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# Learning to Cartoonize Using White-box Cartoon Representations

## Supplementary Material

Anonymous CVPR submission

Paper ID 6791

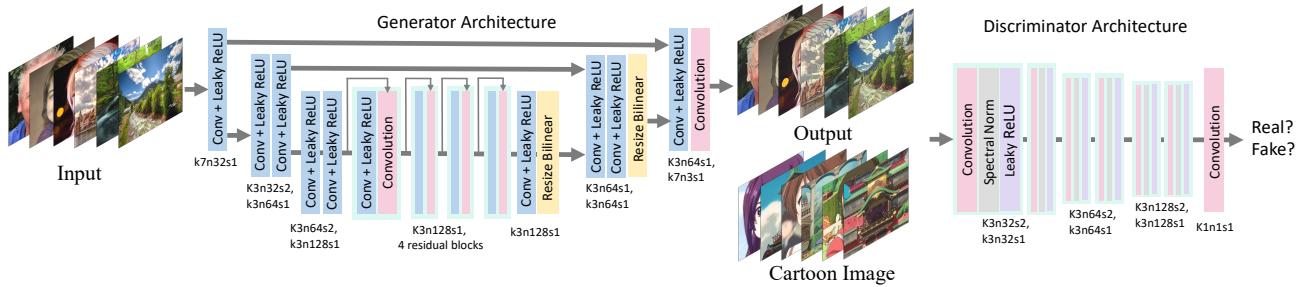


Figure 0. The architecture of generator network and discriminator network.

In this supplementary material, we show more experimental results, including the architecture of generator network and discriminator network, results of our method in different use cases, comparison between our results and cartoons in the same scenes, and examples used in the user study.

## 1. Network Architecture

We show the architecture of generator network and discriminator network in Figure 0. The generator network is a fully-convolutional U-Net [6] like network. We use stride-convolution layer for down-sample and bilinear interpolation layer for upsample to avoid checkerboard artifacts. The network consists of only three kind of layers: convolution, Leaky ReLU (LReLU) [4] and bilinear-resize layers. This enables it to be easily embedded in edge devices such as mobile phones. PatchGAN [2] is adapted in the discriminator network, where the last layer is a convolution layer. Each pixel in the output feature map correspond to a patch in the input image, with the size equals to the perceptive field, and is used to judge whether the patch belongs to cartoon images or generated images. Spectral normalization [5] is placed after every convolution layer (except the last one) to enforce Lipschitz constrain on the network and stabilize training.

## 2. Results in Different Use Cases

In Section 4.1 of the main paper, we apply our method on different scenes and show the cartoonized results. Due to the

limitation of space, Only 12 pairs of examples with small resolution are shown. Here we collect images from more use cases with higher resolution, and show the results generated by our method. The content of images includes male celebrities (shown in Figure 2), female celebrities (shown in Figure 3), food (shown in Figure 4), sceneries (shown in Figure 5 and Figure 6), indoors (shown in Figure 7), city views (shown in Figure 8 and Figure 9), and other objects (shown in Figure 10). Overall, the above-shown results demonstrate that our method can generate high-quality cartoonized images, and can be applied on diverse use cases and real-world scenes.

## 3. Comparison with Cartoon Images

We collect several images from Shinkai Makoto's cartoon films and their counterpart real-world photos that are taken in the same scenes. We then apply our method on the collected real-world photos, and show the comparison of our results and cartoon images in Figure 11 and Figure 12. Note that the images are randomly placed without class tags, and are supposed to be distinguished by the readers.

