Hairstyle Transfer

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목차

1. Hairstyle Transfer

2. Related Services

3. Related Works

4. Future Works

5. My Thoughts

Hairstyle Transfer



Source Target Output

Hairstyle Transfer



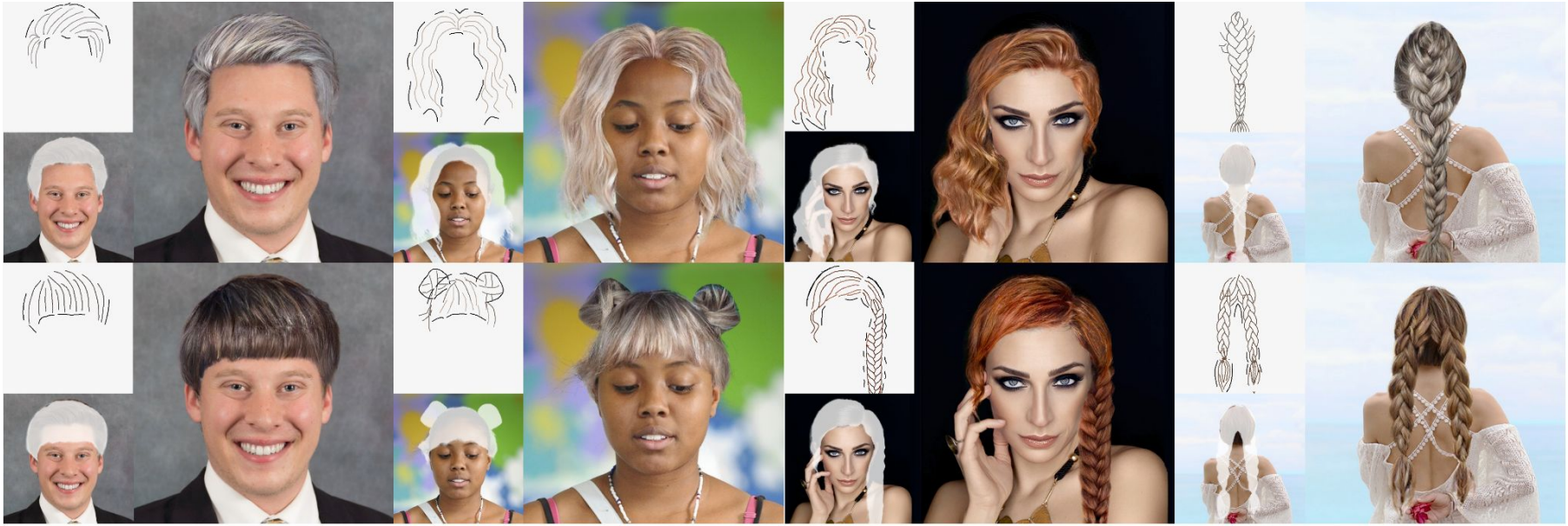
[1] High Frequency

[2] Delicacy

[3] Inpainting

[4] Aligning

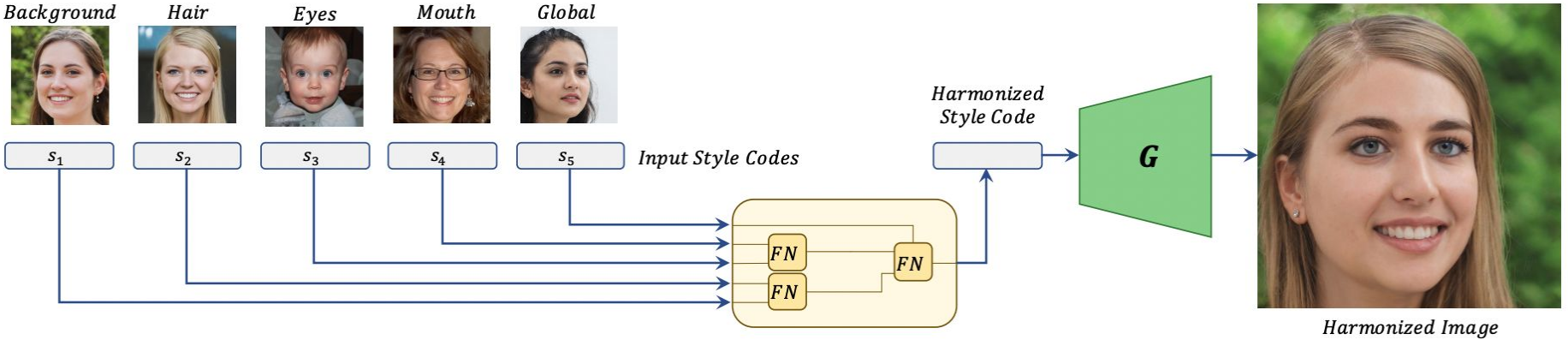
Other Solutions - Sketch Hair Salon



Other Solutions - Sketch Hair Salon



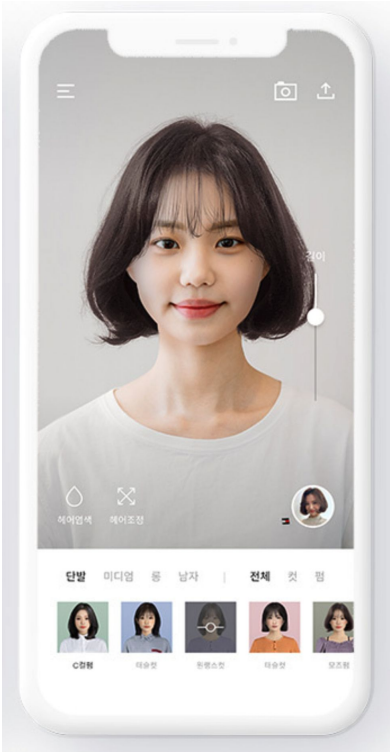
Other Solutions - StyleFusion



Other Solutions - StyleFusion



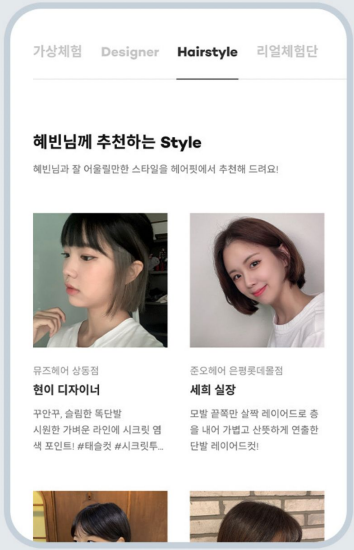
Related Services - HairFIT



내 근처에 있는 실력있는
디자이너를 추천해 드려요.

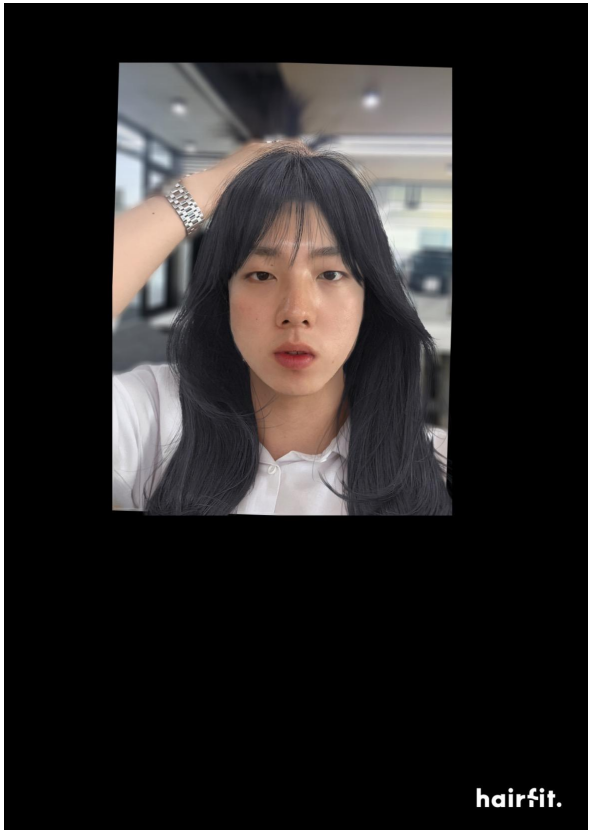


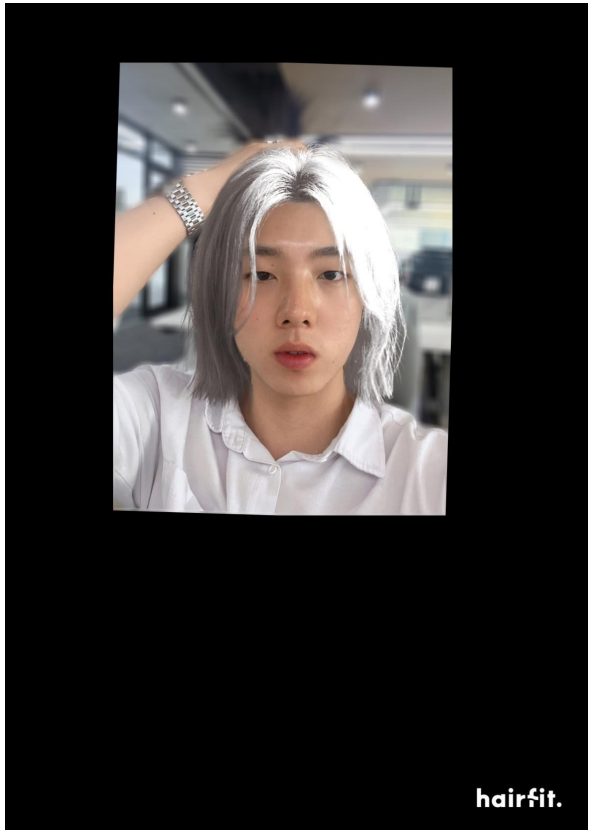
회원님이 좋아하시는 스타일의
포트폴리오를 추천해 드려요.



