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CVPR



VANCOUVER, CANADA



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3DAvatarGAN: Bridging Domains for Personalized Editable Avatars

TUE-PM-040



Rameen Abdal



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Sergey Tulyakov

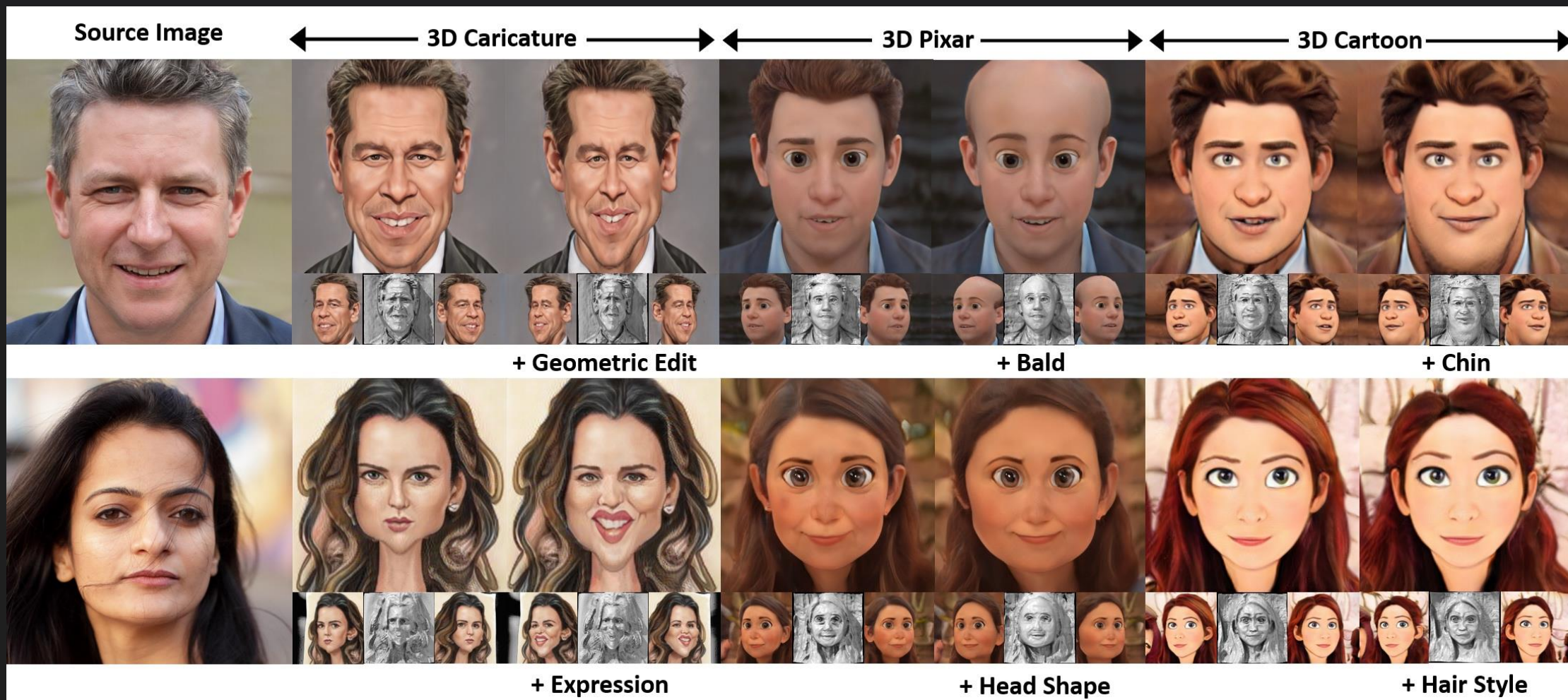
What is 3DAvatarGAN?



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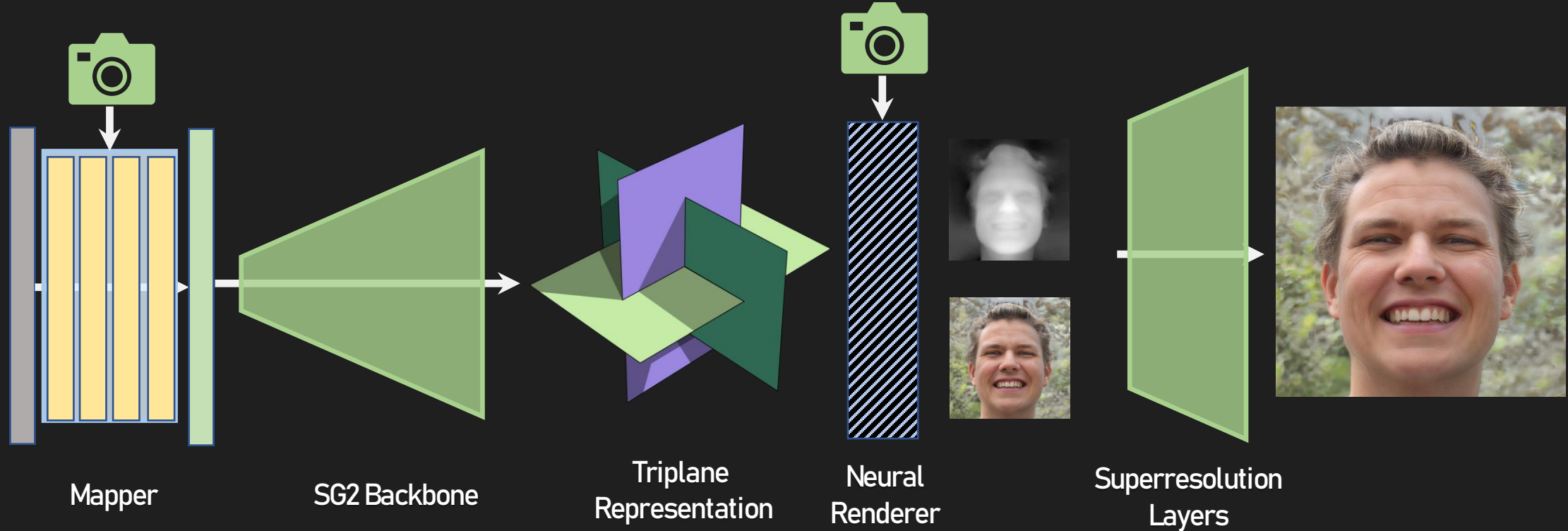
EG3D Architecture



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Some Open Questions



1. Can a 3D generator be adapted for a different domain?
2. What about the artistic domains which do not stem from a 3D model?
3. How to estimate the geometry of different domains while preserving texture quality?
4. Can we link two or more domains with unpaired data?

