Supplementary Materials to
"Blind Face Restoration via Integrating Face Shape and Generative Priors"

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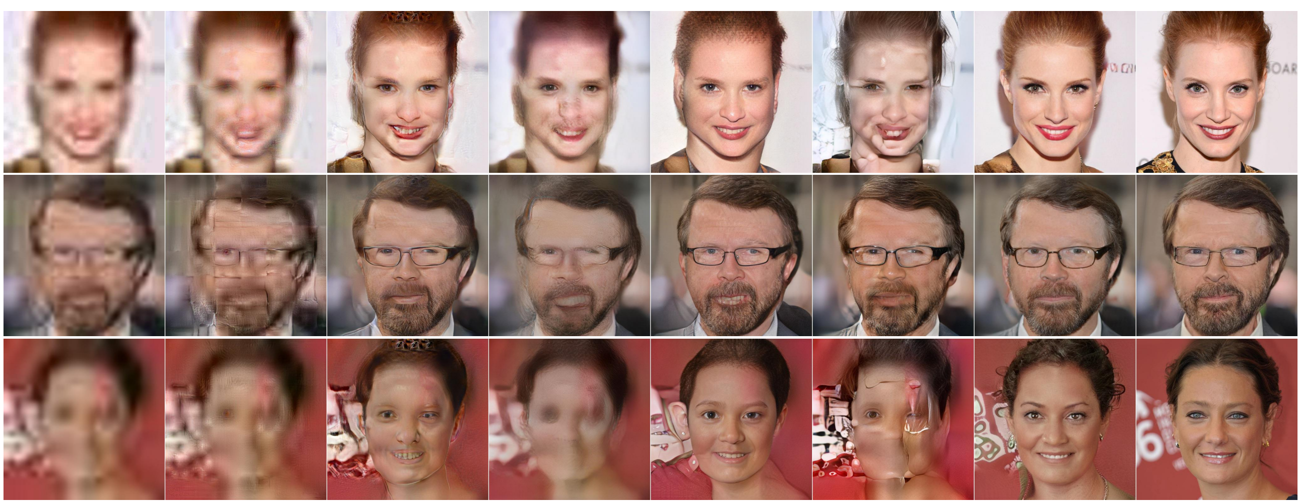
https://github.com/TencentYoutuResearch/BFR-SGPN

In the supplementary, we provide the following materials:

- More visual comparisons on synthetic dataset in Section 1.
- More visual comparisons on images in the wild in Section 2. We collected LQ images smaller than 50×50 from CelebA [5], WIDERFACE [8] and LFW [3] for testing, forming 1247 test images.
- More visual comparisons on face inpainting in Section 3.
- We show how to generalize our method to automatic face colorization and reference-based face colorization in Section 4.

1. Experiments on Synthetic Images

In this section, we show more visual comparisons on synthetic dataset. The comparisons include two tasks, blind face restoration (BFR) and face super-resolution (FSR). The results on the BFR task are presented in Figures 1 and 2. The results on the FSR task are presented in Figure 3.



(a) (b) (c) (d) (e) (f) (g) (h)

Figure 1. Visual comparison of blind face restorations (BFR) with other state-of-the-art methods. From left to right: (a) LQ input, (b) HiFaceGAN [7], (c) DFDNet [4], (d) PSFRGAN [1], (e) GPEN [9], (f) GFPGAN [6], (g) Our SGPN and (h) Ground truth. Please zoom in to see the details.

