_{x \in long} En(x) - \frac{1}{N_2} \sum_{x' \notin long} En(x')$$

Short
Hair

$$x \Rightarrow En(x) + z_{long} = z' \Rightarrow Gen(z')$$

Long
Hair

Photo Editing



<https://www.youtube.com/watch?v=kPEIJJsQr7U>

Generative Visual Manipulation on the Natural Image Manifold

Jun-Yan Zhu
Philipp Krähenbühl
Eli Shechtman
Alexei A. Efros



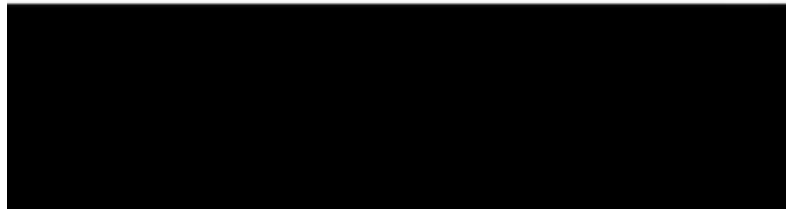
<https://www.youtube.com/watch?v=9c4z6YsBGQ0>

Jun-Yan Zhu, Philipp Krähenbühl, Eli Shechtman and Alexei A. Efros. "Generative Visual Manipulation on the Natural Image Manifold", ECCV, 2016.