Problems We Solve



1. How do we adapt to an artistic domain like Pixar, Cartoons, Caricatures?
2. How to ensure the geometric and texture consistency and avoid flat geometry?
3. How to make the output avatars editable and animatable?
4. How to find a 3D avatar of a person using single image?

1. How Do We Adapt To An Artistic Domain?



How to deal with dataset

size?

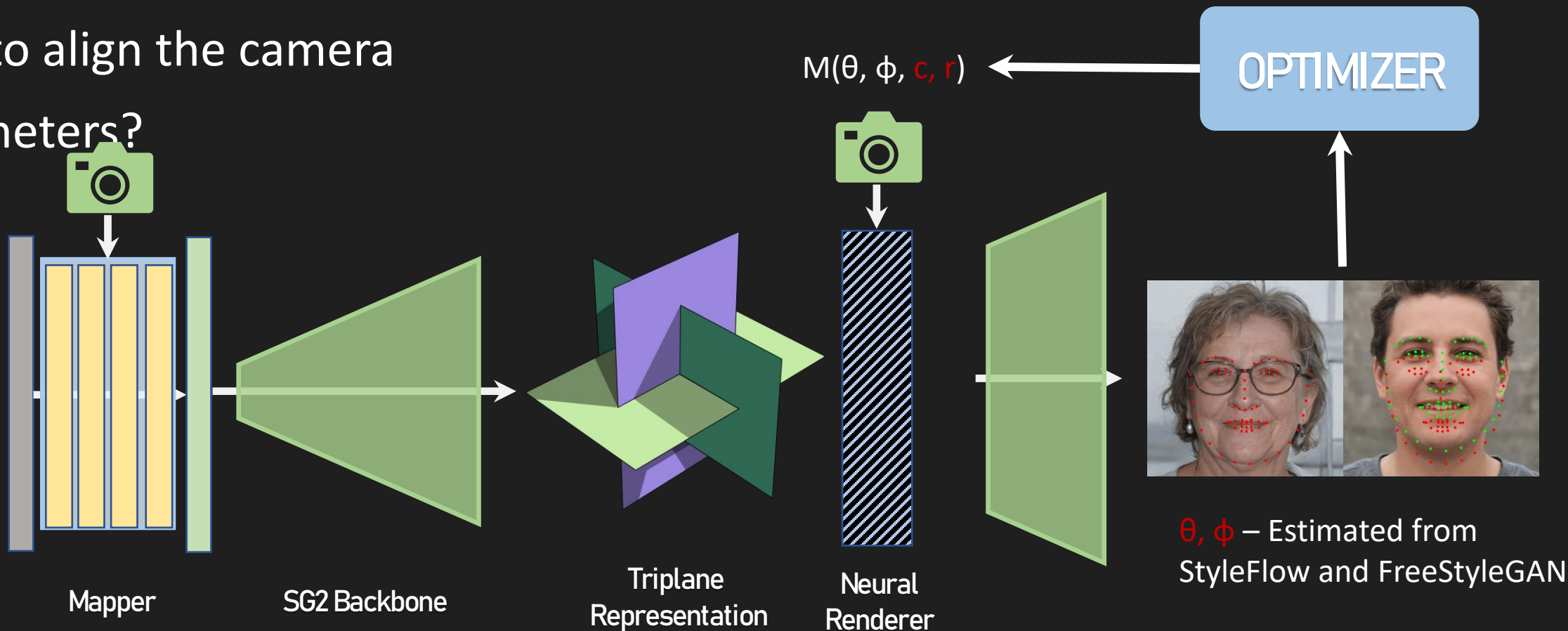


DualStyleGAN fine tuned on ~200 images using StyleGAN2 architecture

1. How Do We Adapt To An Artistic Domain?



How to align the camera
parameters?



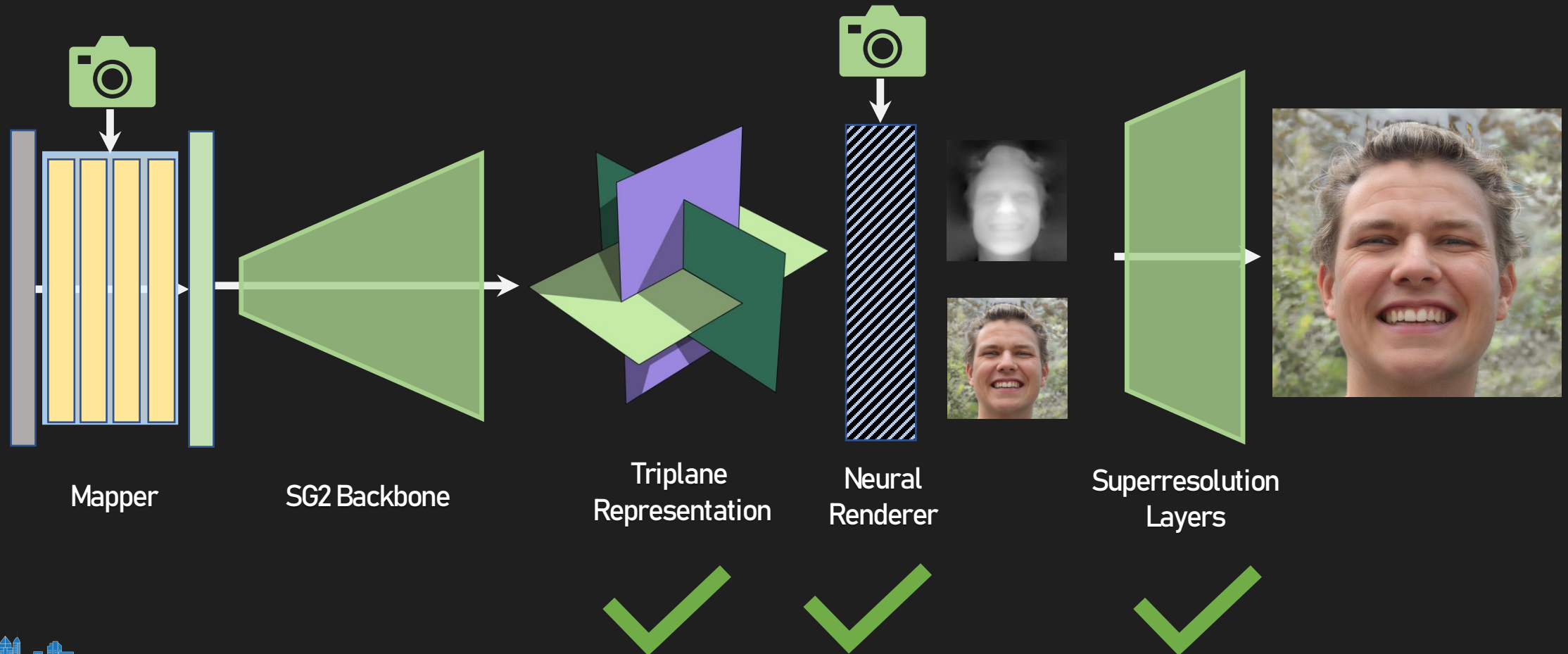
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2. Geometric and Texture Consistency