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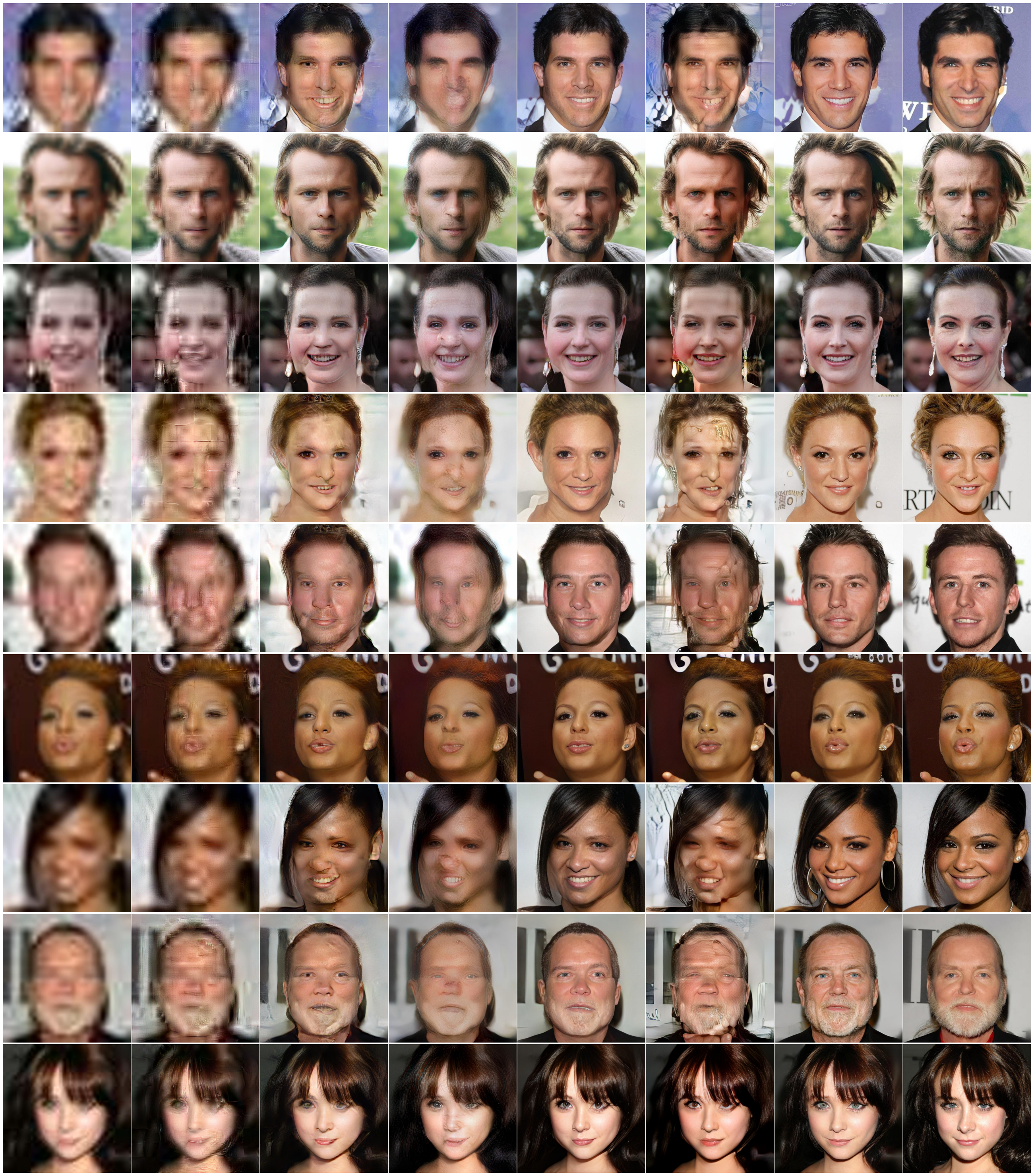


(a) (b) (c) (d) (e) (f) (g) (h)

Figure 2. Visual comparison of blind face restorations (BFR) with other state-of-the-art methods. From left to right: (a) LQ input, (b) HiFaceGAN [7], (c) DFDNet [4], (d)PSFRGAN [1], (e) GPEN [9], (f) GFPGAN [6], (g) Our SGPN and (h) Ground truth. Please zoom in to see the details.