## 4. Images Shown in the User Study

Our user study is powered by [www.wjx.cn](http://www.wjx.cn), which is a smartphone application embedded in the Tencent WeChat. The screenshot of the application interface is shown in Figure 1, and the results of the user study are shown in Figure 13,

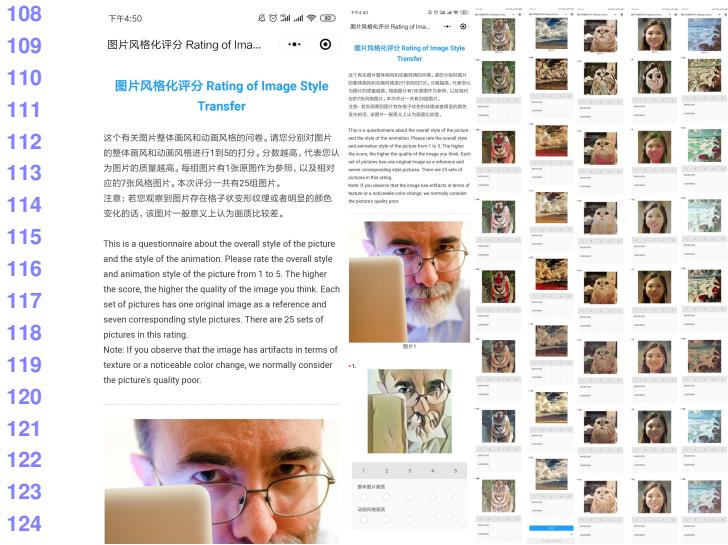


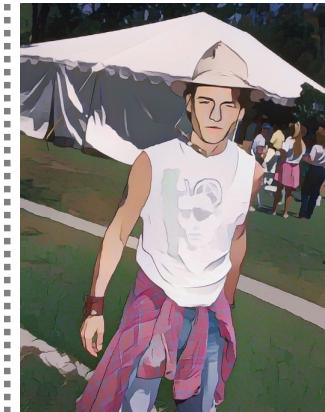
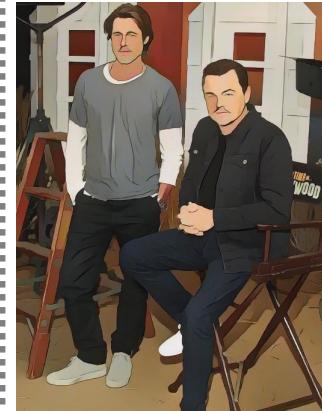
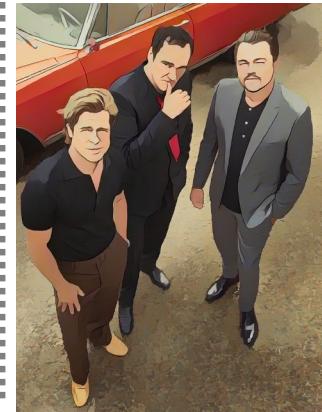
Figure 1. Smartphone application interface of our user study.

Figure 14 and Figure 15.

In the user study, we collect 30 images and process them with Fast Neural Style [3], CycleGAN [7], CartoonGAN [1] and our methods. 10 candidate are asked to score each image from 1 to 5, and the results of user study are shown in the Section 4.4 in the main paper. Here, we show all 30 groups of images processed by different methods. Note that CartoonGAN has 4 styles, and we show them all in the user study, and calculate the average score of the four styles as the final score for CartoonGAN.

## References

- [1] Yang Chen, Yu-Kun Lai, and Yong-Jin Liu. Cartoongan: Generative adversarial networks for photo cartoonization. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, pages 9465–9474, 2018. [2](#)
- [2] Phillip Isola, Jun-Yan Zhu, Tinghui Zhou, and Alexei A Efros. Image-to-image translation with conditional adversarial networks. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pages 1125–1134, 2017. [1](#)
- [3] Justin Johnson, Alexandre Alahi, and Li Fei-Fei. Perceptual losses for real-time style transfer and super-resolution. In *European Conference on Computer Vision*, pages 694–711. Springer, 2016. [2](#)
- [4] Andrew L Maas, Awni Y Hannun, and Andrew Y Ng. Rectifier nonlinearities improve neural network acoustic models. In *Proc. icml*, volume 30, 2013. [1](#)
- [5] Takeru Miyato, Toshiki Kataoka, Masanori Koyama, and Yuichi Yoshida. Spectral normalization for generative adversarial networks. *arXiv preprint arXiv:1802.05957*, 2018. [1](#)
- [6] Olaf Ronneberger, Philipp Fischer, and Thomas Brox. U-net: Convolutional networks for biomedical image segmentation. In *International Conference on Medical image computing and computer-assisted intervention*, pages 234–241. Springer, 2015. [1](#)
- [7] Jun-Yan Zhu, Taesung Park, Phillip Isola, and Alexei A Efros. Unpaired image-to-image translation using cycle-consistent adversarial networks. In *Proceedings of IEEE International Conference on Computer Vision*, 2017. [2](#)