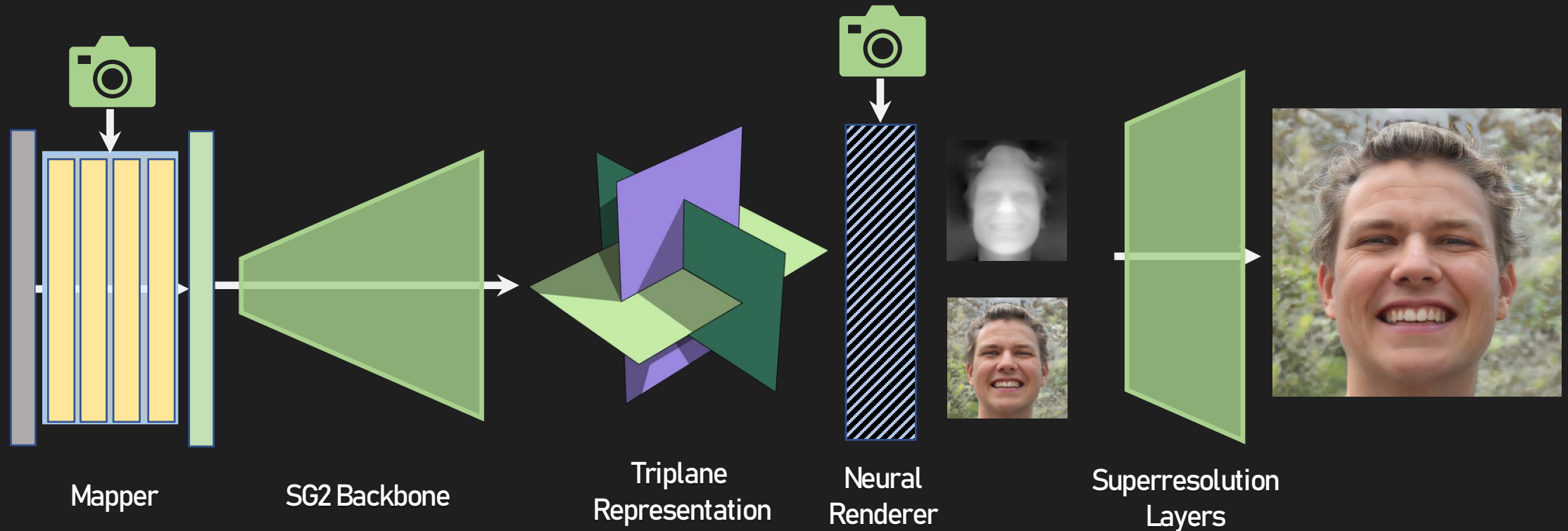
Texture Layers



2. Geometric and Texture Consistency



Geometry Layers



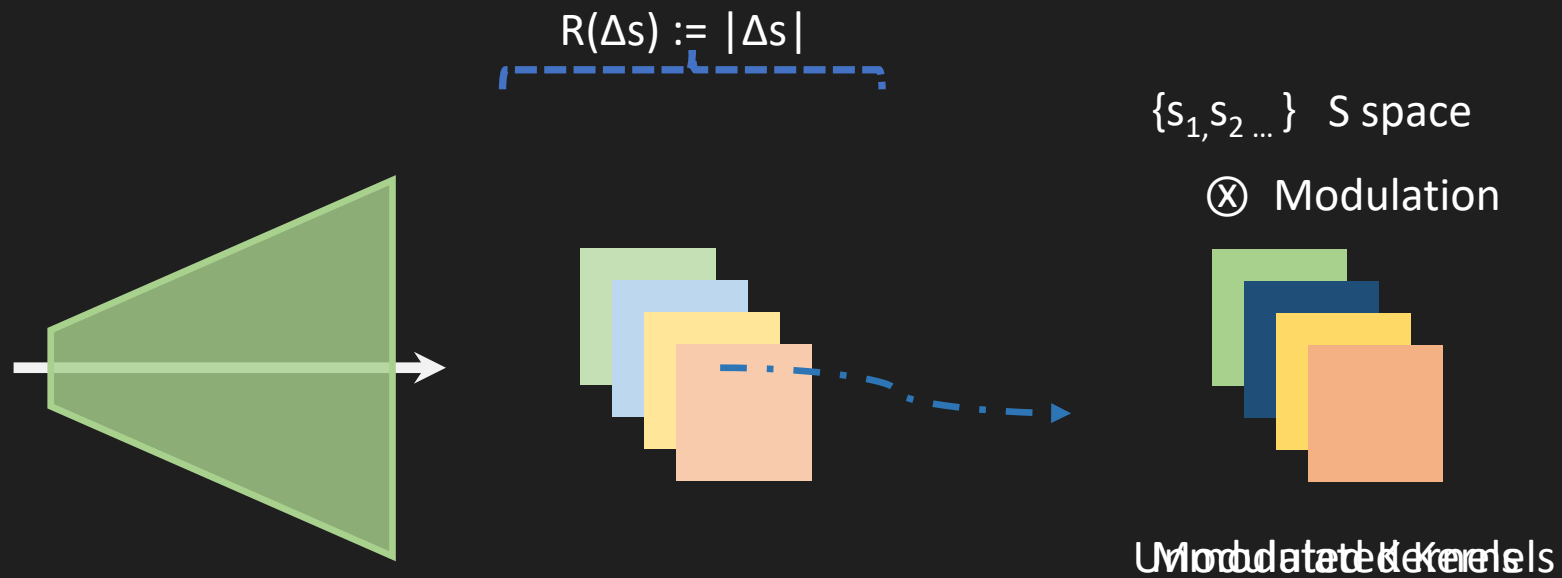
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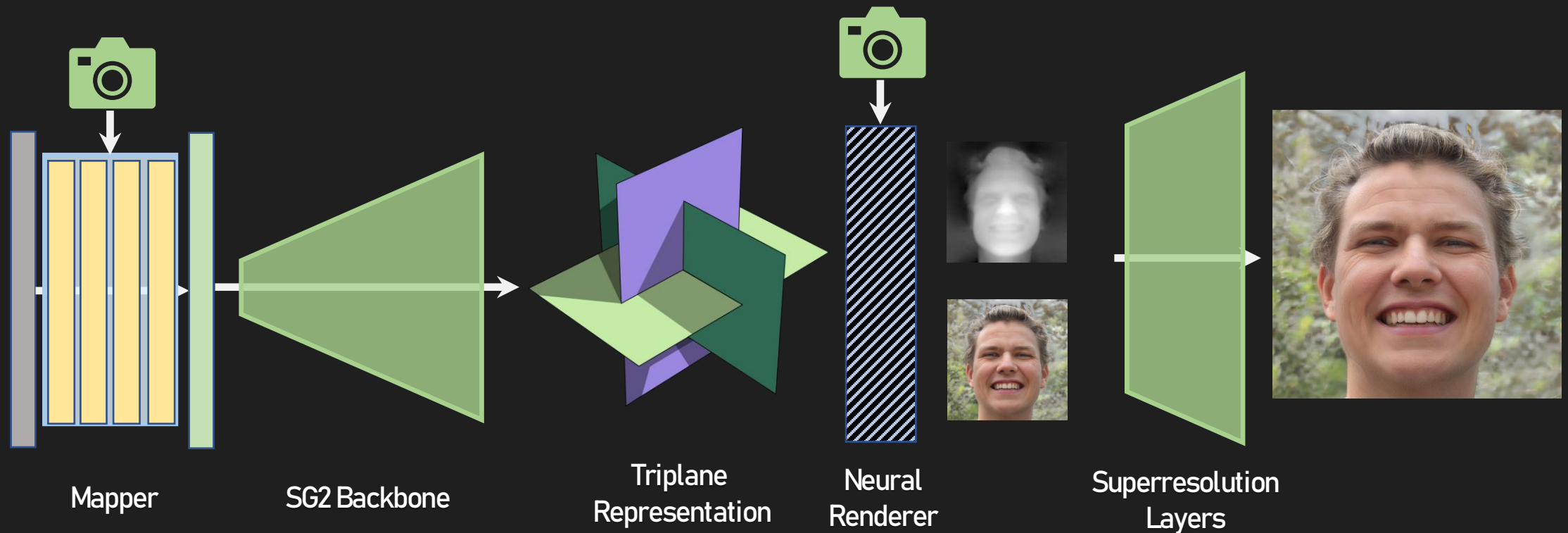
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2. Geometric and Texture Consistency



