StyleFaceUV: A 3D Face UV Map Generator for View-Consistent Face Image Synthesis

Wei-Chieh Chung*[1] Jian-Kai Zhu*[1] I-Chao Shen[2] Yu-Ting Wu[3] Yung-Yu Chuang[1]

[1]National Taiwan University [2]The University of Tokyo [3]National Taipei University

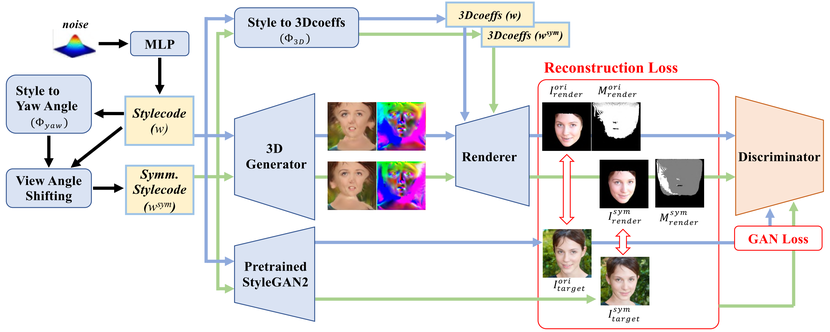
* These authors contributed equally to this work

BMVC 2022

Summary

- Recent deep image generation models, such as StyleGAN2, has confronted with the challenge of synthesizing 2D face images with multi-view consistency.
- By leveraging StyleGAN2 as 3D generator, we achieved:
  - View-Consistent face image generation
  - The 3D face model synthesized from our latent codes are compatible to the original StyleGAN2 latent space
  - Provide explicit face attribute control over generated face
- Synthesize 3D-applicable face for downstream tasks

Pipeline



Loss function

- Reconstruction loss w/ gradient mask

$$\mathcal{L}_{rec} = \mathcal{L}_{photo} + \lambda_{percept}\mathcal{L}_{percept}$$

$$\mathcal{L}_{photo}(I_t, I_r, M_r) = \frac{\|I_r - I_t\|_2^2 \odot M_r}{|M_r|}$$

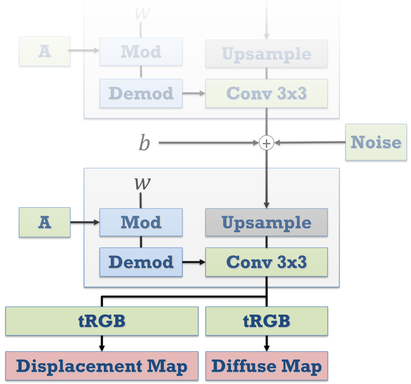
- GAN loss

$$\mathcal{L}_{GAN}{}' = \mathcal{L}_{GAN} + \lambda_{rec}\mathcal{L}_{rec}$$

- Multi-view consistency loss

$$\mathcal{L}_{multi} = \mathcal{L}_{GAN}^{ori}{}' + \lambda_{multi}\mathcal{L}_{GAN}^{sym,}$$

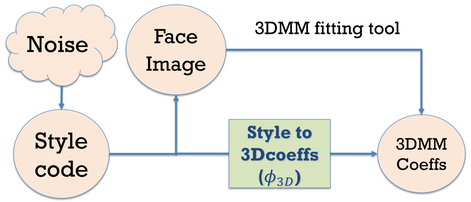
3D Generator



Method

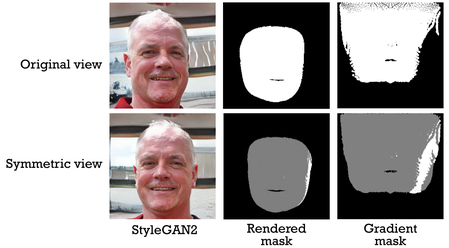
Style to 3Dcoeffs

- Fit 3DMM coefficients from StyleGAN2 generated face image
- Train a module ϕ_{3D} to estimate 3DMM coefficients given stylecode



Gradient mask

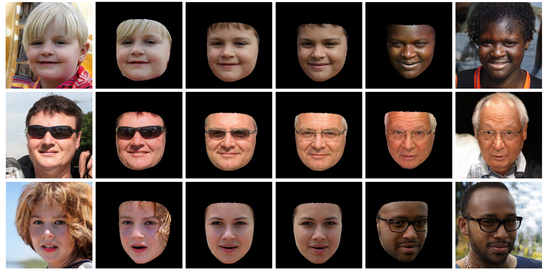
- Differentially render parameterized face model brings gradient at visible region in texture



Experiments and results

Multi-view consistency

Smooth transition



Explicit attribute control