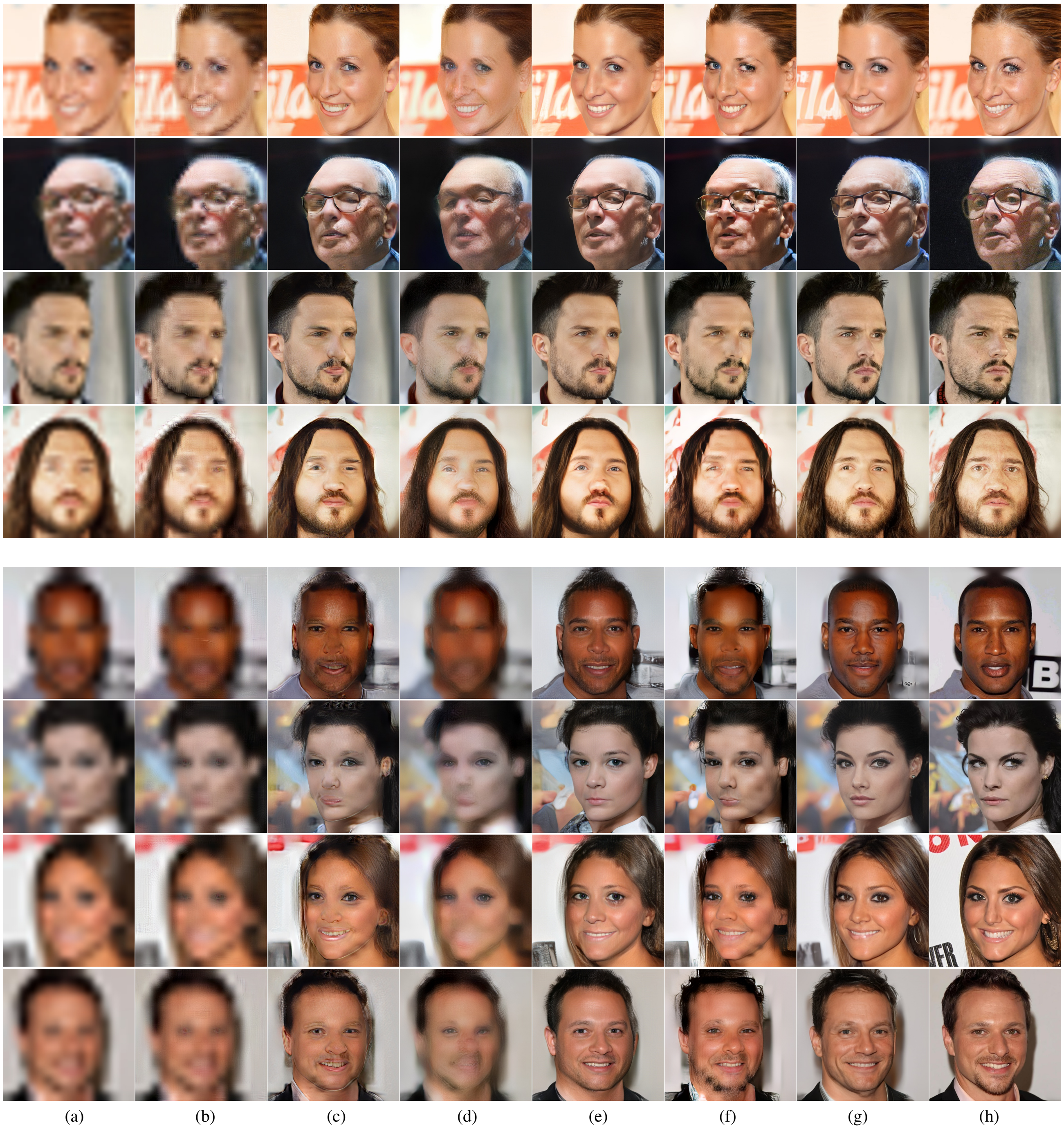


Figure 3. Visual comparison of face super-resolution (FSR) with other state-of-the-art methods. From left to right: (a) LQ input, (b) HiFaceGAN [7], (c) DFDNet [4], (d)PSFRGAN [1], (e) GPEN [9], (f) GFPGAN [6], (g) Our SGPN and (h) Ground truth. Please zoom in to see the details. The first four rows show the results of scale factor $16\times$. The last four rows show the results of scale factor $32\times$.

2. Experiments on Images in the Wild

In this section, we show more visual comparisons on real LQ images. The results are presented in Figure 4.

Figure 4. Visual comparison of real LQ faces restorations. From left to right: (a) LQ input, (b) HiFaceGAN [7], (c) DFDNet [4], (d)PSFRGAN [1], (e) GPEN [9], (f) GFPGAN [6], (g) Our SGPN and (h) 3D Reconstruction. Please zoom in to see the details.

3. Face Inpainting

In this section, we show more visual comparisons of face inpainting. The results are presented in Figure 5.