Depth Regularization



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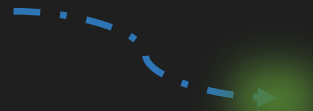
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2. Geometric and Texture Consistency



Depth Regularization

Regularize Average Background Depth



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Training Losses and Regularizations



1. Adversarial Loss with R1 regularization (StyleGAN-ADA)
2. S space regularization
3. Depth Regularization

$$\mathbf{R}(\Delta s) := \|\Delta s\|_1$$

$$a_d := \frac{1}{M} \sum_{n=1}^M \left(\frac{1}{N_n} \|D_n \odot S_b(I_n)\|_F^2 \right)$$

$$\mathbf{R}(D) := \|a_d \cdot J - (D_t \odot S_b(I_t))\|_F$$

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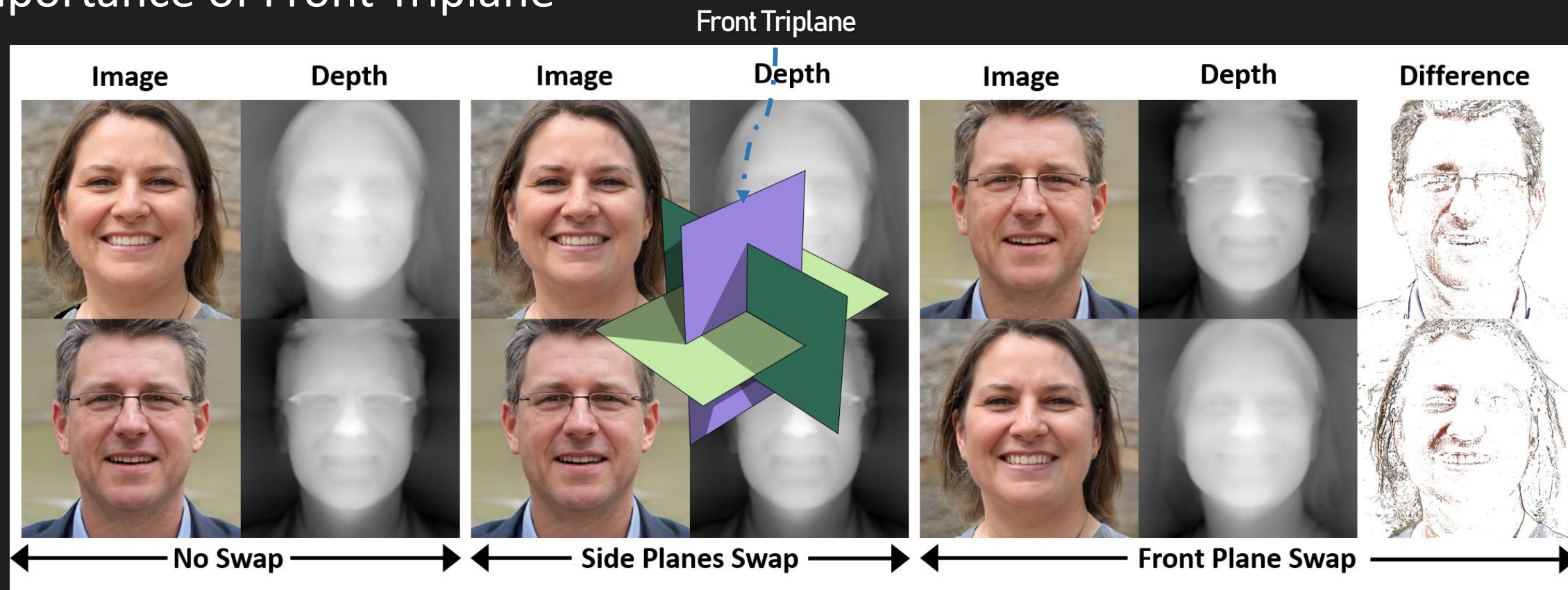
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3. Editing and Animation