Related Services - HairFIT





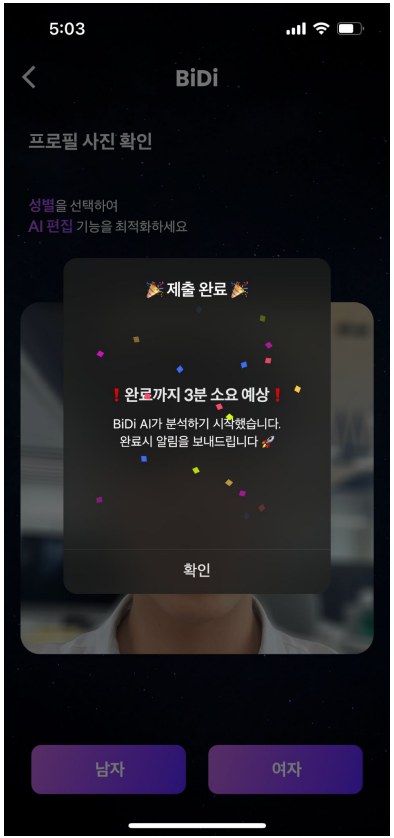


Related Services - BiDi



Related Services - BiDi

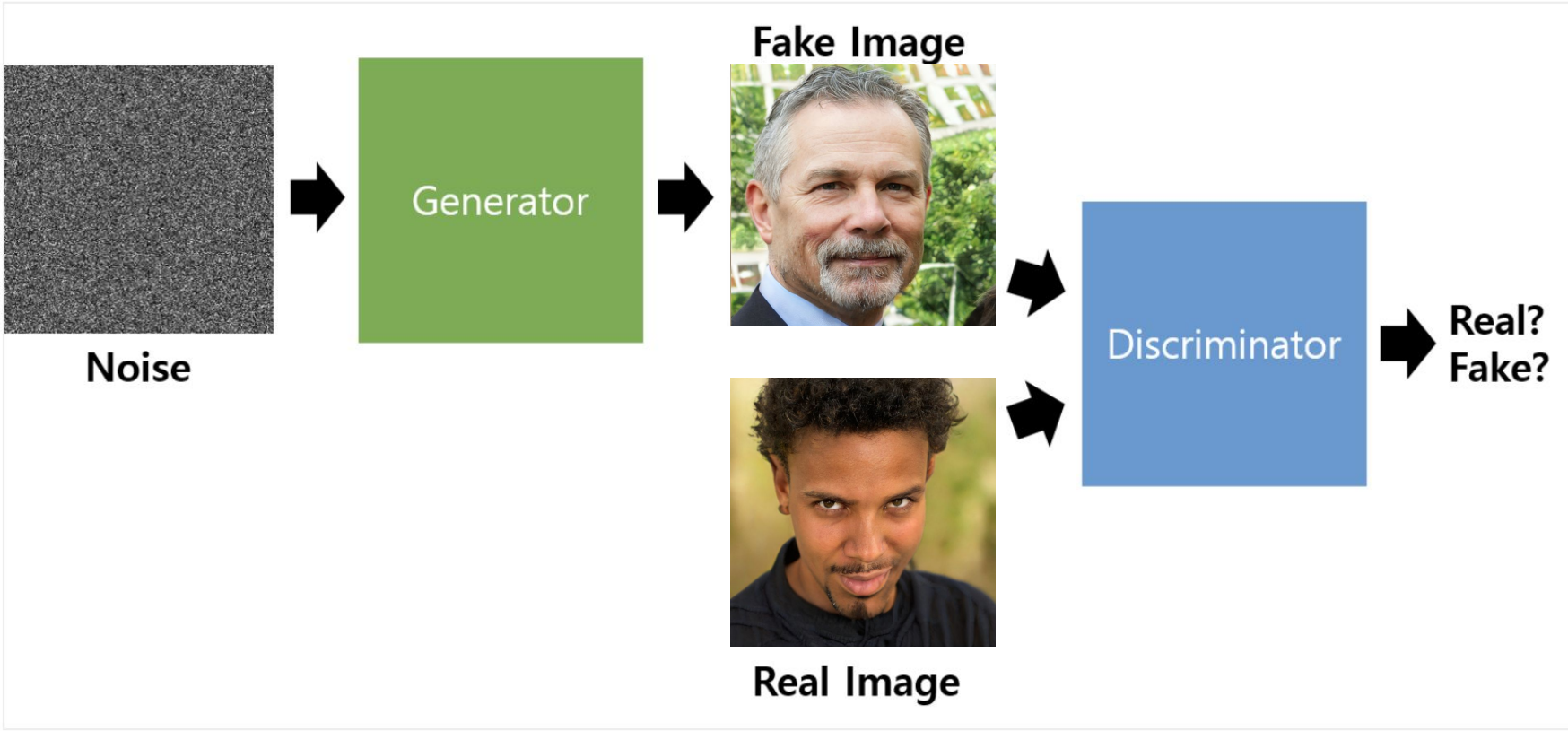




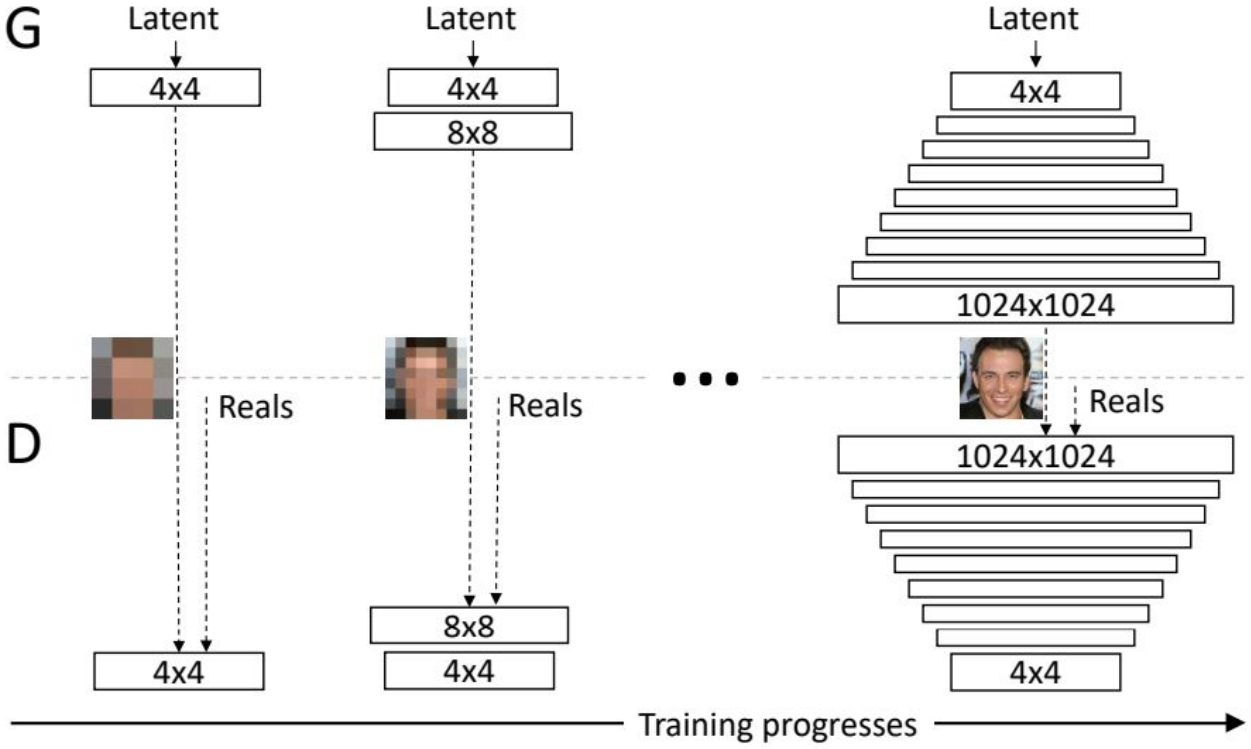




Background - GAN

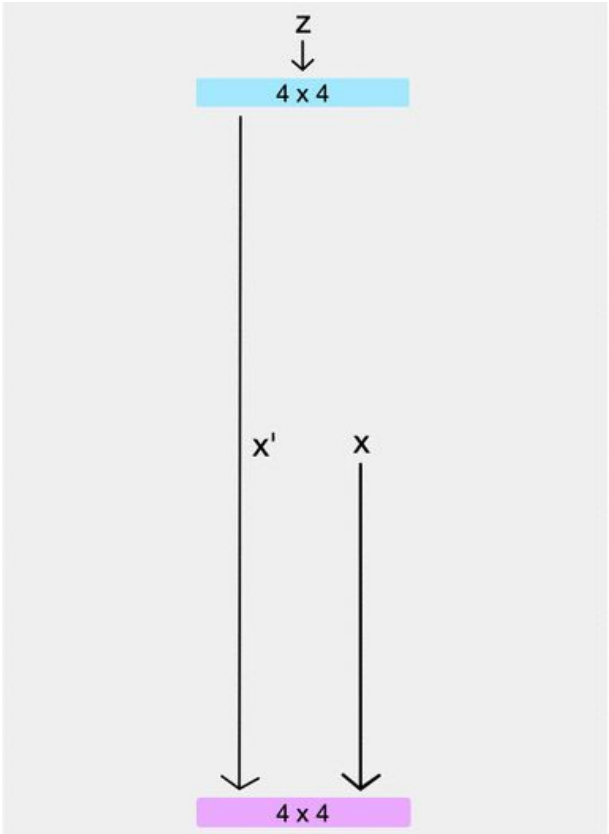


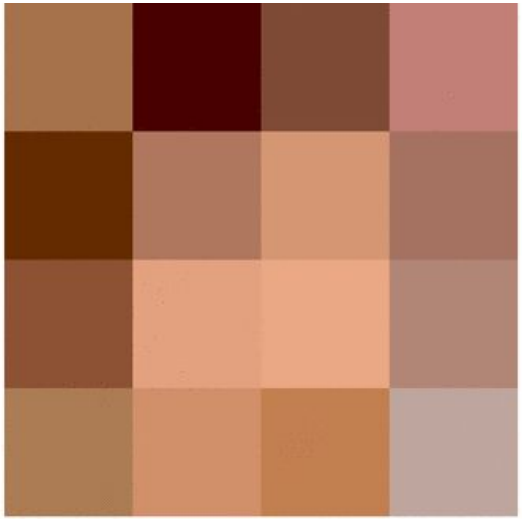
Background - PGGAN





Background - PGGAN



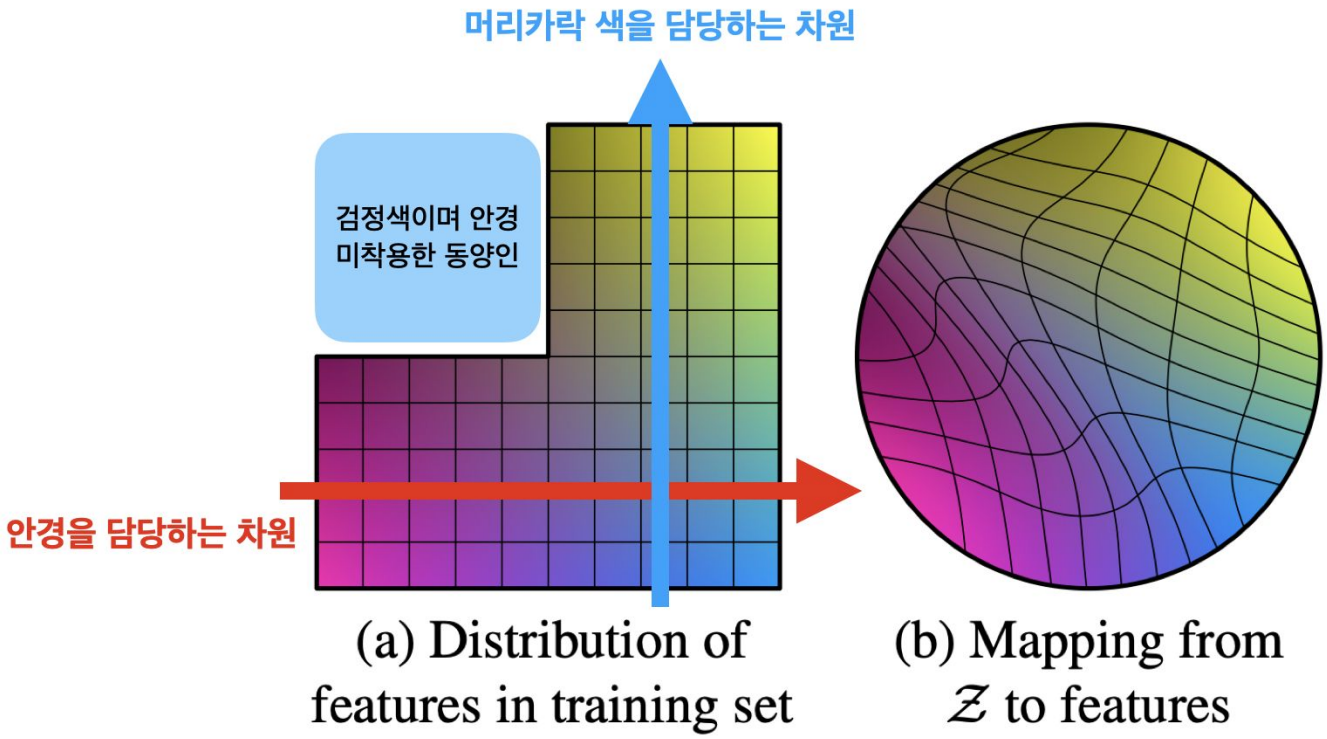


Training time: 0 days
4x4 resolution

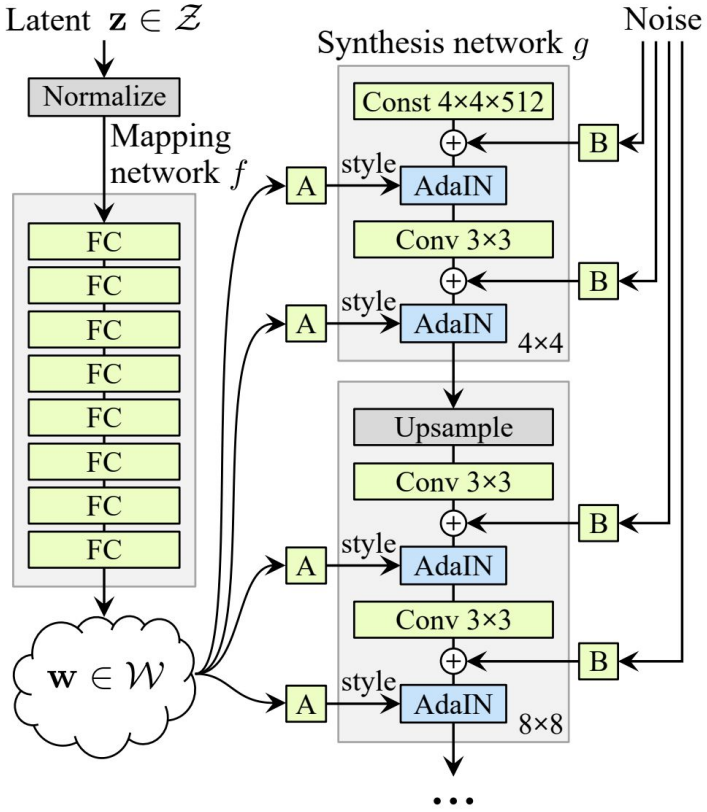
Generator
Discriminator

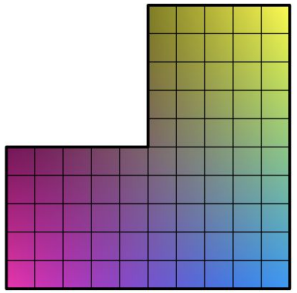
z = random code
x = real image
x' = generated image