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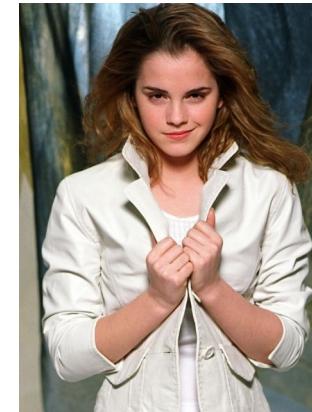
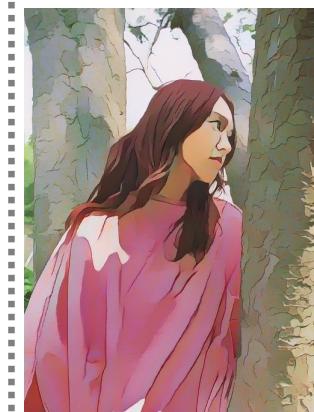
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Cartoonized result

Real-world photo

Cartoonized result

Figure 2. Cartoonized male Celebrities.

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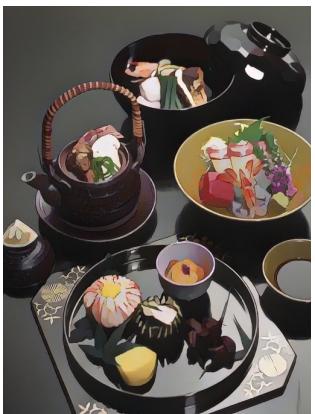
Real-world photo

Cartoonized result

Real-world photo

Cartoonized result

Figure 3. Cartoonized female Celebrities.

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Real-world photo

Cartoonized result

Real-world photo

Cartoonized result

Figure 4. Cartoonized food.

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Real-world photo



Cartoonized result

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Real-world photo

Cartoonized result

Figure 5. Cartoonized scenery.

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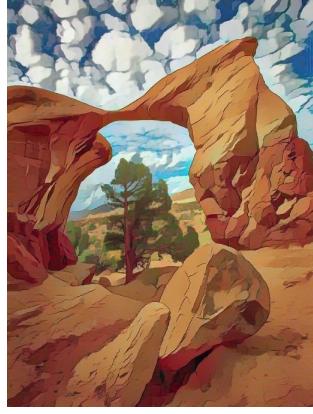
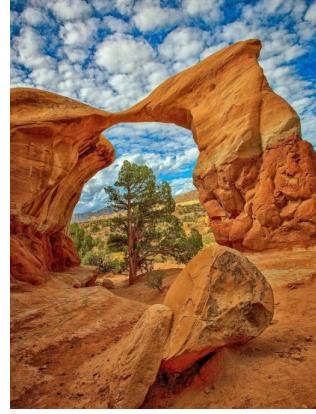
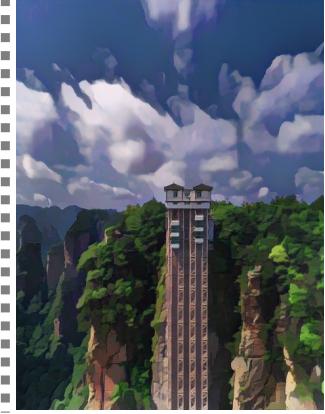
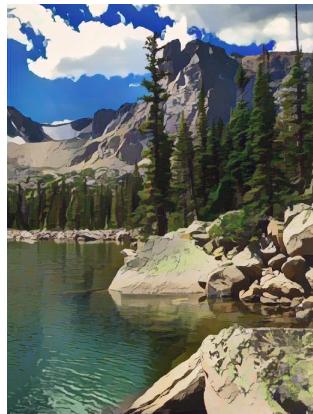
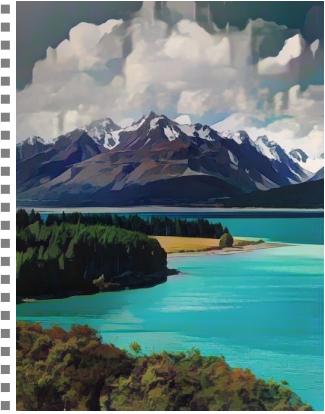
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Real-world photo