Importance of Front Triplane



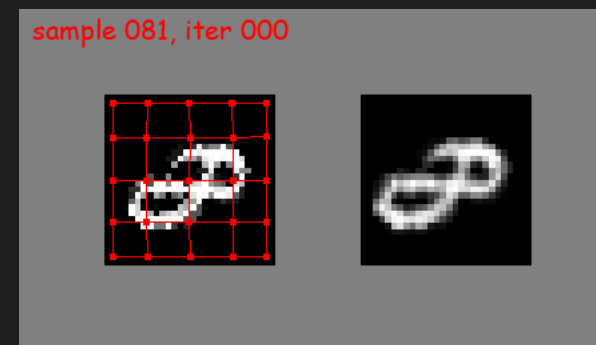
Chamfer distance changes by 20 ~30%

Chamfer distance changes by 80 ~ 90%

3. Editing and Animation



Thin Plate Splines



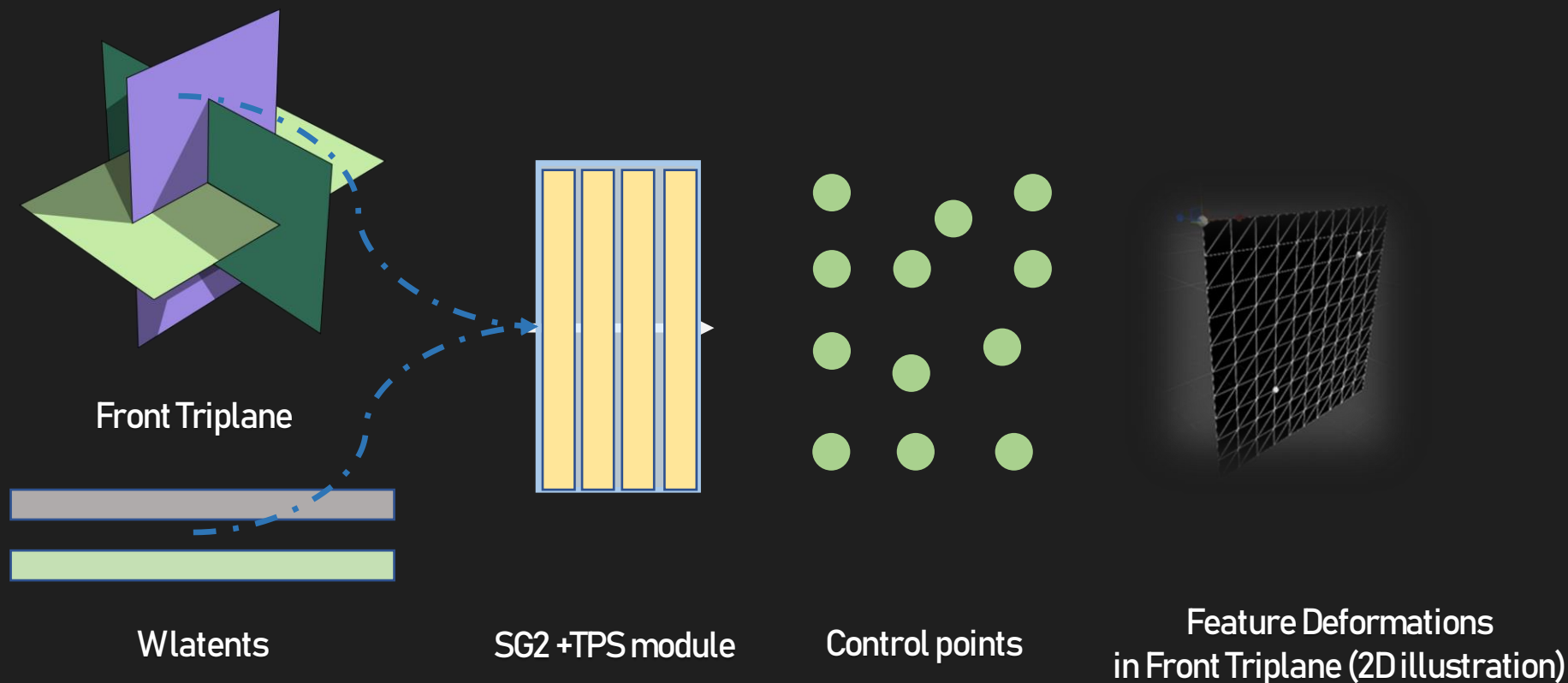
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3. Editing and Animation



Thin Plate Spline



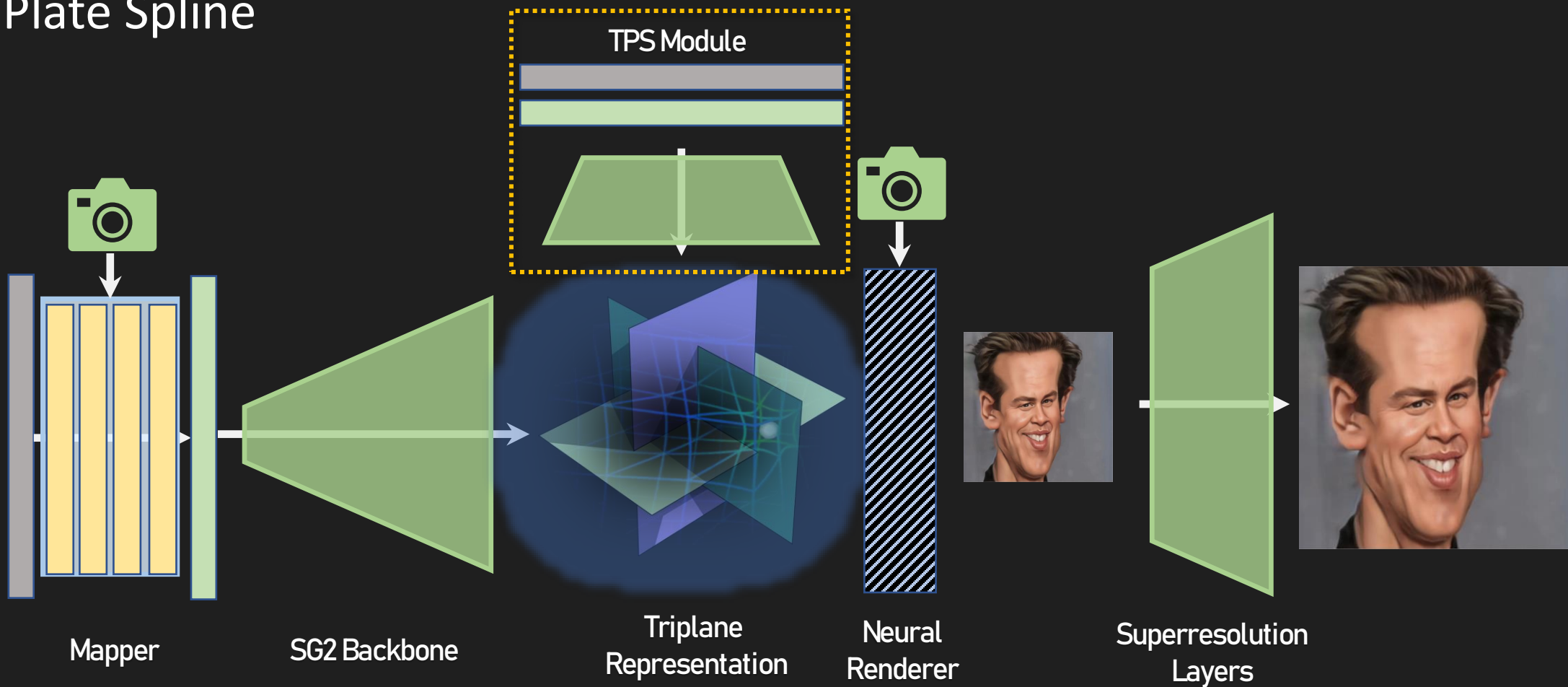
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3. Editing and Animation