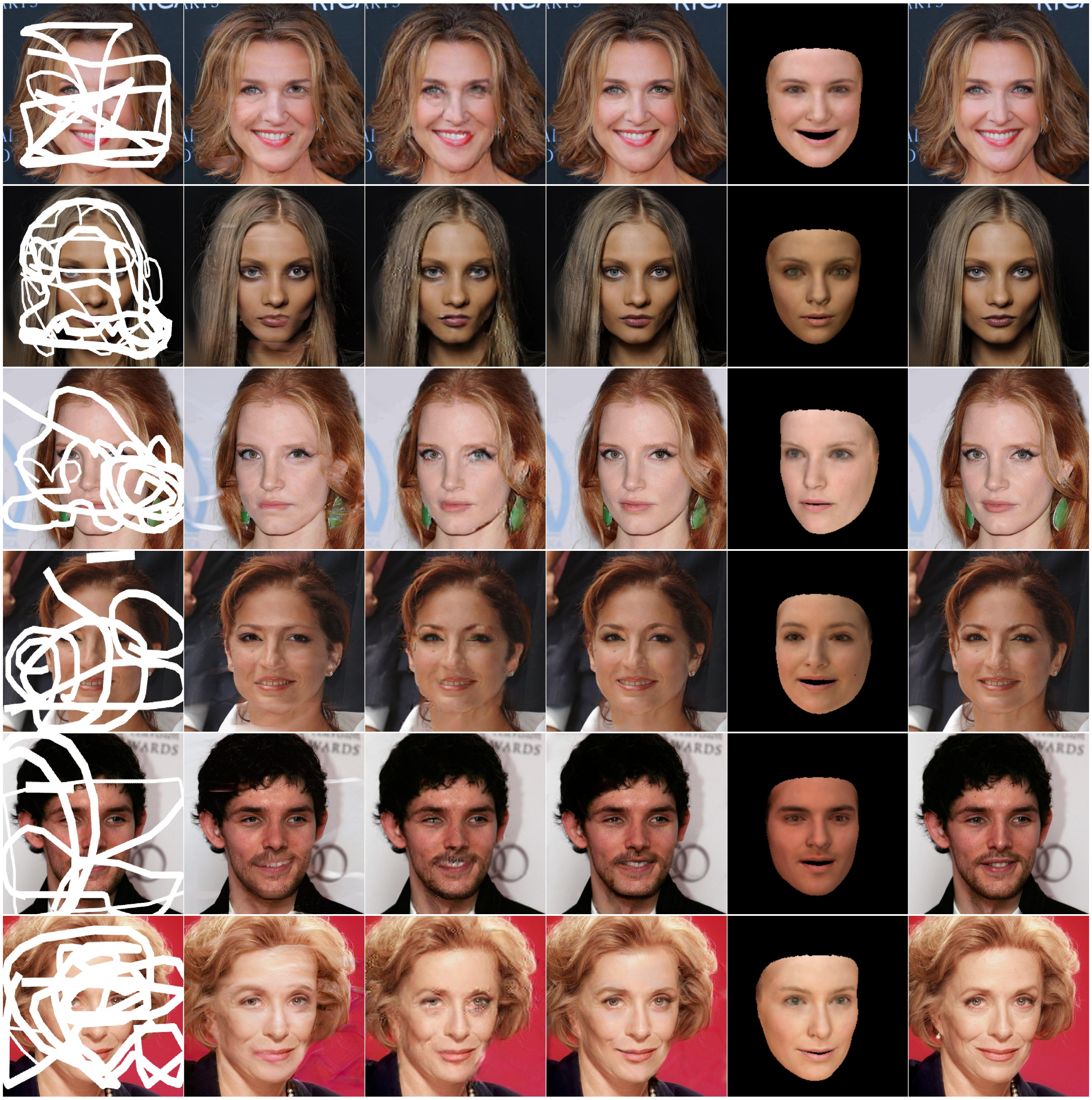


Figure 5. Visual comparison of face inpainting. From left to right: (a) Masked input, (b) GPEN [9], (c) CTSDG [2], (d) Our SGPN, (e) 3D Reconstruction, and (f) Ground truth. Please zoom in to see the details.

4. Face Colorization

Automatic Face Colorization. Our method can be trained to colorize gray face images automatically following the same training strategies. The results of automatic face colorization are presented in Figure 6. We compare with the state-of-the-art automatic colorization methods, including DeOldify [1] and GPEN [9]. One can see that our method can produce more realistic results.

Reference-based Face Colorization. Our method can also be generalized to the reference-based colorization scenario. That is, the colorization process is guided by an extra reference face image. During training, we add a color consistent loss to encourage the colors in the output image to be close to the rendered 3D image,

$$\mathcal{L}_{color} = \|A * \left(\mathbf{Blur}(\hat{I}) - \mathbf{Blur}(I_{d3d})\right)\|_1, \tag{1}$$