Background - PGGAN

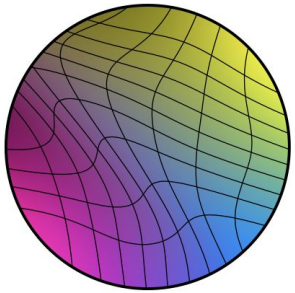


Background - StyleGAN

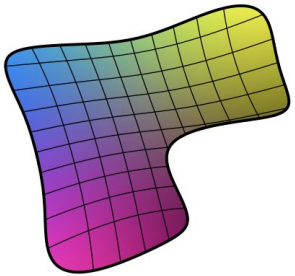




(a) Distribution of features in training set

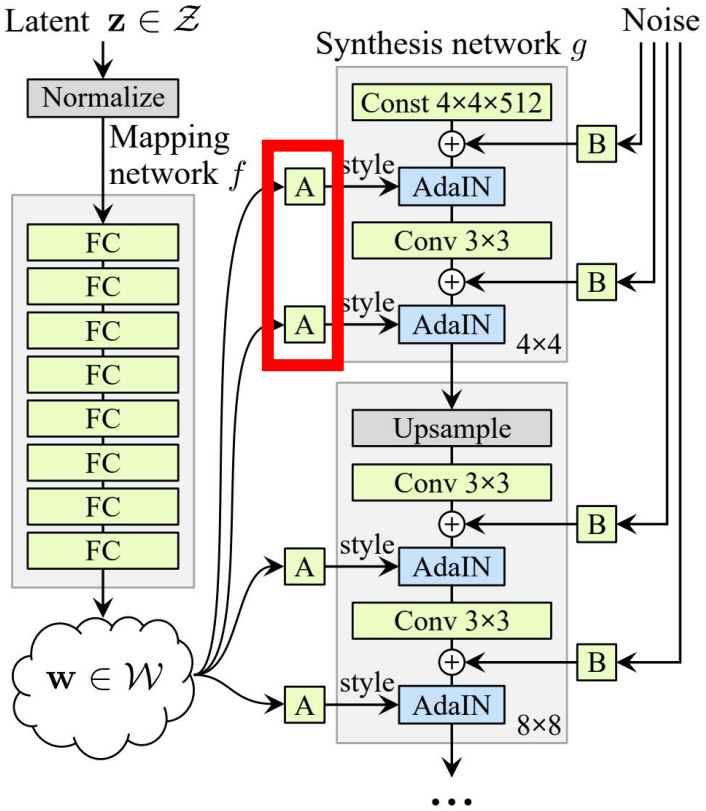


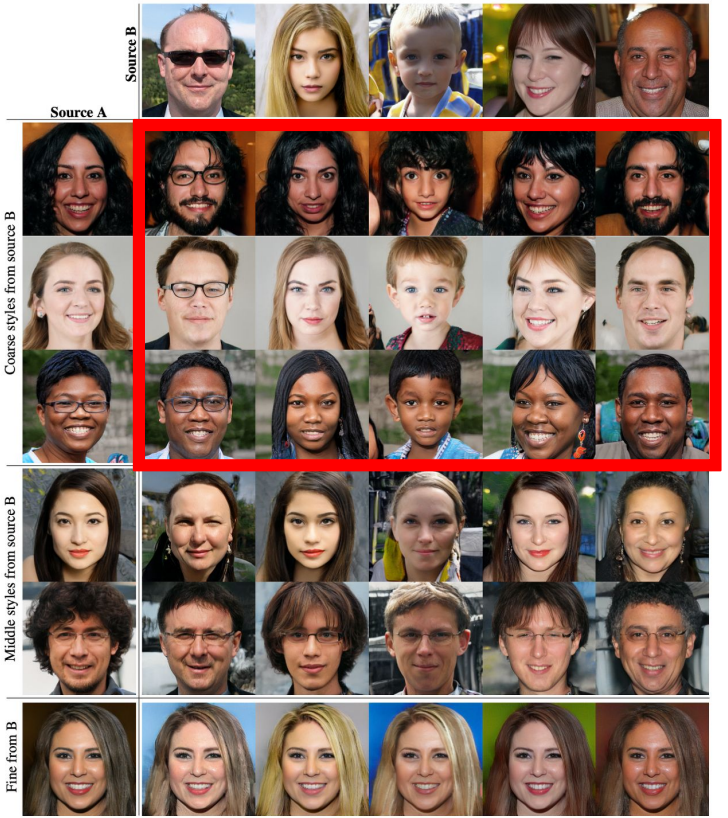
(b) Mapping from $\mathcal{Z}$ to features