Thin Plate Spline



Training Losses and Regularizations



1. Initial Points Regularization.
2. Diversity loss: Inter-latent and Intra-latent.
3. Unpaired Segmentation Regularization.

$$\mathbf{R}(\mathbf{T}_1) := \alpha \sum_{n=1}^2 \|c_I - c_n\|_1 - \beta \|c_1 - c_2\|_1 - \sigma \|c'_1 - c'_2\|_1.$$

$$\mathbf{R}(\mathbf{T}_2) := \|S(G_t(w)), S(I_t)\|_1$$

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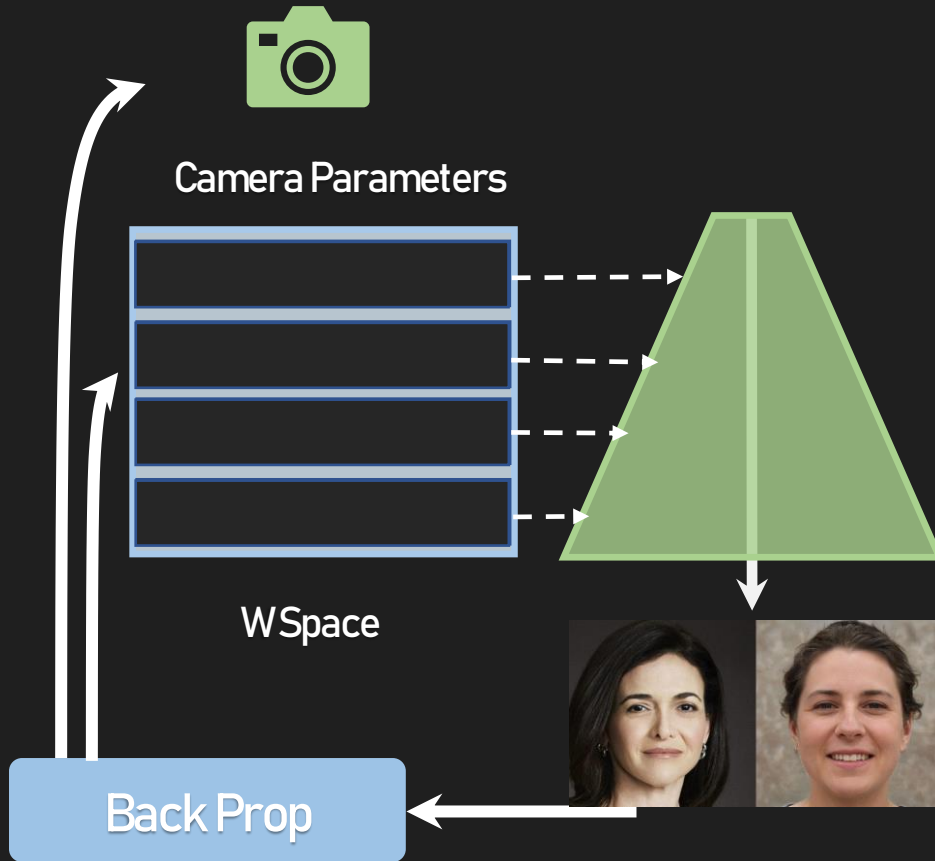
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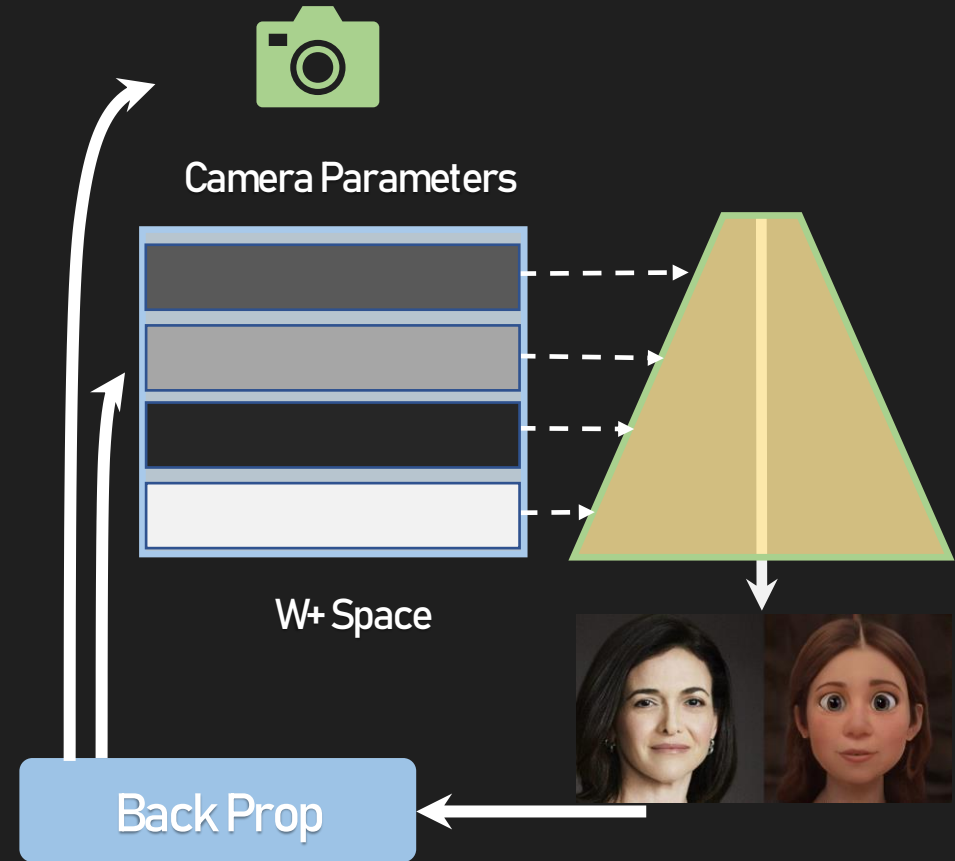
4. Real to Avatar