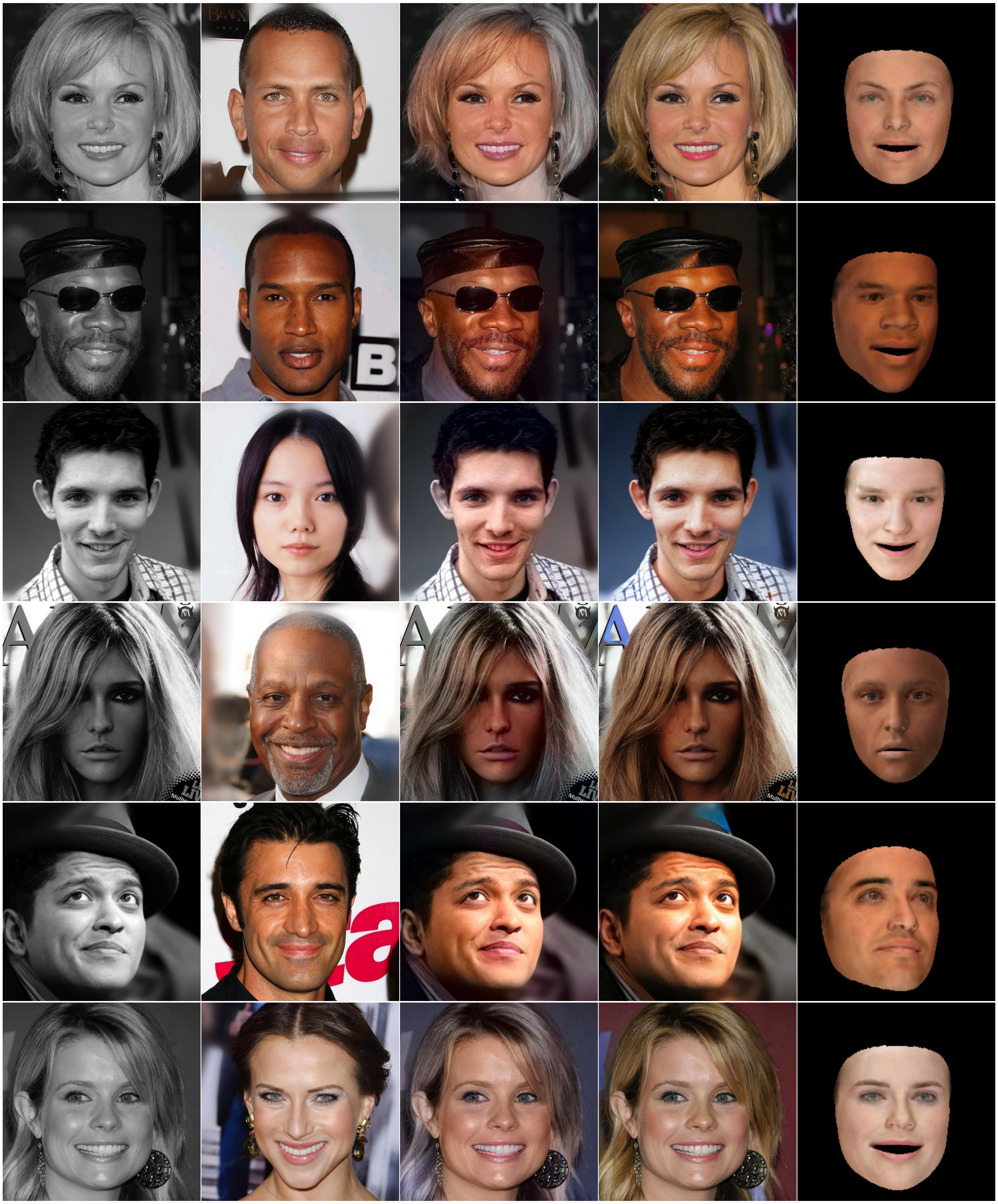
where A represents the skin regions while $\mathbf{Blur}$ denotes the average blur operations. During testing, the shape, expression and pose coefficients from the gray input and the texture and illumination coefficients from the reference image are merged together to render a guidance 3D image. This 3D image will be used to guide the colorization.

Figure 7 shows the visual comparisons with the state-of-the-art reference-based colorization method [10]. The skin tone of the face and neck is not consistent in the result produced by [10]. In comparison, our method achieves visually better colorization results.

(a) (b) (c) (d) (e)

Figure 6. Comparison with automatic colorization methods. From left to right: (a) Gray input, (b) DeOldify, (c) GPEN [9], (d) Our SGPN, and (e) Ground truth. Please zoom in to see the details.

[1] https://github.com/jantic/DeOldify



(a) (b) (c) (d) (e)

Figure 7. Comparison with reference-based colorization methods. From left to right: (a) Gray input, (b) Reference face, (c) Zhang *et al*. [10], (d) Our SGPN, and (e) Guiding 3D Reconstruction. Please zoom in to see the details.

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