Cartoonized result

Real-world photo

Cartoonized result

Figure 6. Cartoonized scenery.

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Real-world photo

Cartoonized result

Real-world photo

Cartoonized result

Figure 7. Cartoonized indoor scenes.

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Real-world photo

Cartoonized result

Figure 8. Cartoonized city scenes.

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Real-world photo

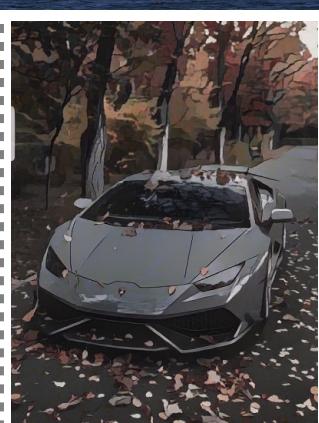
Cartoonized result

Real-world photo

Cartoonized result

Figure 9. Cartoonized city scenes.

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Real-world photo

Cartoonized result

Real-world photo

Cartoonized result

Figure 10. Cartoonized different objects.

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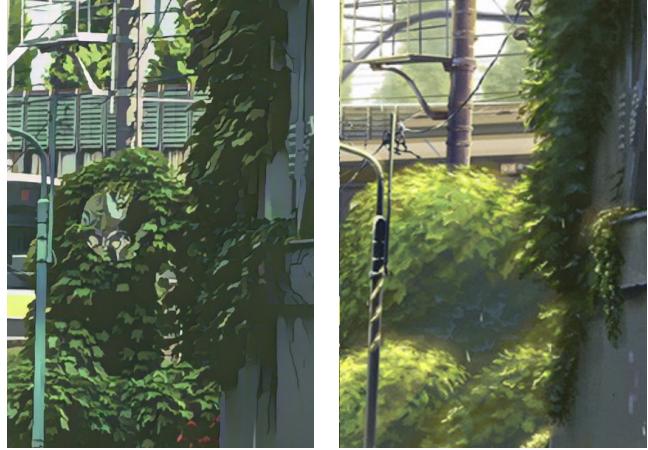
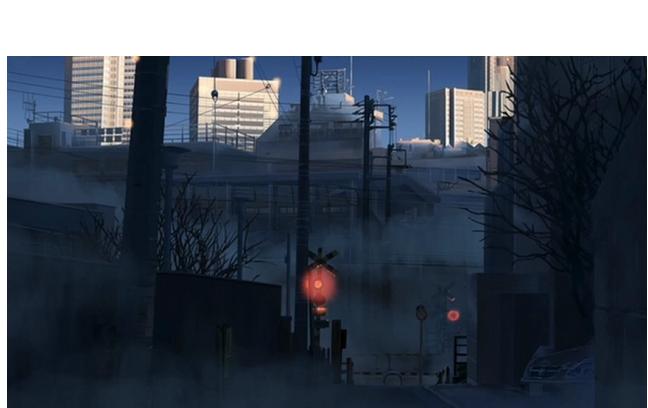
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Figure 11. Cartoons and results of our method in the same scene. They are randomly placed and supposed to be distinguished by the readers.



Figure 12. Cartoons and results of our method in the same scene. They are randomly placed and supposed to be distinguished by the readers.