(c) Mapping from $\mathcal{W}$ to features

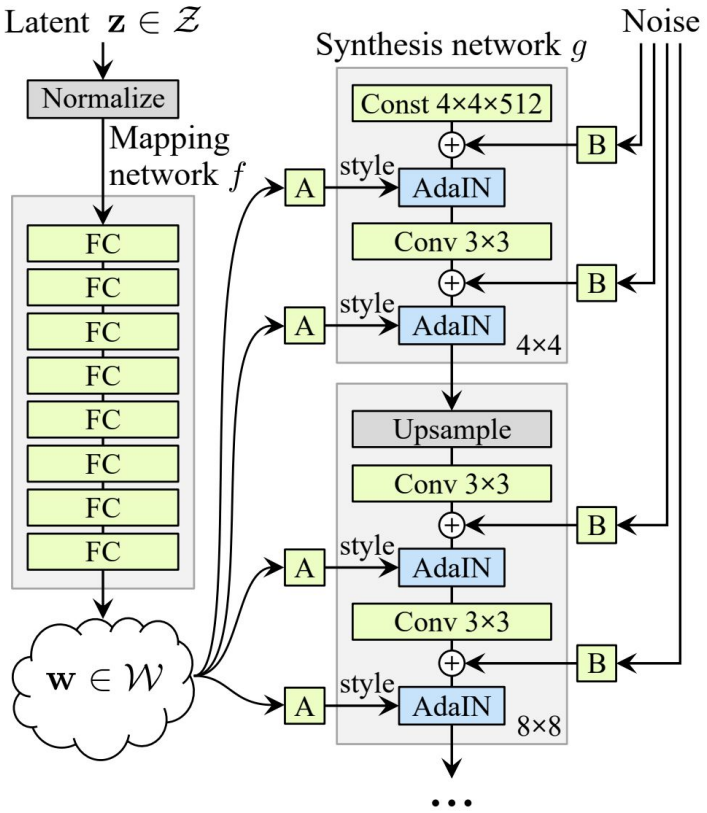
Background - StyleGAN



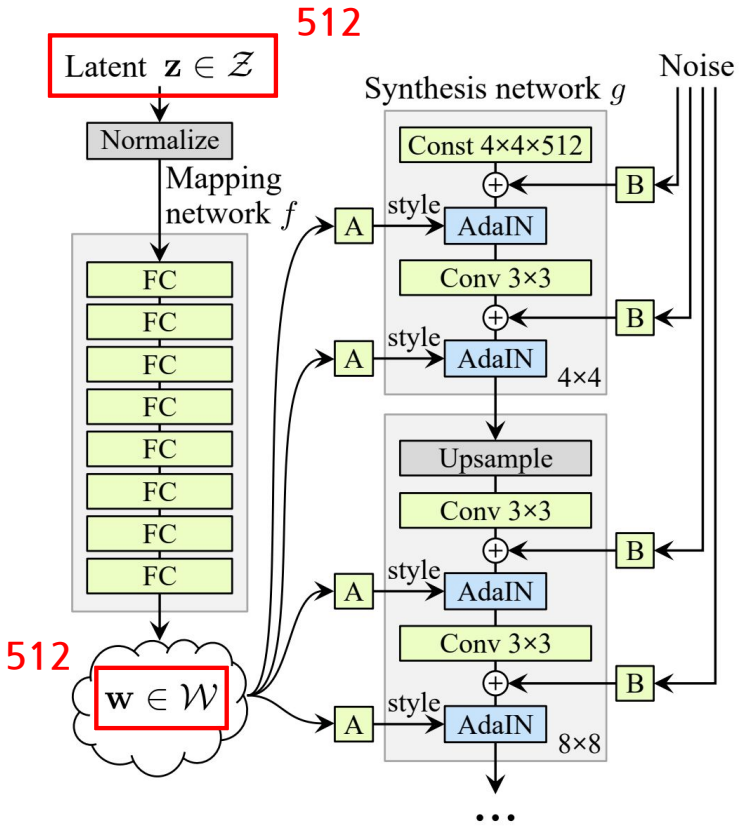


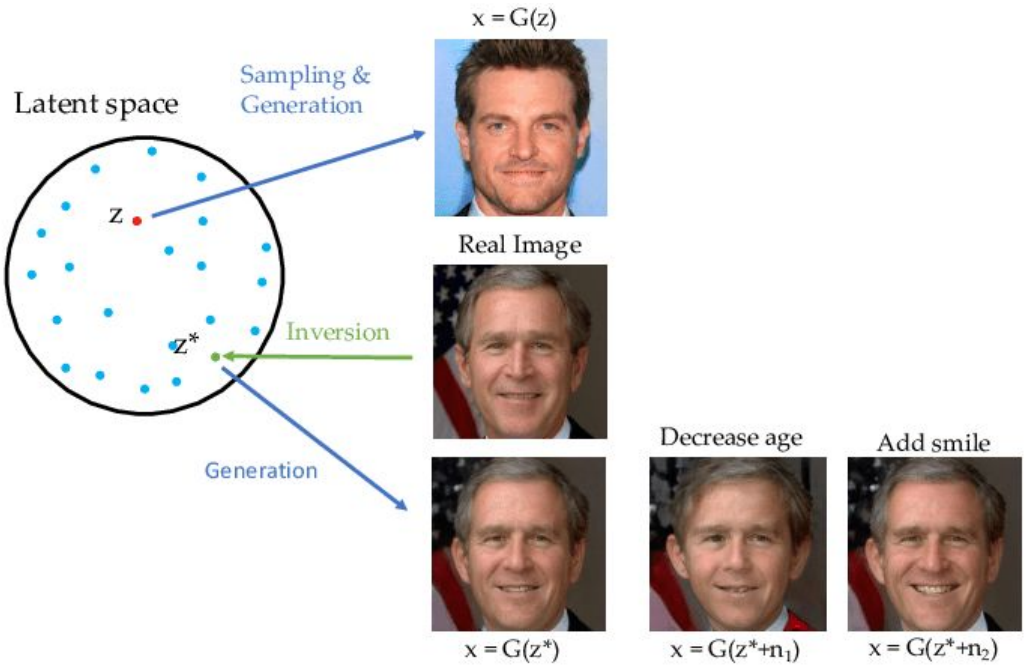
Background - StyleGAN



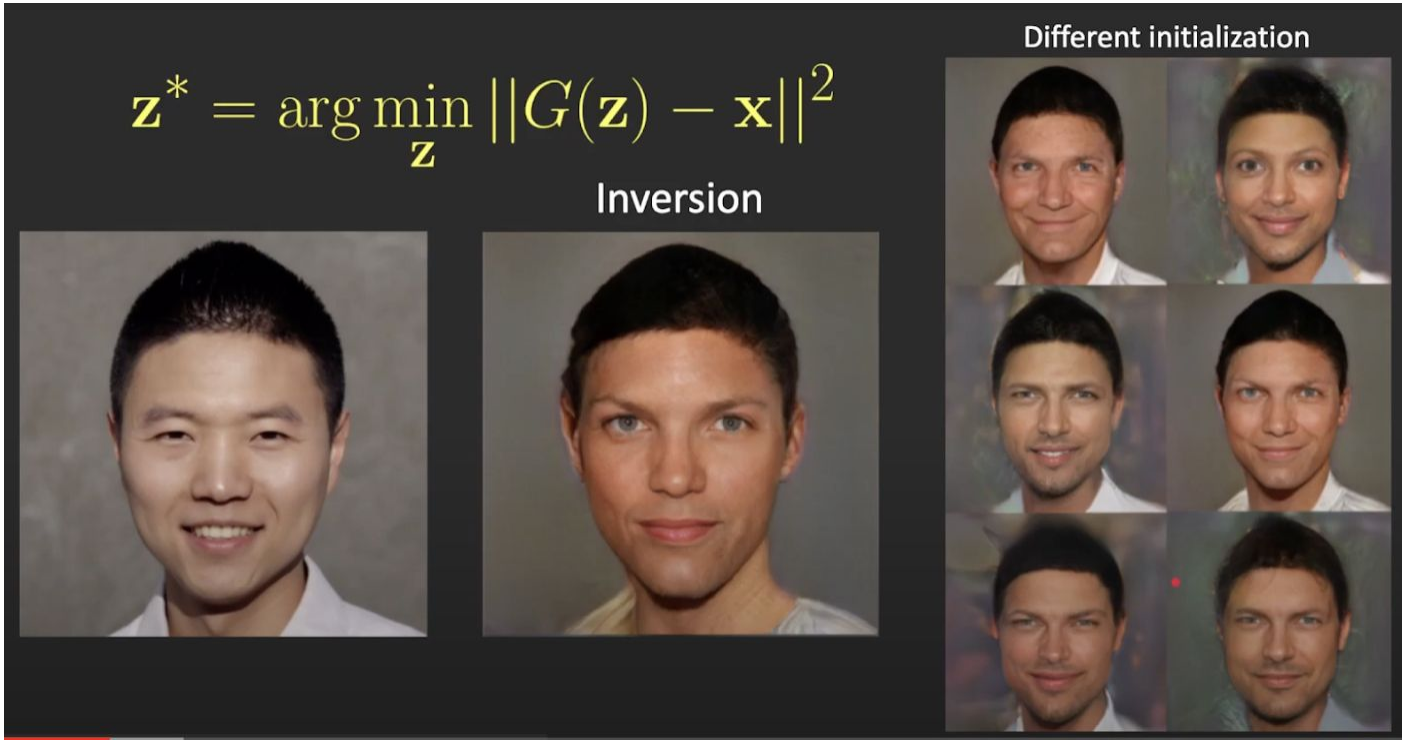


Background - GAN Space / GAN Inversion

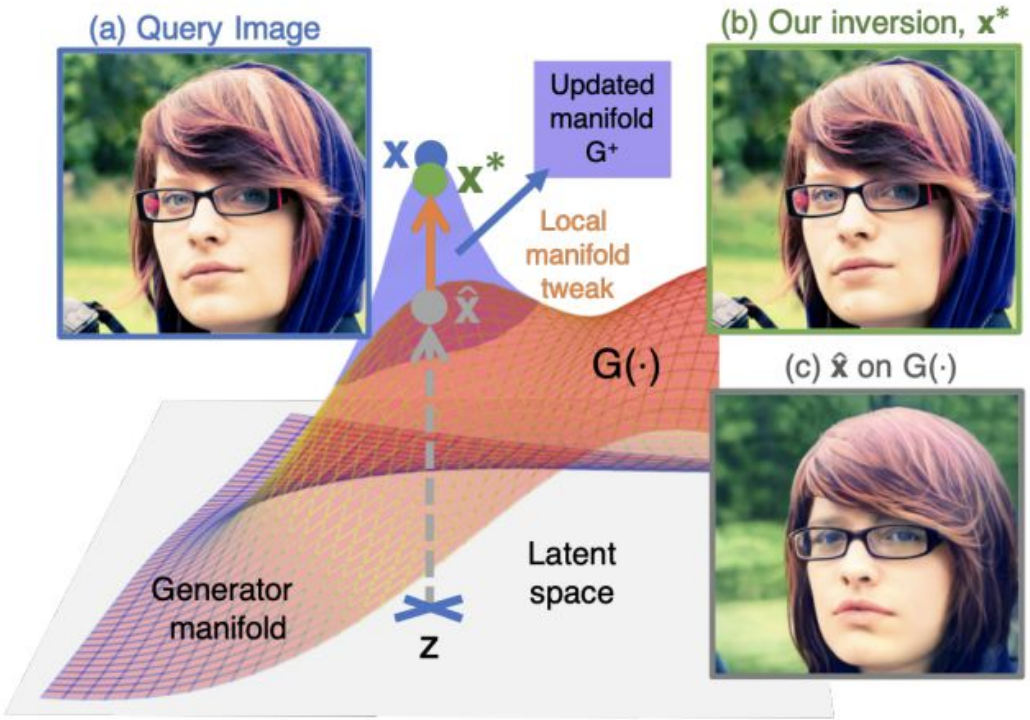




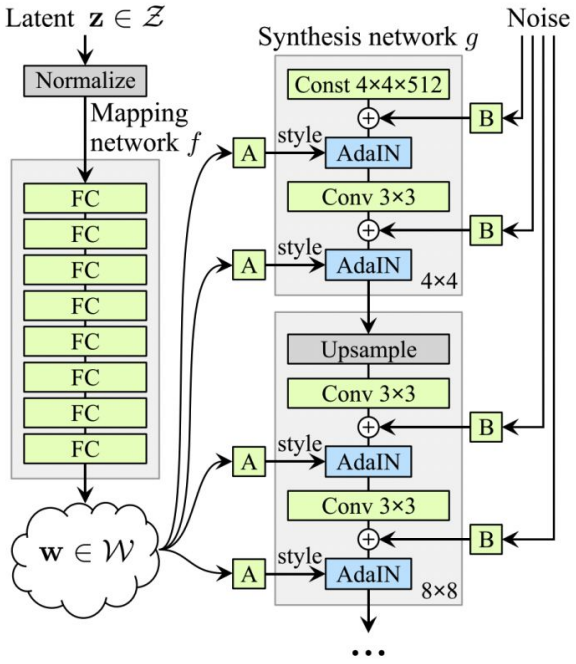
Background - Latent Optimization

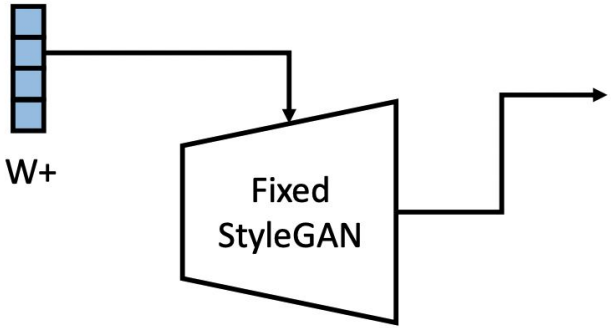


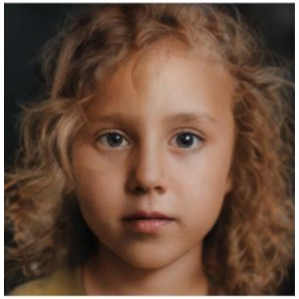
Background - Latent Optimization



Background - Latent Optimization (W+ Space)







Fake Image

Reconstruction Loss

1. L2
2. LPIPS (Perceptual, VGG)
3. Identity Loss (Face Rec. Net.)



Real Image

Background - Latent Optimization (FS Space)

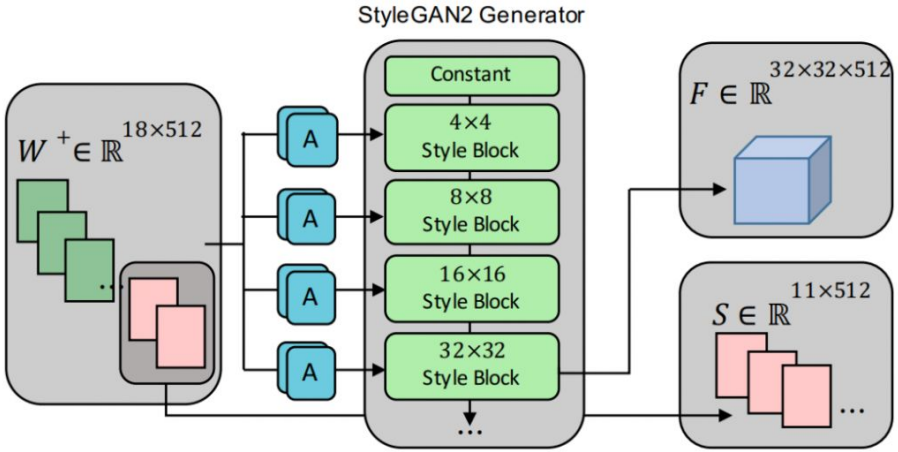
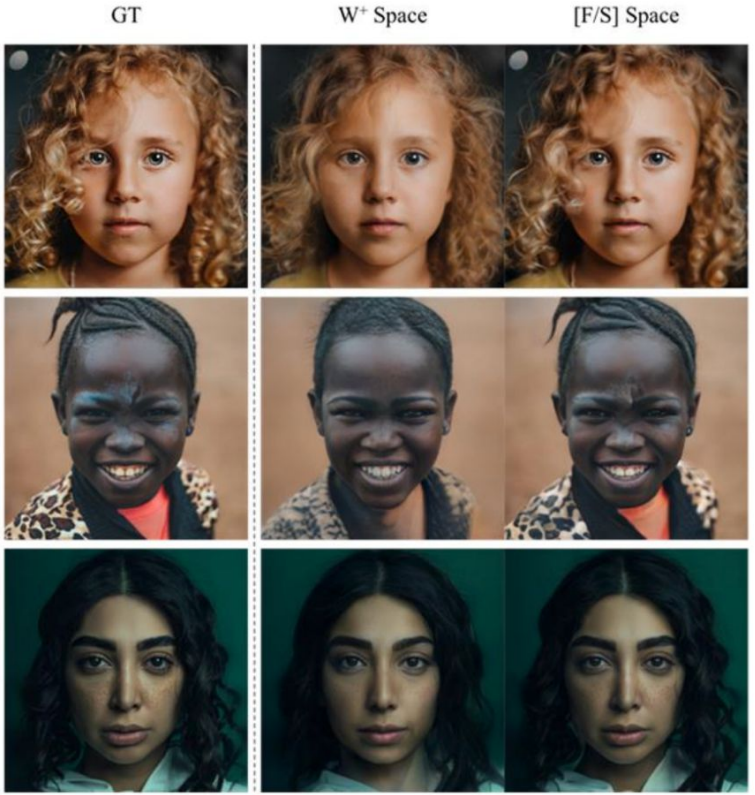
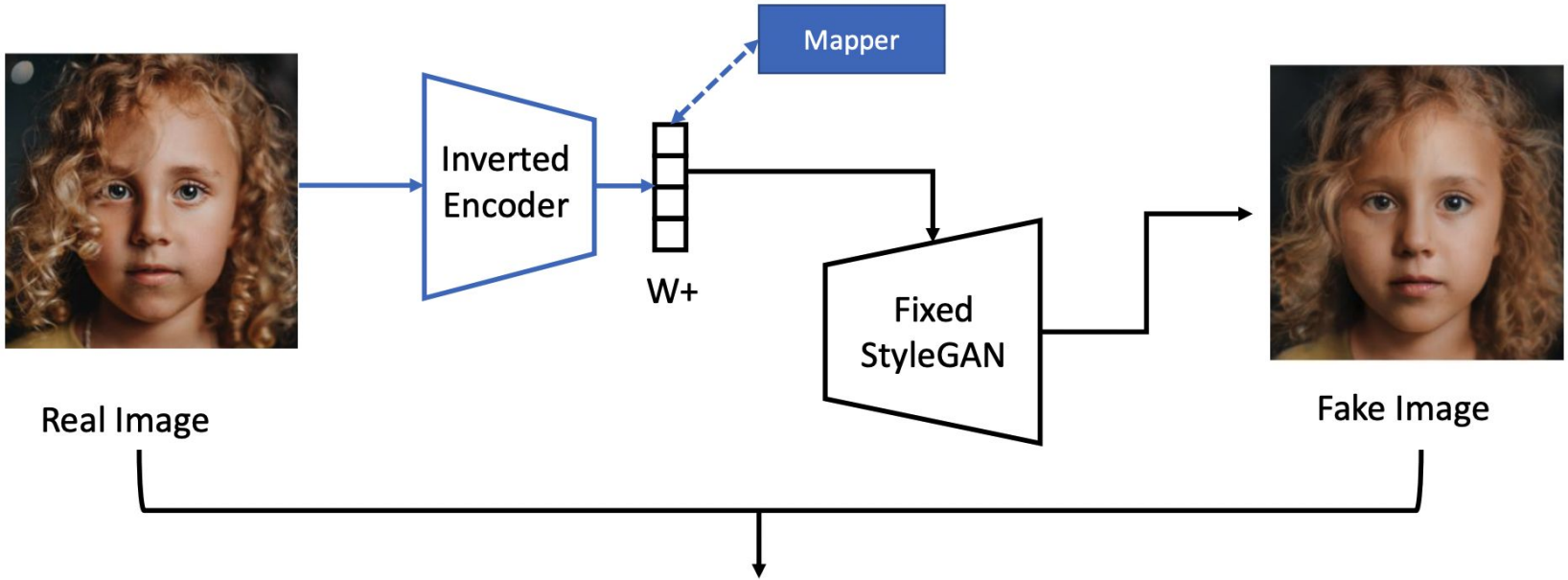


Fig. 2. The relation between FS and $W+$ latent space. The first m (for m =7) blocks of the $W+$ code are replaced by the output of style block m to form a structure tensor F, and the remaining parts of $W+$ are used as an appearance code S.



Background - Latent Encoding



Reconstruction Loss

1. L2
2. LPIPS
3. Identity Loss

Latent Space Walking





Related Works

Conference	Paper	Institute
SIGGRAPH 20	MichiGAN: Multi-Input-Conditioned Hair Image Generation for Portrait Editing	USTC, Snap Inc.
CVPR 21	LOHO: Latent Optimization of Hairstyles via Orthogonalization	Toronto Univ., Modiface, Inc.
BMVC 21	HairFIT: Pose-Invariant Hairstyle Transfer via Flow-based Hair Alignment and Semantic-Region-Aware Inpainting	**KAIST AI**
SIGGRAPH Asia 21	Barbershop: GAN-based Image Compositing using Segmentation Masks	KAUST
CVPR 22	HairMapper: Removing Hair from Portraits Using GANs	Zhejiang Univ.
CVPR 22	HairCLIP: Design Your Hair by Text and Reference Image	USTC
ECCV 22 (Under Review)	Style Your Hair: Latent Optimization for Pose-Invariant Hairstyle Transfer via Local-Style-Aware Hair Alignment	**KAIST AI**

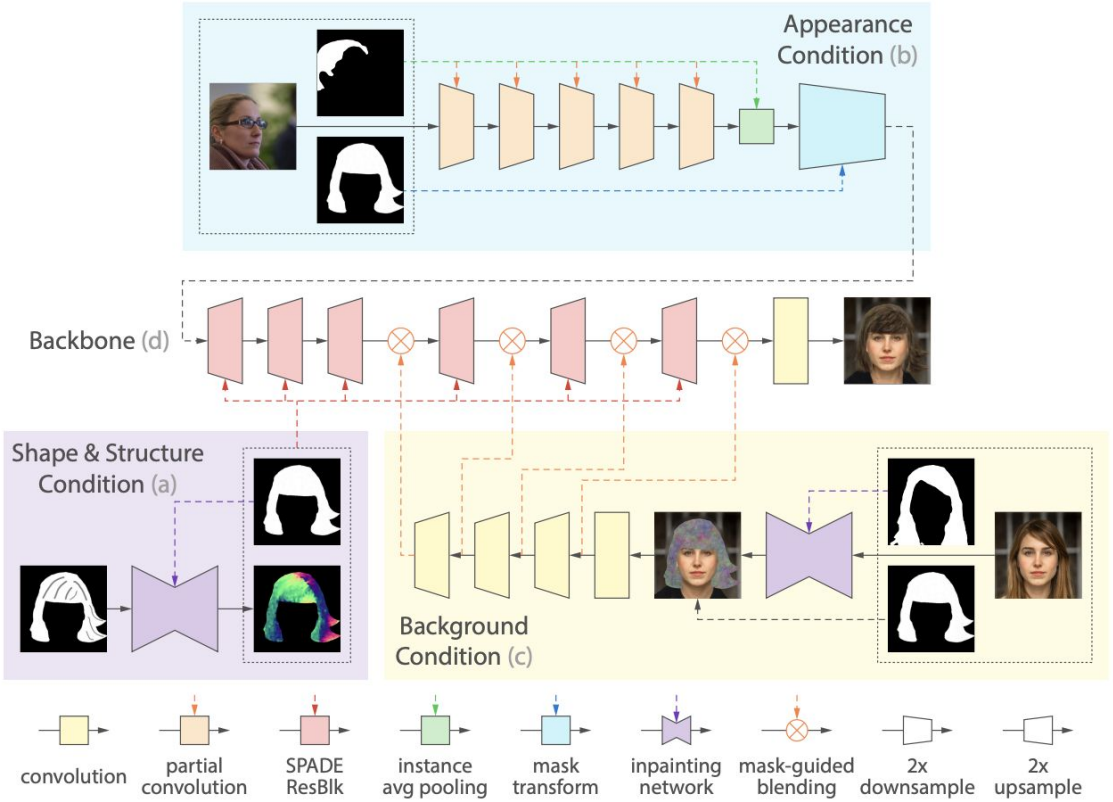
Related Works

Conference	Paper	Backbone	Latent space	Preserving Target Hairstyle	Quality of Inpainting	Pose invariant
SIGGRAPH 20	MichiGAN	Encoder,Decoder	X	Normal	Normal	X
CVPR 21	LOHO	StyleGAN2, Inpainting Net.	Latent Optimization	Normal - Good	Good	X
BMVC 21	HairFIT	MonkeyNet, ALIAS generator	X	Normal	Normal	O (with muti-view dataset)
SIGGRAPH Asia 21	**Barbershop**	StyleGAN2	Latent Optimization	Good	Good	X
CVPR 22	**HairMapper**	StyleGAN2	Latent encoding	Good (but, only removing hair)	Good	O
CVPR 22	**HairCLIP**	StyleGAN2, CLIP	Latent encoding	Quite different	Good	O
ECCV 22 (Under Review)	**Style Your Hair**	StyleGAN2	Latent Optimization	Good	Good	O