Invert in G_s



Invert in G_T



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4. Real to Avatar



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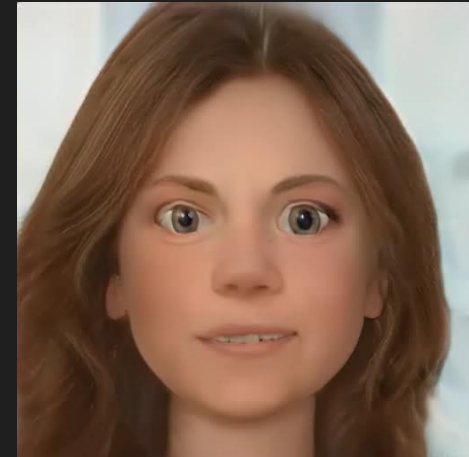


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4. Real to Avatar



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Results – 3D Avatars

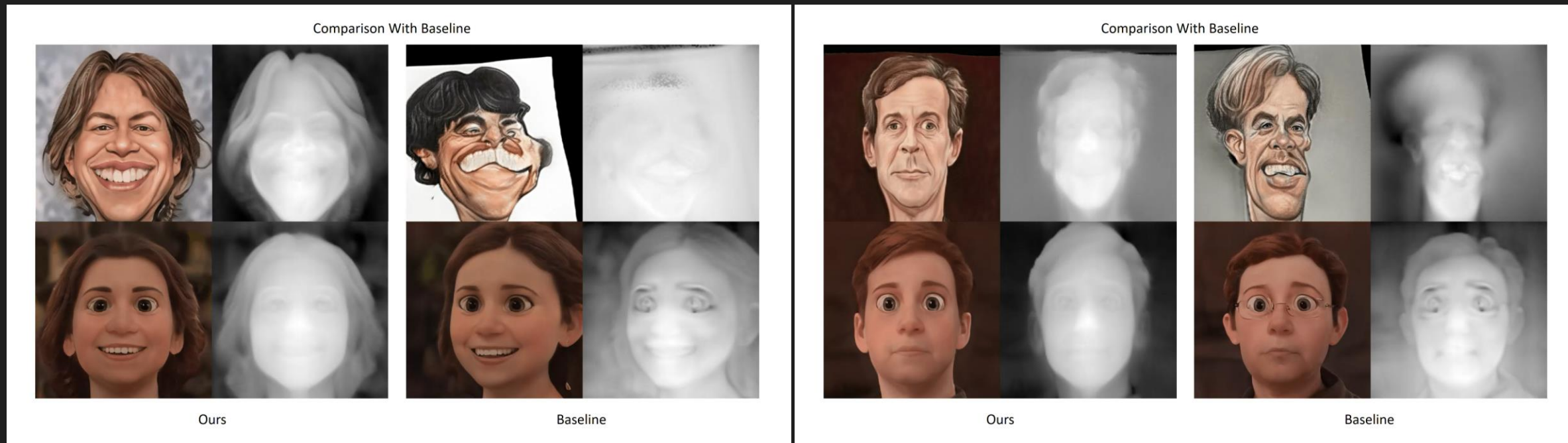


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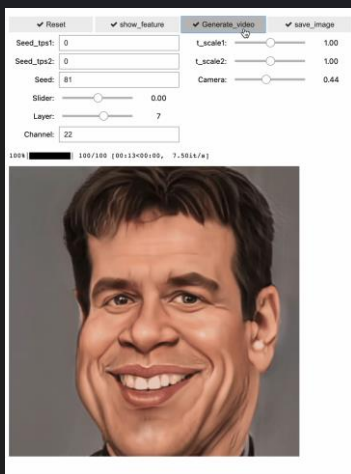
Results – Comparison with Baseline



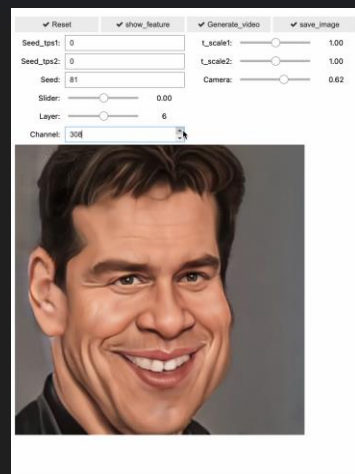
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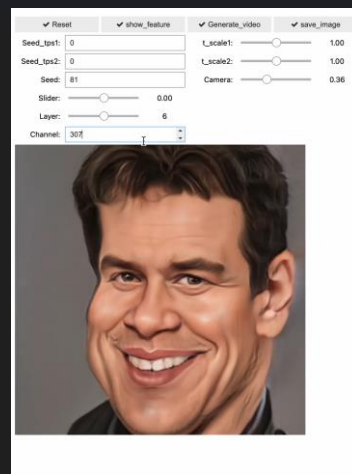
Results – S space Edits