Neural Photo Editing

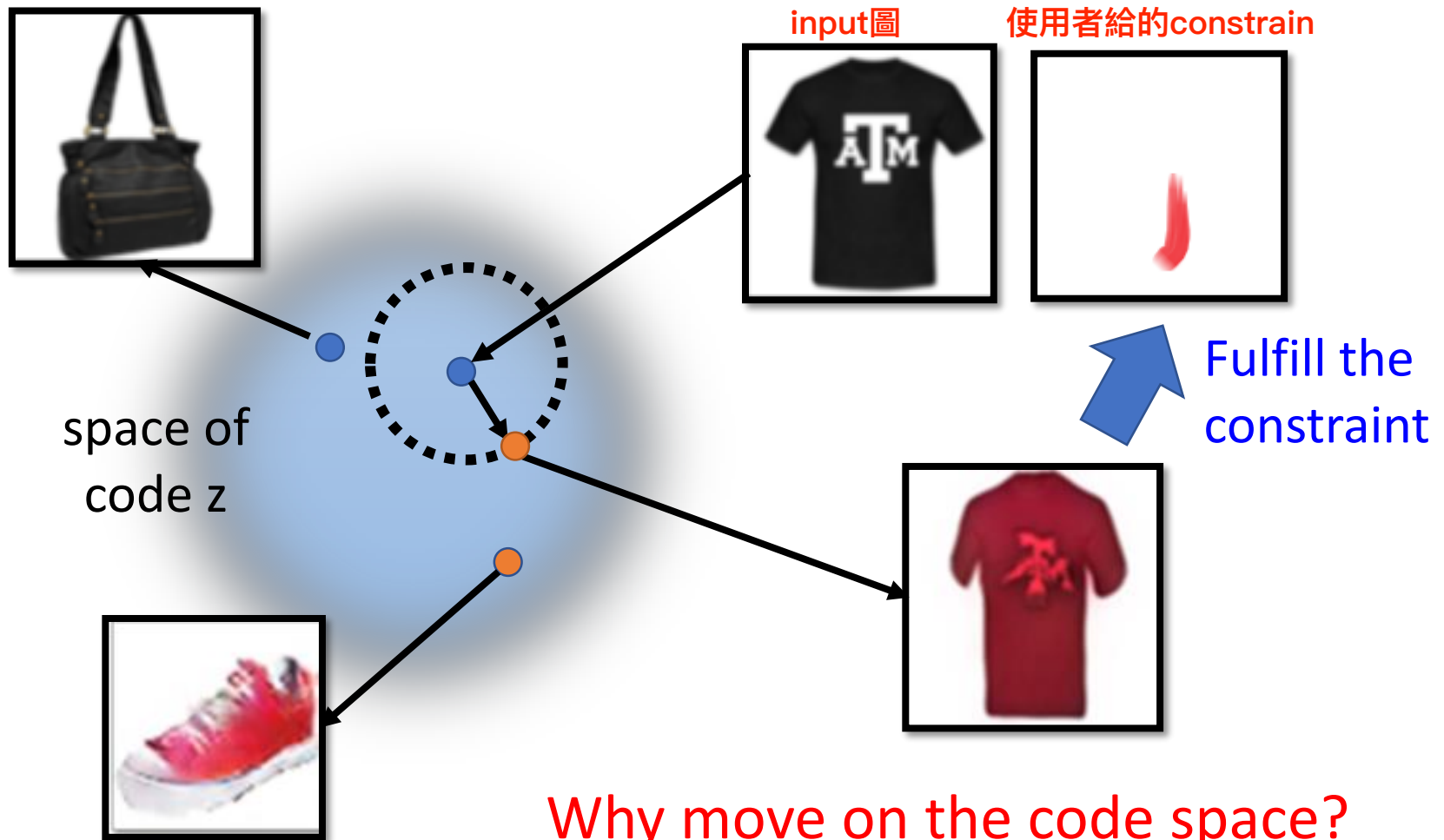
Andrew Brock



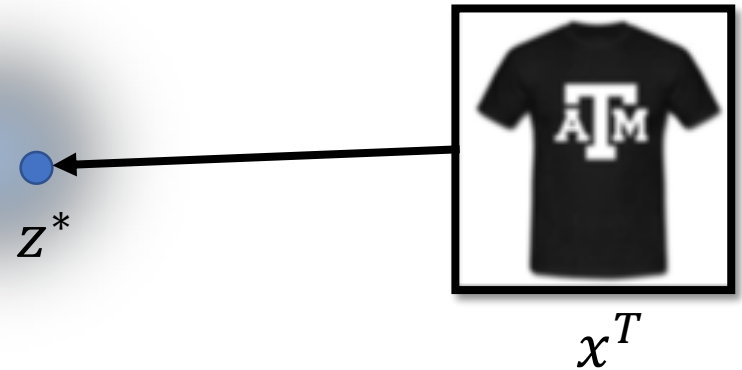
Andrew Brock, Theodore Lim, J.M. Ritchie, Nick Weston, **Neural Photo Editing with Introspective Adversarial Networks**, arXiv preprint, 2017

從latent space周圍sample一些圖片找出跟原本input像的圖片以及符合使用者給的constrain

Basic Idea



Back to z



- **Method 1**

跟原來的圖片越近越好

$$z^* = \arg \min_z \underline{L(G(z), x^T)}$$

Gradient Descent

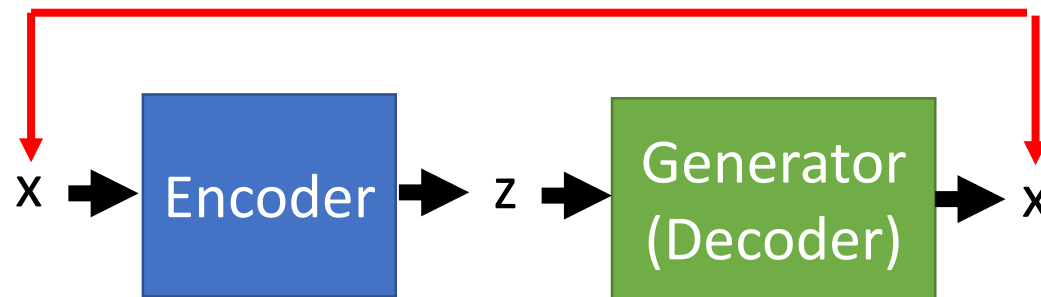


Difference between $G(z)$ and x^T

- Pixel-wise
- By another network VGG等等的

- **Method 2**

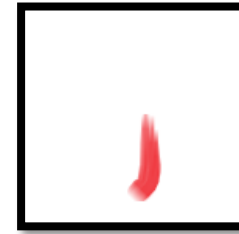
as close as possible



- **Method 3**

Using the results from method 2 as the initialization of method 1

Editing Photos



- z_0 is the code of the input image

Using discriminator to check the image is realistic or not

image

$$z^* = \arg \min_z \underbrace{U(G(z))}_{\text{有沒有符合constrain}} + \lambda_1 \underbrace{\|z - z_0\|^2}_{\text{希望新舊的內容越接近越好}} - \lambda_2 \underbrace{D(G(z))}_{\text{Using discriminator to check the image is realistic or not}}$$