MichiGAN (SIGGRAPH 20)

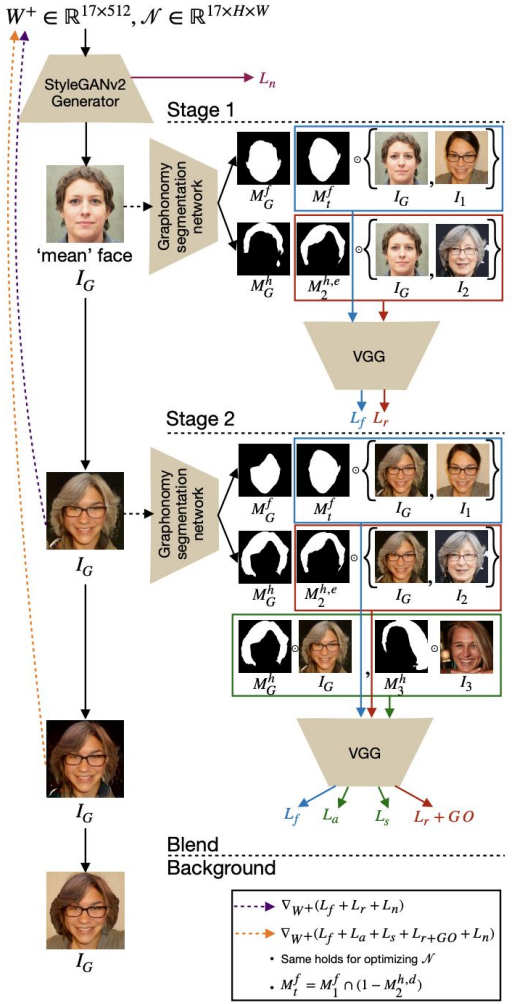


MichiGAN (SIGGRAPH 20)

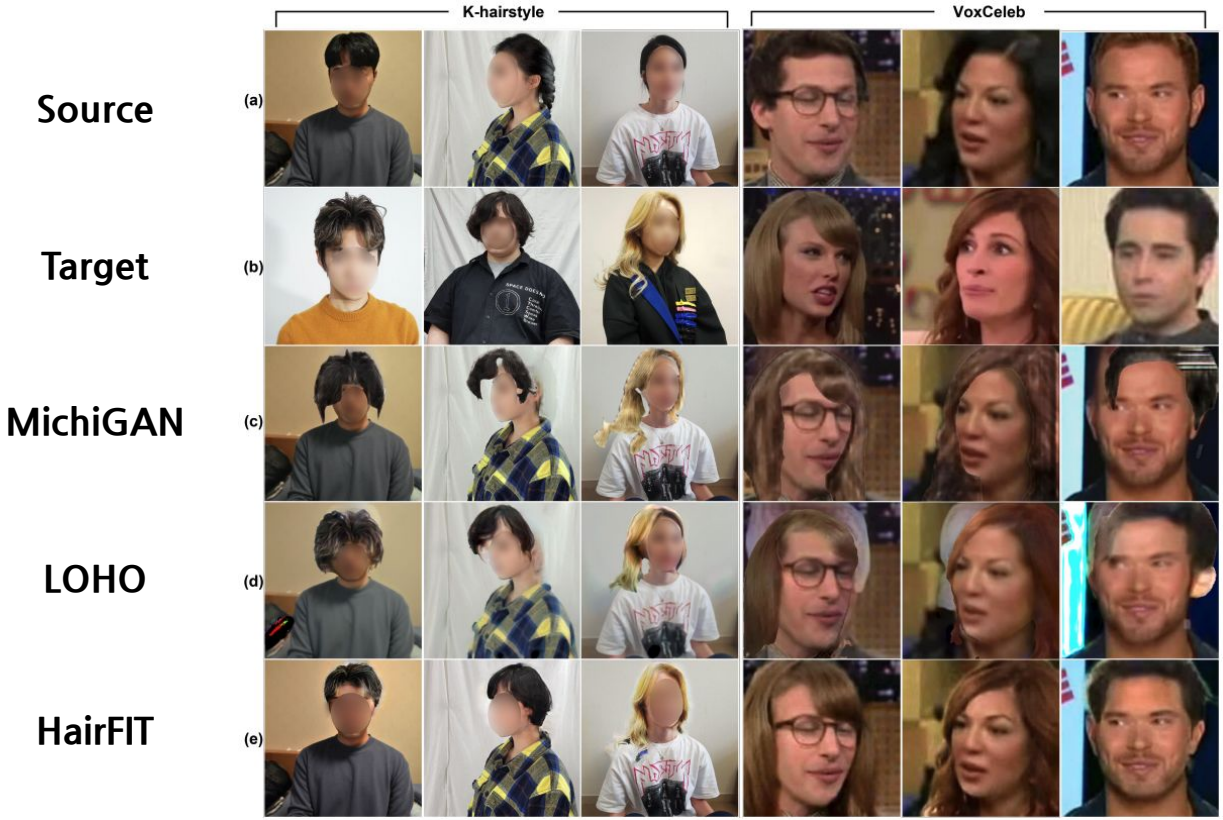


LOHO (CVPR 21)


(a)
(b)
(d)


$W^+ \in \mathbb{R}^{17\times512}, \mathcal{N} \in \mathbb{R}^{17\times H\times W}$
StyleGANv2 Generator
L_n
Stage 1
'mean' face
I_G
Graphonomy segmentation network
M_G^f
M_t^f
I_G
I_1
M_G^h
$M_2^{h,e}$
I_2
VGG
L_f L_r
Stage 2
M_3^h
I_3
L_a
L_s
$L_r + GO$
Blend
Background
$\nabla_{W^+}(L_f + L_r + L_n)$
$\nabla_{W^+}(L_f + L_a + L_s + L_{r+GO} + L_n)$
Same holds for optimizing $\mathcal{N}$
$M_t^f = M_1^f \cap (1 - M_2^{h,d})$

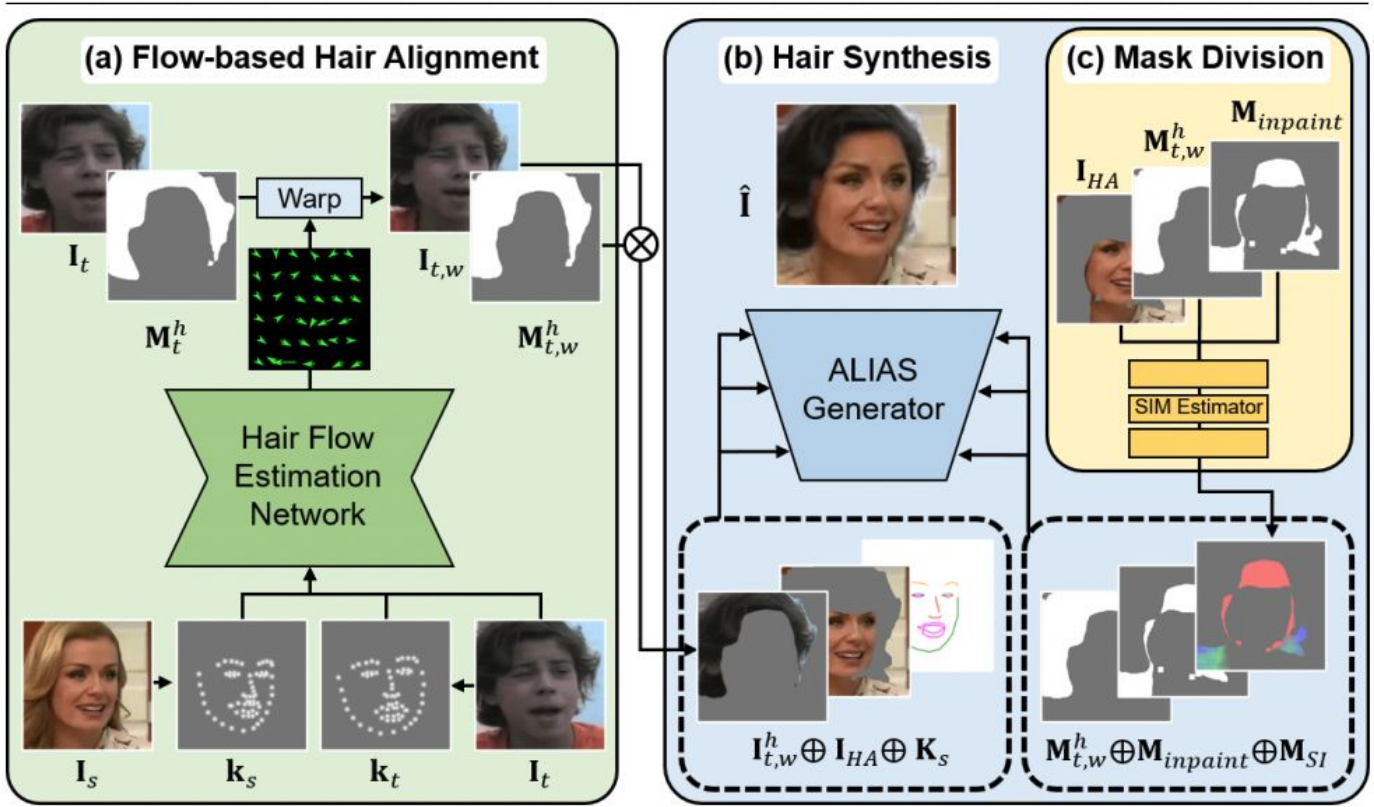
HairFIT (BMVC 21)



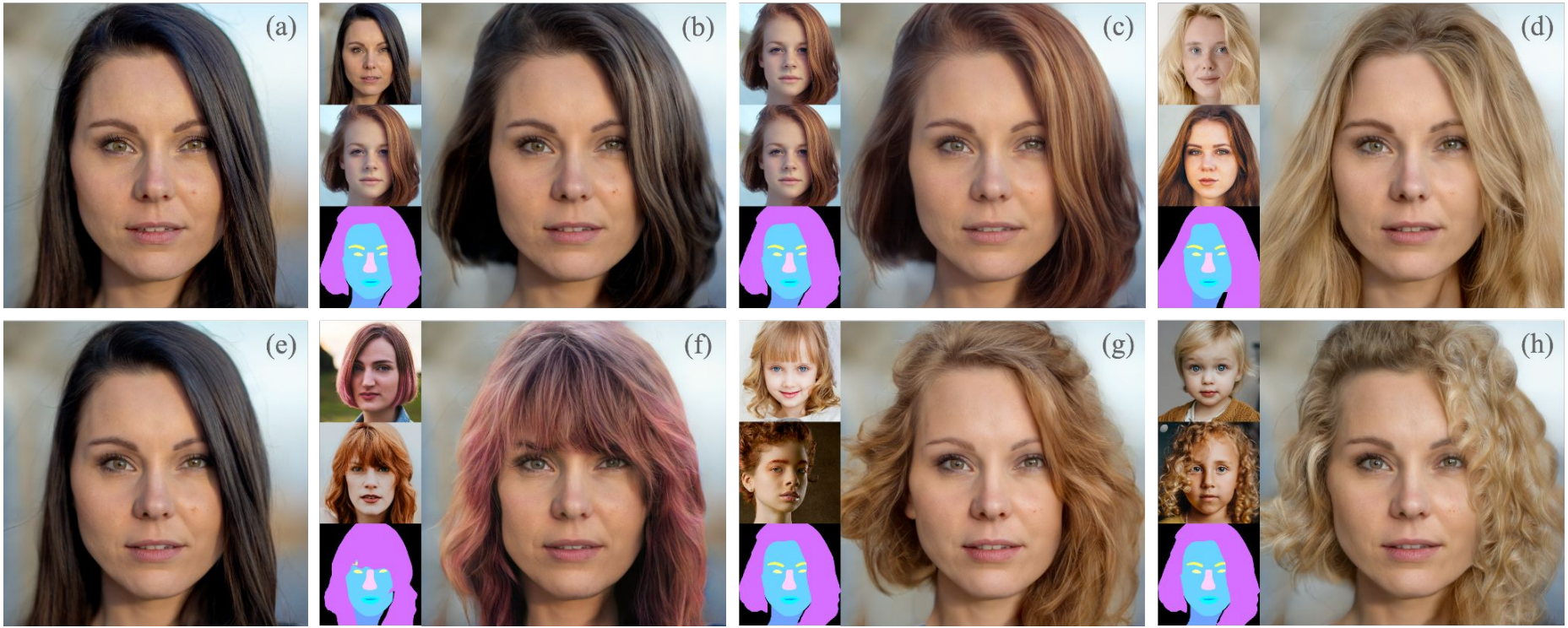
HairFIT (BMVC 21)



HairFIT (BMVC 21)



Barbershop (CVPR 22)



Barbershop (CVPR 22)