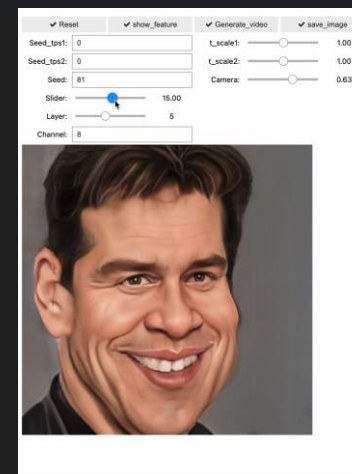
+Animation



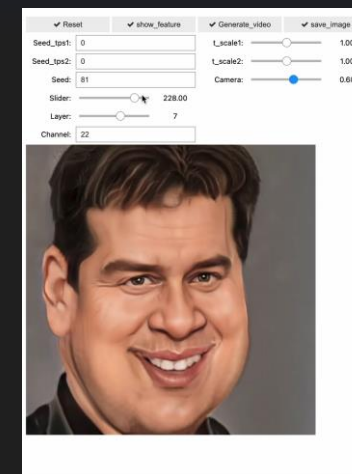
+Hair



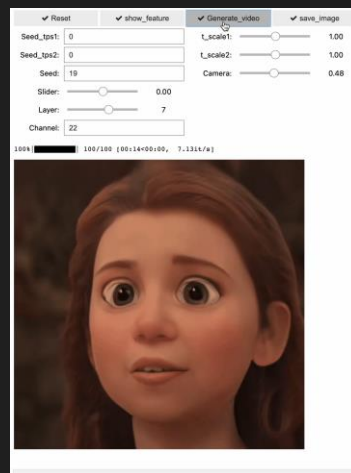
+Eyebrows



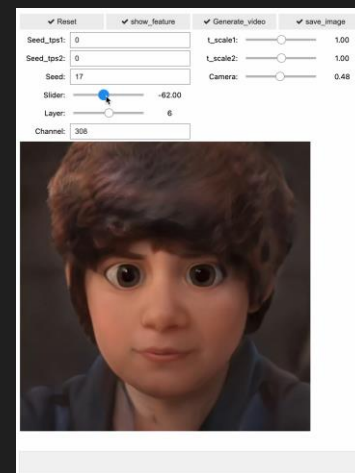
+Chin



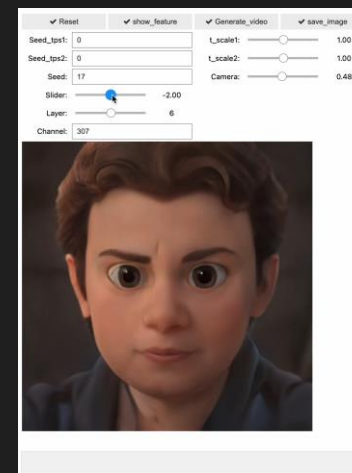
+Cheeks



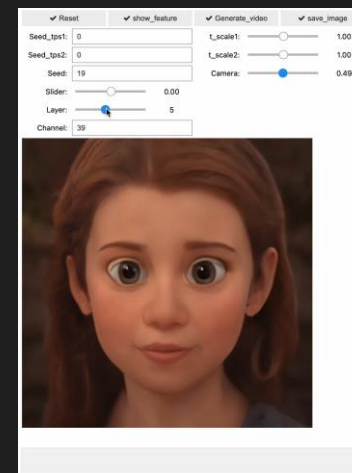
+Animation



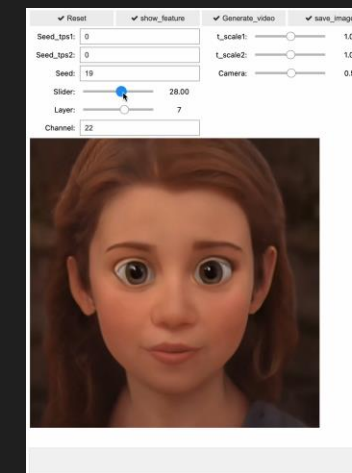
+Hair



+Eyebrows

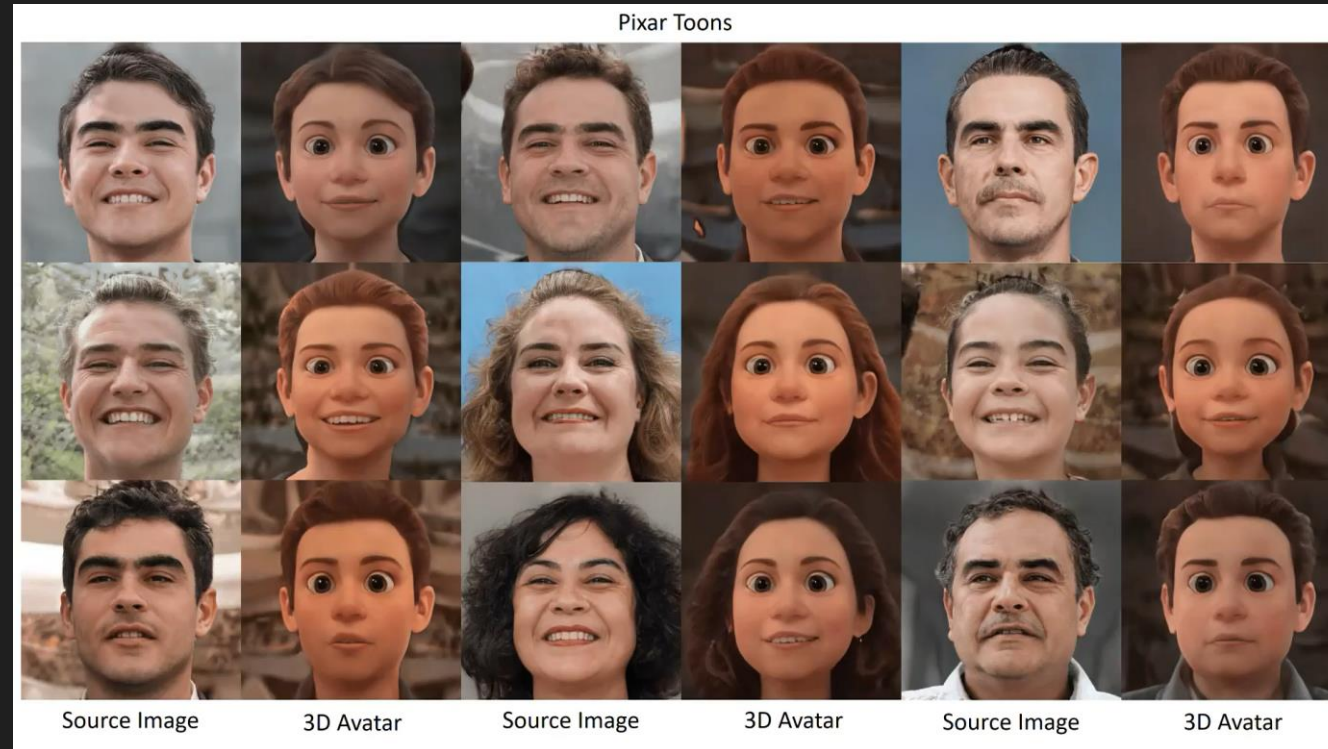


+Expression



+Cheeks

Results - Animation



More Results: <https://rameenabdal.github.io/3DAvatarGAN/>

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Results – Geometric Editing



✓ Reset ✓ show_feature ✓ Generate_video ✓ save_image

Seed_tps1: 0 t_scale1: 1.00


Seed_tps2: 0 t_scale2: 1.00

Seed: 5 Camera: 1.00

Slider: 0.00

Layer: 0

Channel: 0



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Thanks

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