有沒有符合constrain

Not too far away from the original image



Does it fulfill the constraint of editing?

Image super resolution

- Christian Ledig, Lucas Theis, Ferenc Huszar, Jose Caballero, Andrew Cunningham, Alejandro Acosta, Andrew Aitken, Alykhan Tejani, Johannes Totz, Zehan Wang, Wenzhe Shi, “Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network”, CVPR, 2016

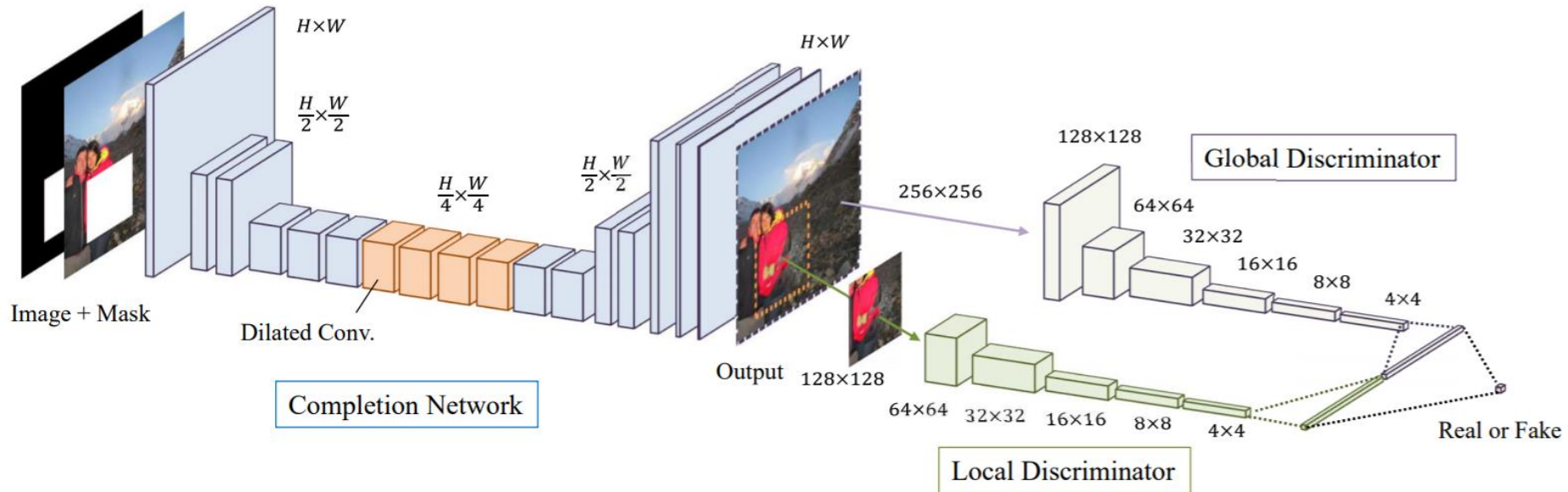
細節的地方GAN表現得比較好



Figure 2: From left to right: bicubic interpolation, deep residual network optimized for MSE, deep residual generative adversarial network optimized for a loss more sensitive to human perception, original HR image. Corresponding PSNR and SSIM are shown in brackets. [4× upscaling]

Image Completion

<http://hi.cs.waseda.ac.jp/~iizuka/projects/completion/en/>



Demo

Image completion is a very complicated task...



Previous approach



Previous approach

<https://www.youtube.com/watch?v=5Ua4NUKowPU>