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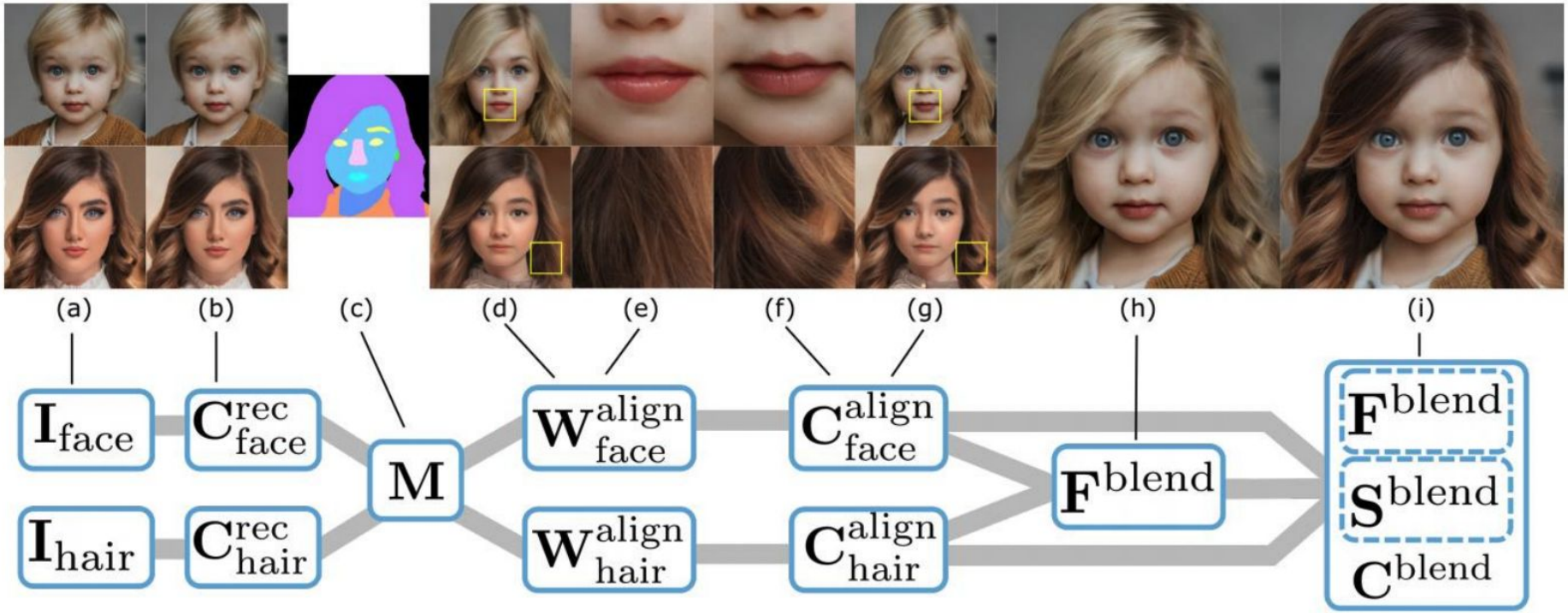
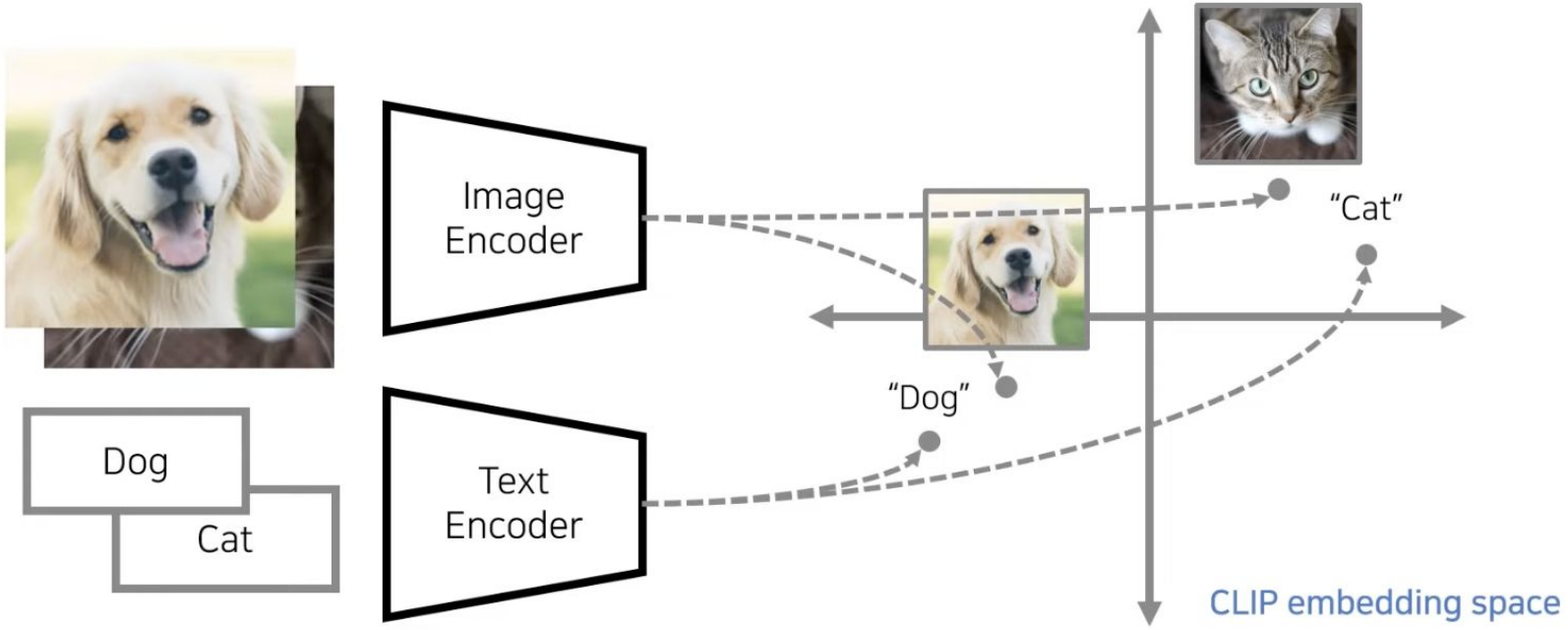
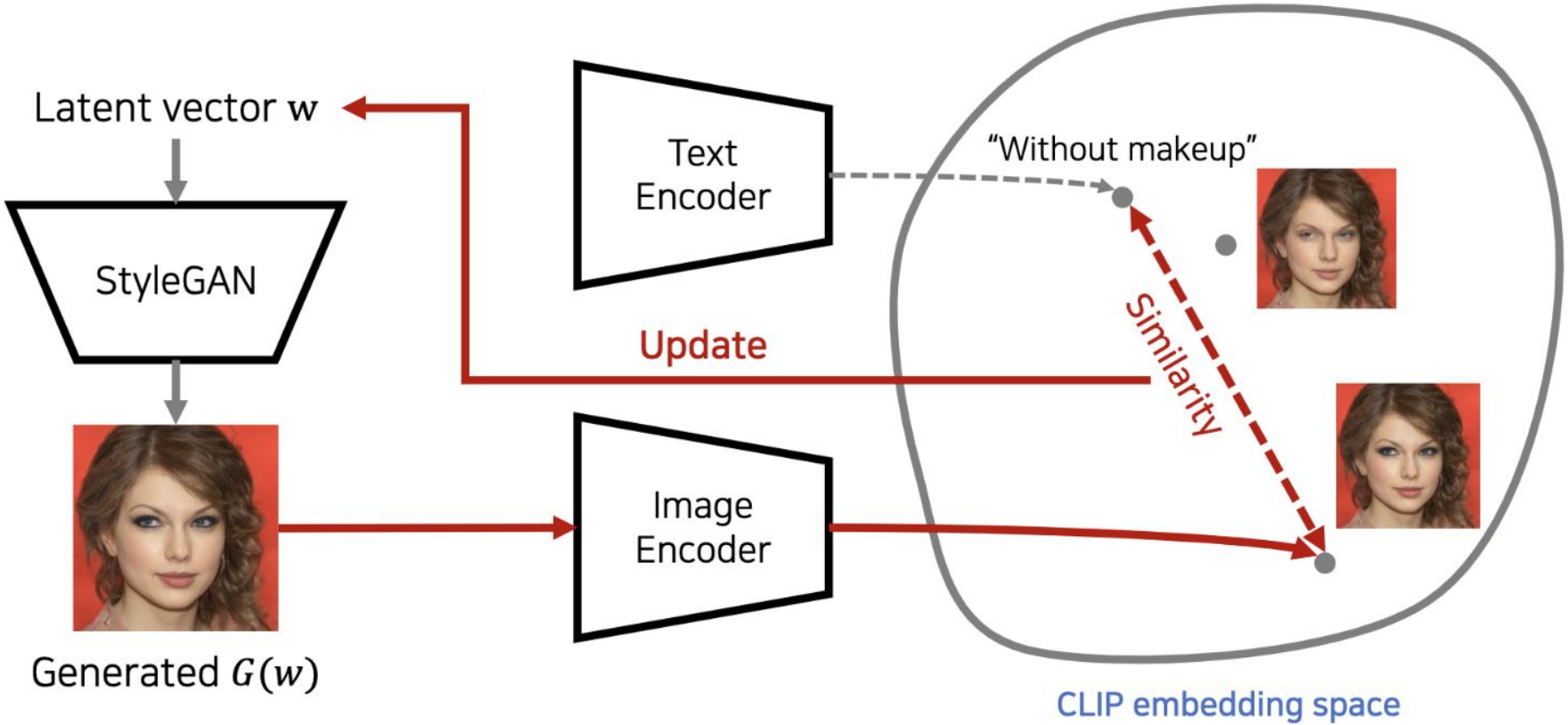


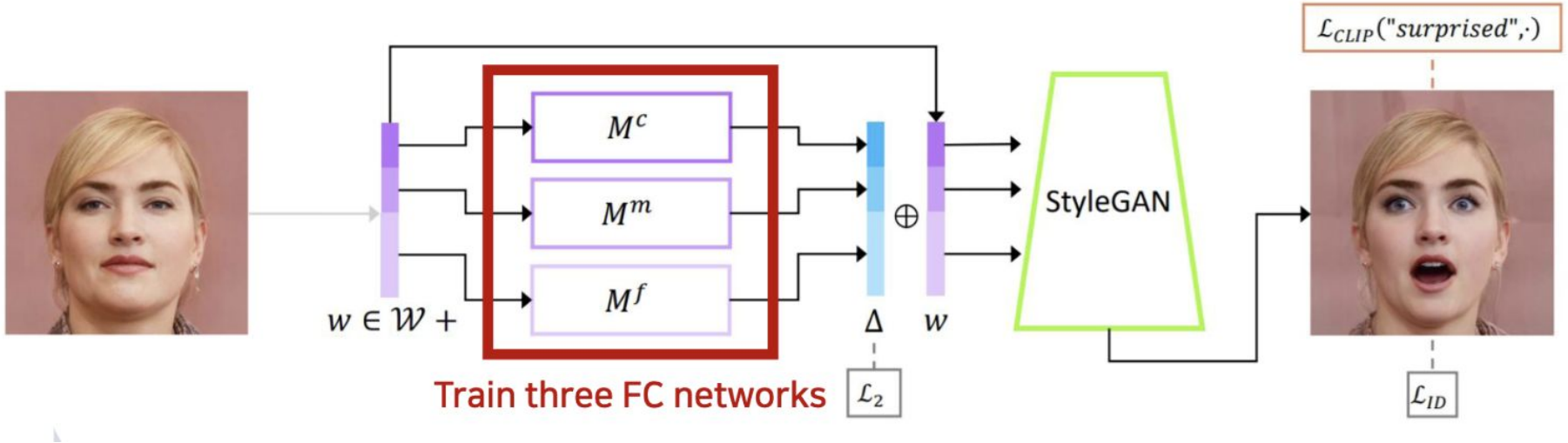
StyleCLIP (ICCV 21)



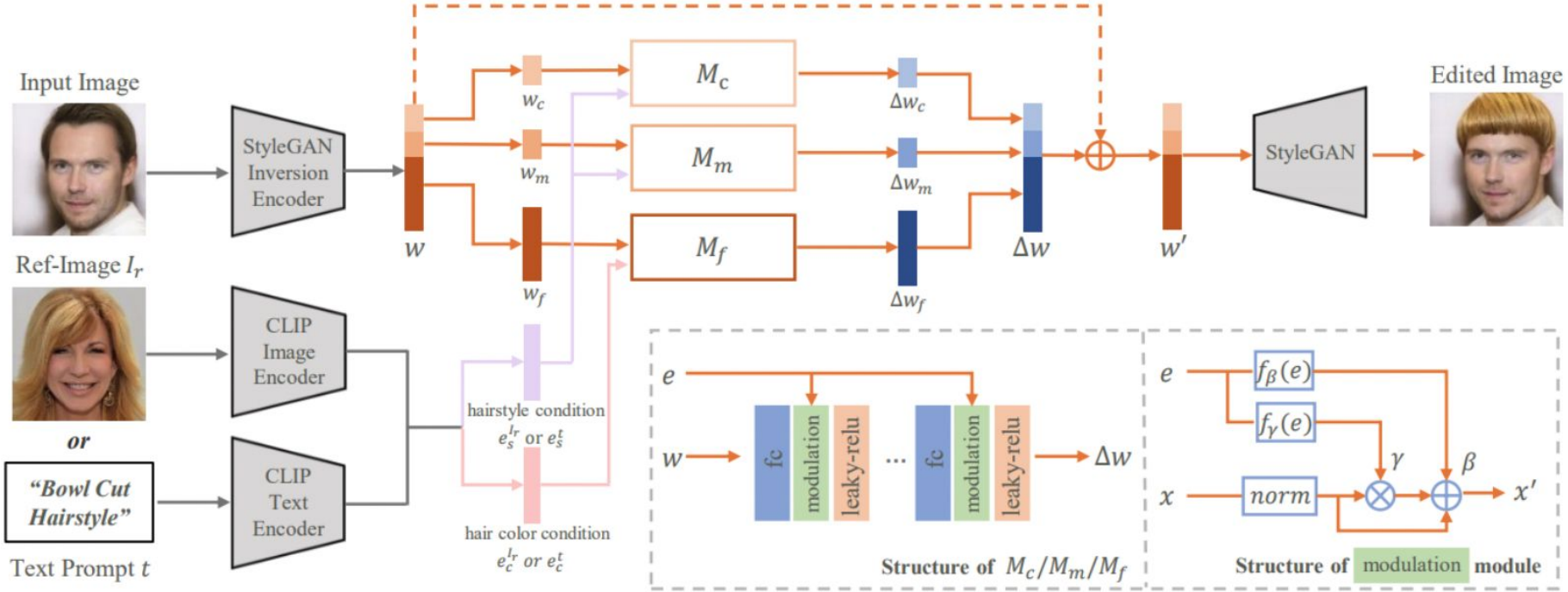
StyleCLIP (ICCV 21)



StyleCLIP (ICCV 21)

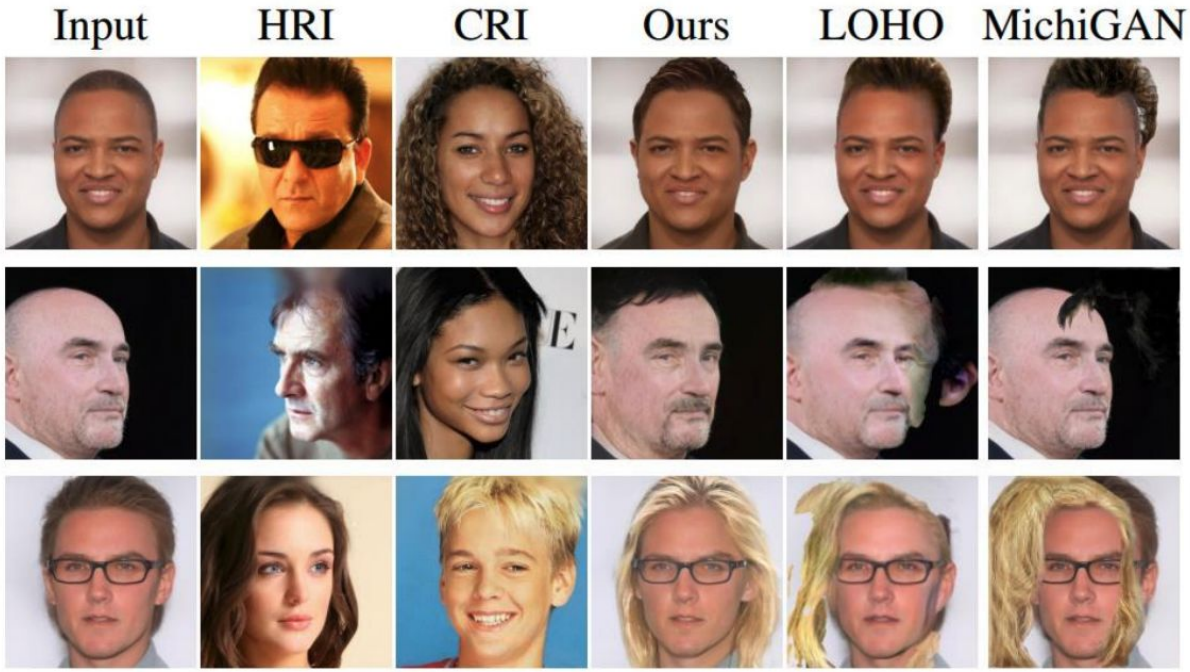


HairCLIP (CVPR 22)



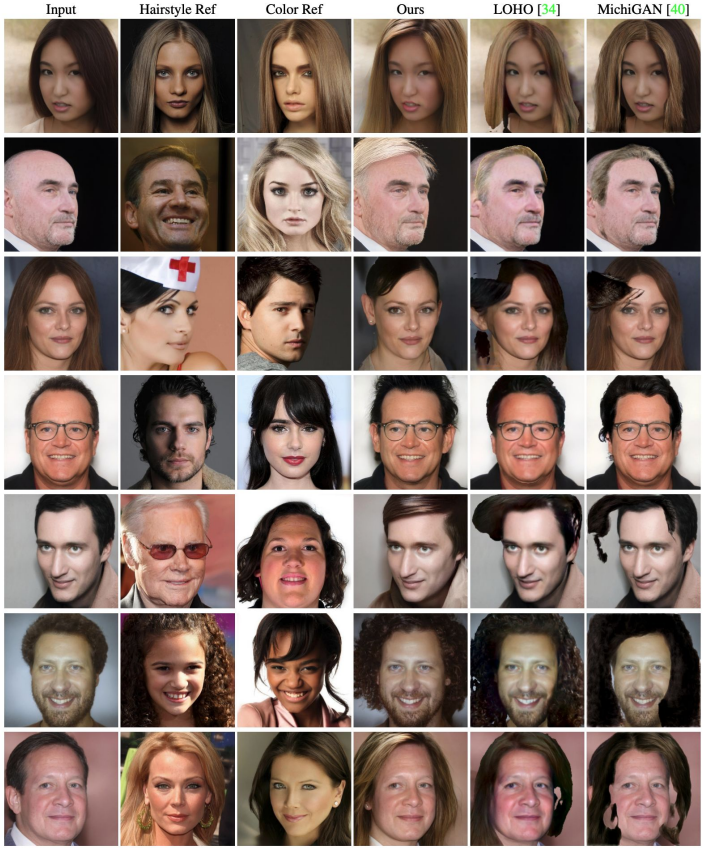
HairCLIP (CVPR 22)



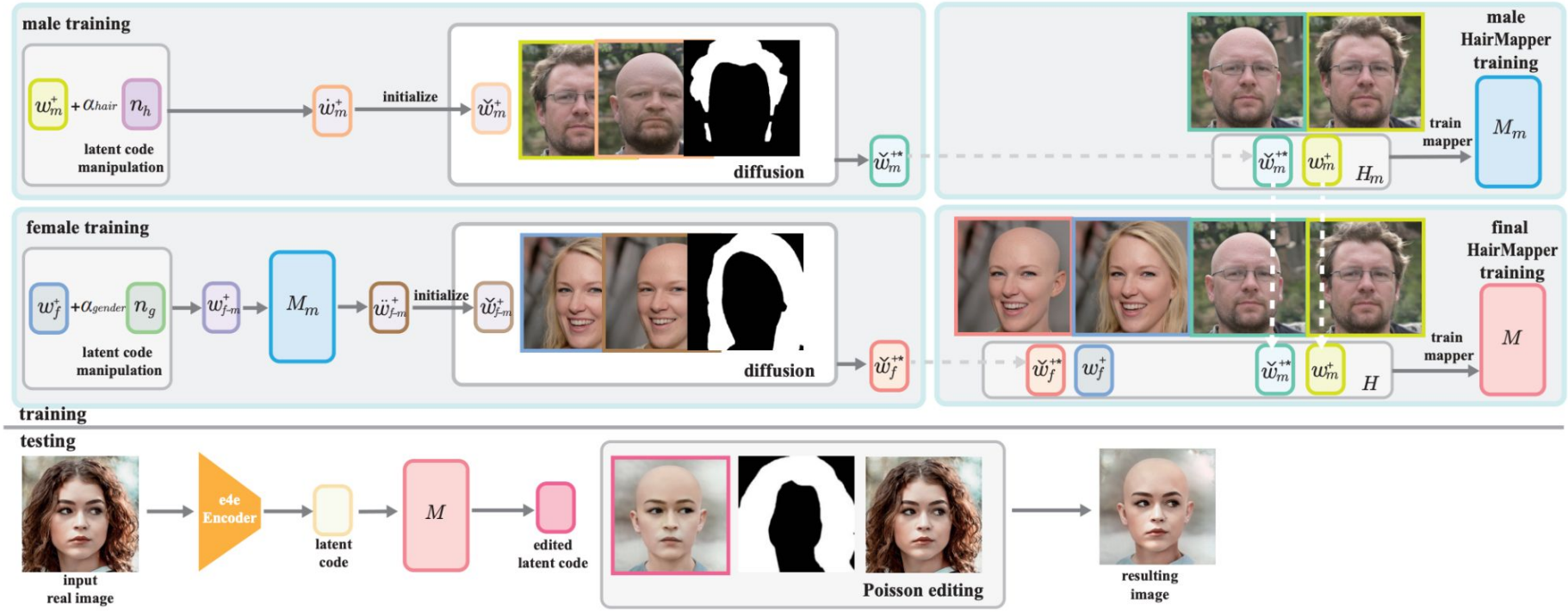


HRI means hairstyle reference image and **CRI** means hair color reference image.

HairCLIP (CVPR 22)



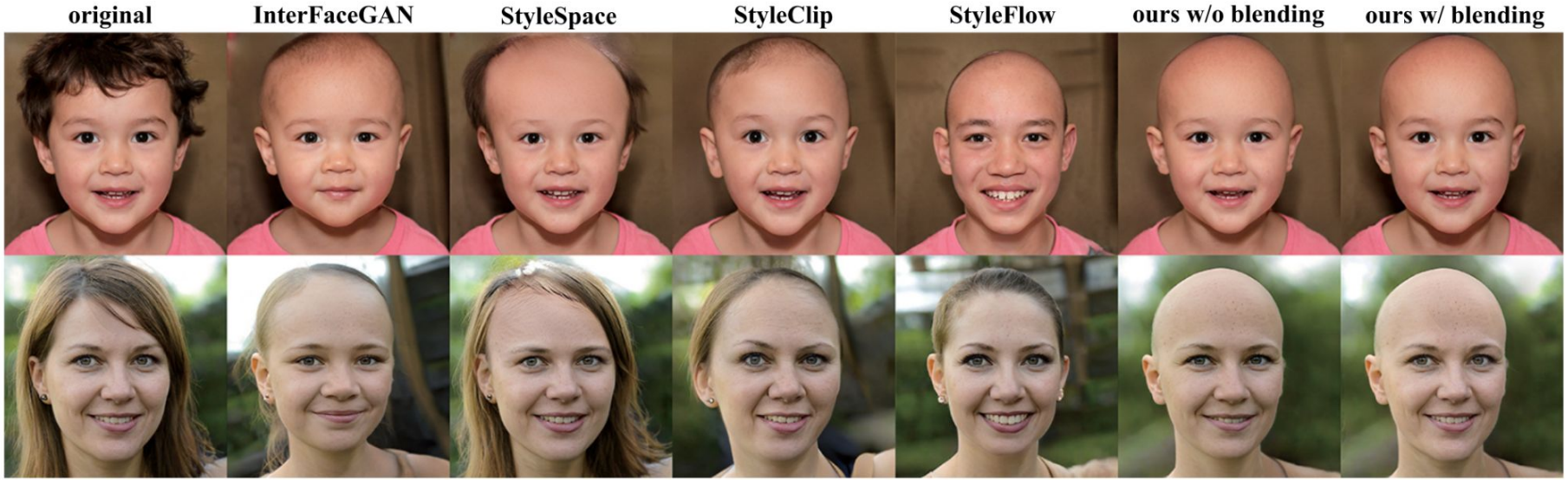
HairMapper (CVPR 22)



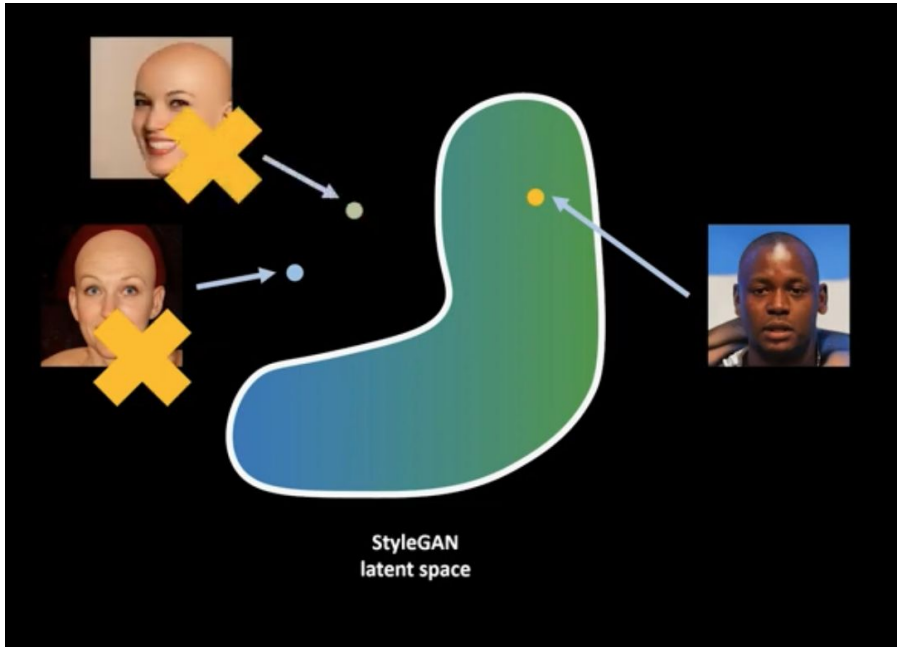
HairMapper (CVPR 22)

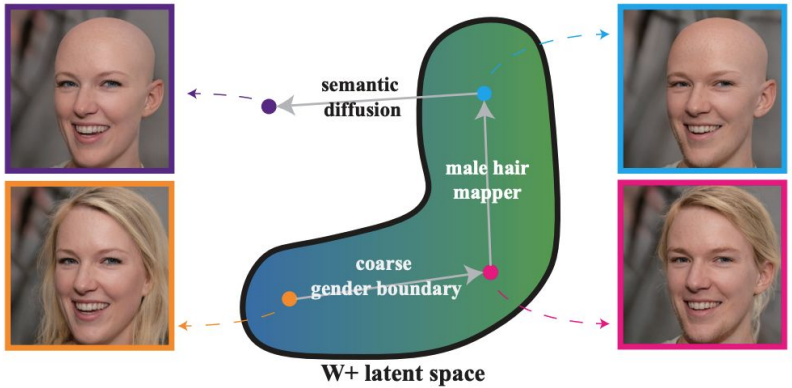


HairMapper (CVPR 22)



HairMapper (CVPR 22)





StyleYourHair (ECCV 22 under review)

- High-quality pose-invariant hairstyle transfer based on 4 latent optimization steps.

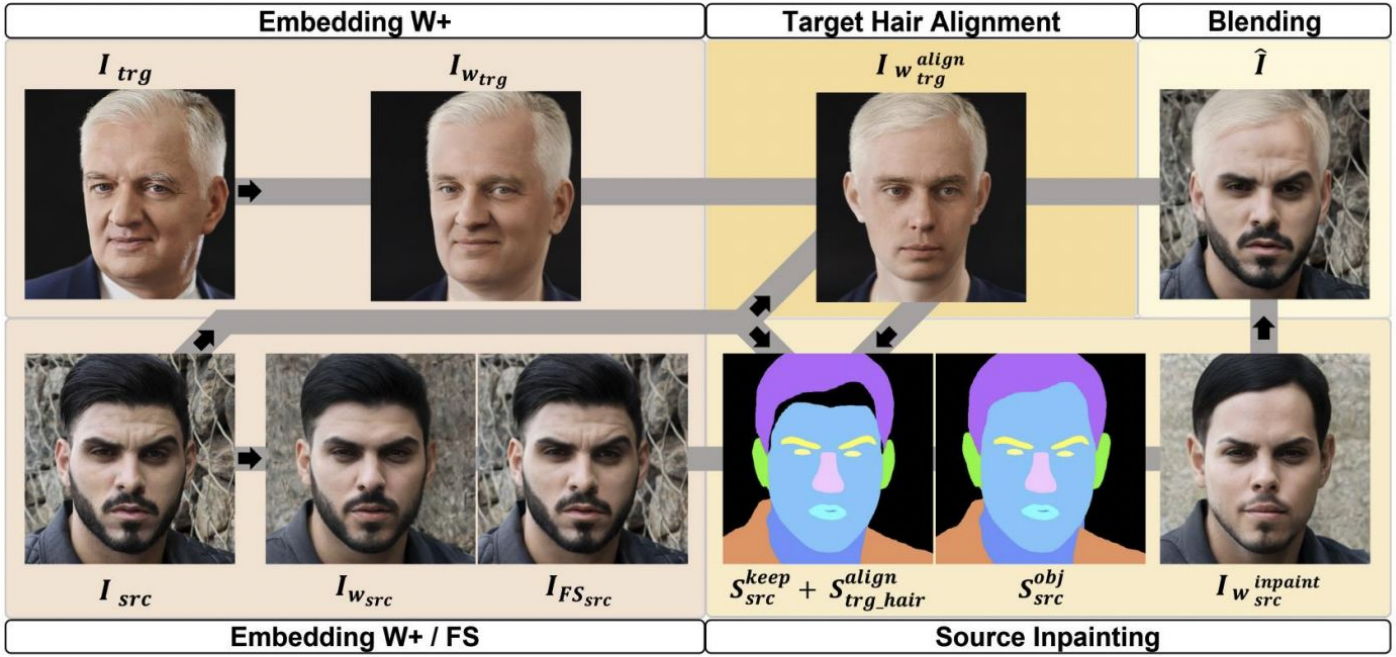
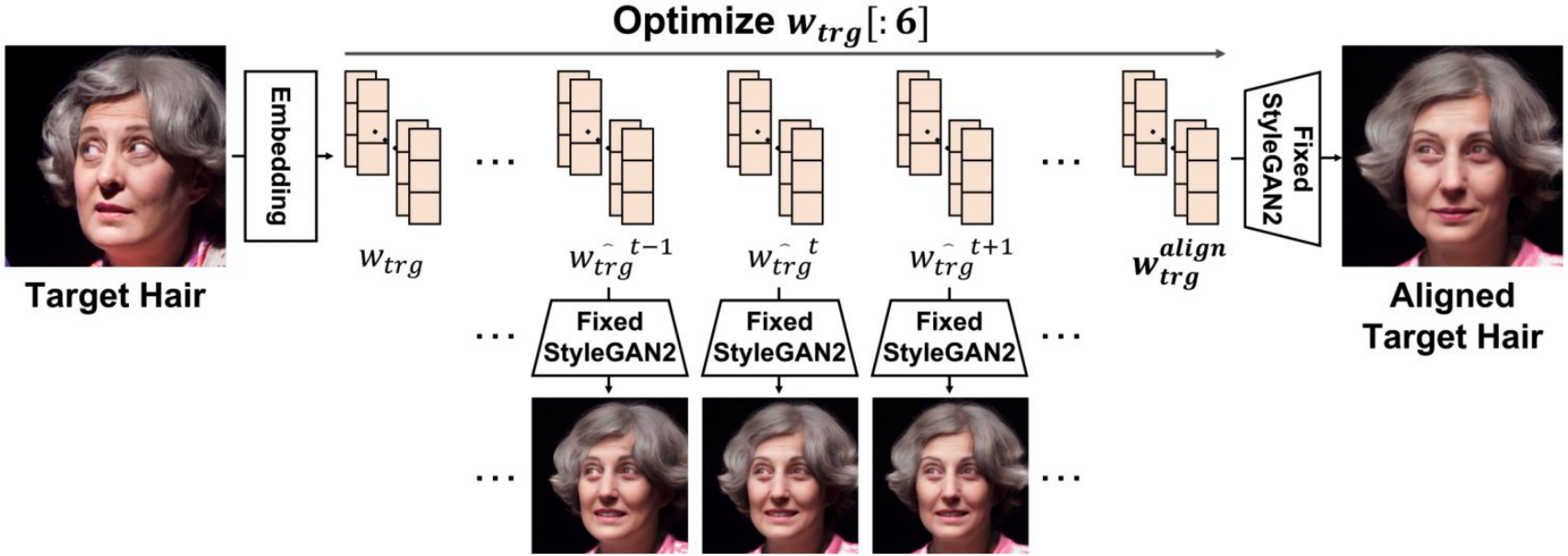


Fig. 4. A visualization of results of each step in our framework.

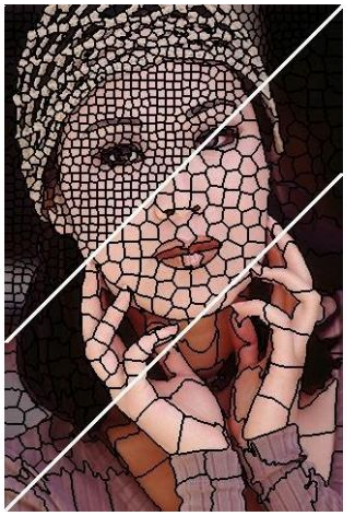
StyleYourHair (ECCV 22 under review)

- Alignment of target hair to source pose by optimizing coarse features of W+ latent codes of target hair image.

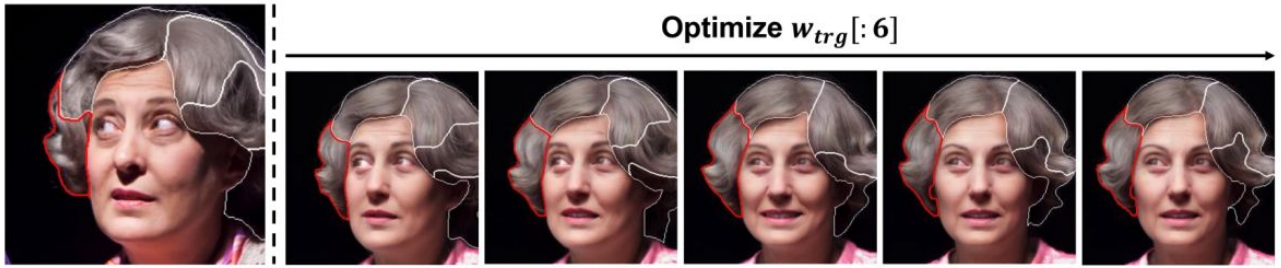


StyleYourHair (ECCV 22 under review)

- Local-style-matching loss to preserve target hairstyle during pose alignment.
- SLIC* [4]: pixel간 거리, pixel 값 차이 (in color space) 기반으로 K-means clustering 수행.



SLIC segments



Target Hair

Aligned Target Hair in Progress

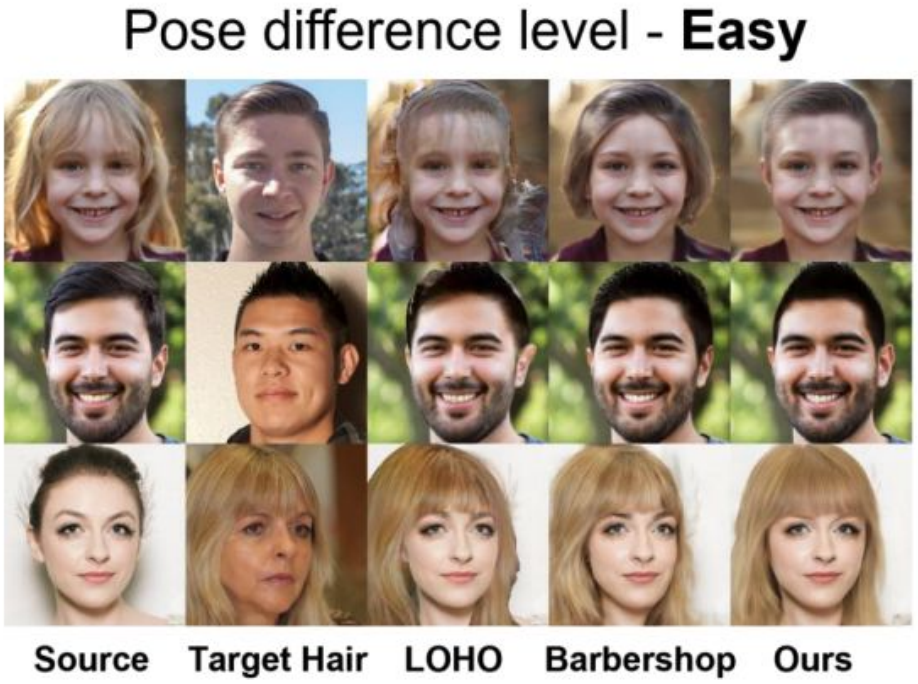
$$\mathcal{L}_{style}(\cdot,\cdot) = \frac{1}{V}\sum_{i=1}^{V}\frac{1}{N_{\mathcal{G}^i}}\|\mathcal{G}^i(\mathrm{VGG}^i(\cdot)) - \mathcal{G}^i(\mathrm{VGG}^i(\cdot))\|_2^2$$

$$\mathcal{L}_{style}^{LSM} = \sum_{i=1}^{N_{style}} \mathcal{L}_{style}(SLIC_{hair}^i(\mathbf{I}_{trg})\odot\mathbf{I}_{trg}, SLIC_{hair}^i(G(\hat{w_{trg}}))\odot G(\hat{w_{trg}}))$$

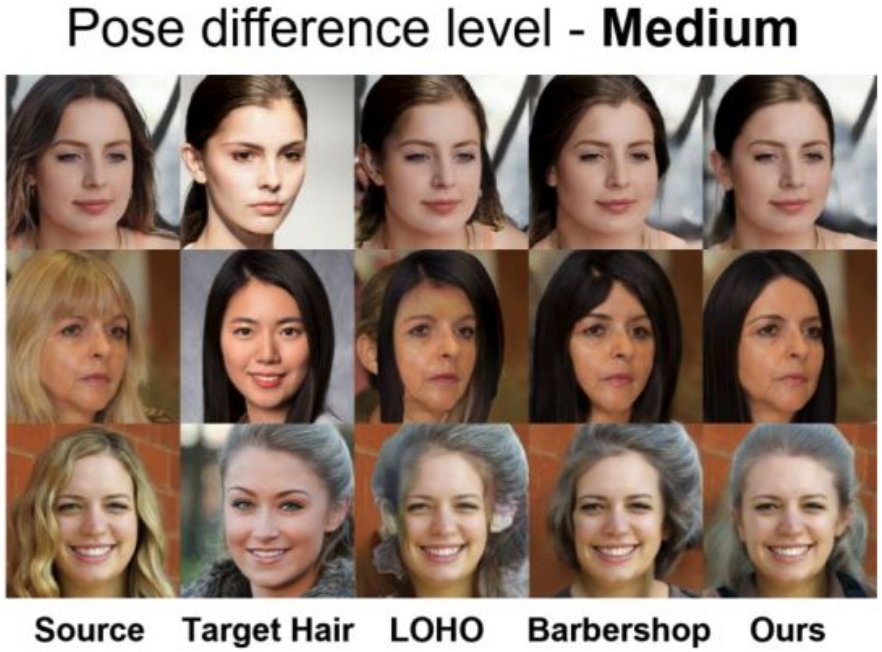
StyleYourHair (ECCV 22 under review)



StyleYourHair (ECCV 22 under review)



StyleYourHair (ECCV 22 under review)



StyleYourHair (ECCV 22 under review)



Future Works & My Thoughts

1. StyleGAN 에서 탈피하기
2. High Delicacy & Offline Learning
3. 3D
4. Industry level 에선 여러 제약 조건들을 걸고 시작하는 것이 중요함

References

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4. https://www.youtube.com/watch?v=TVSJO9uNq7g
5. https://github.com/ndb796/StyleCLIP-Tutorial
6.