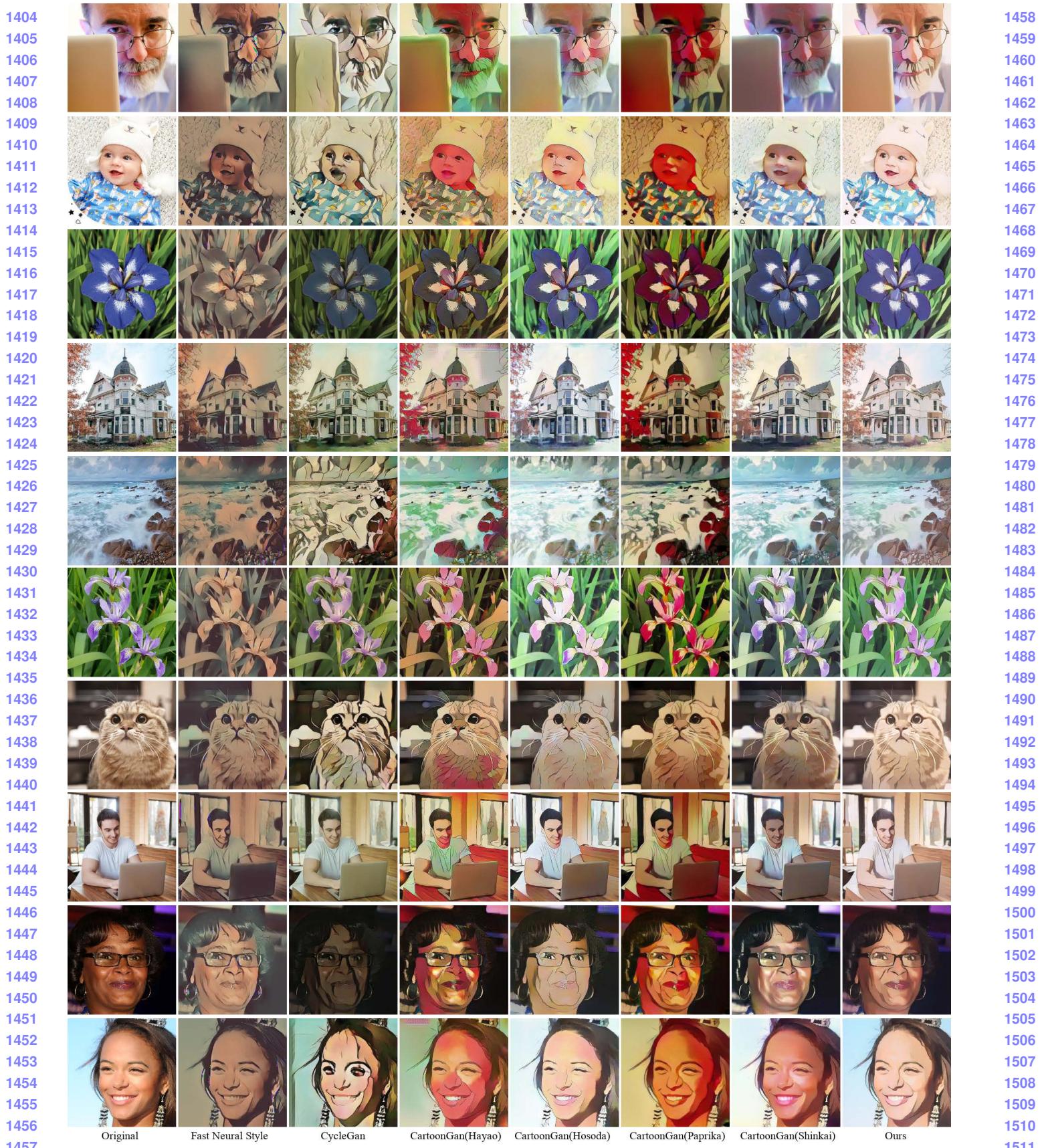


Figure 13. Images shown in the user study.

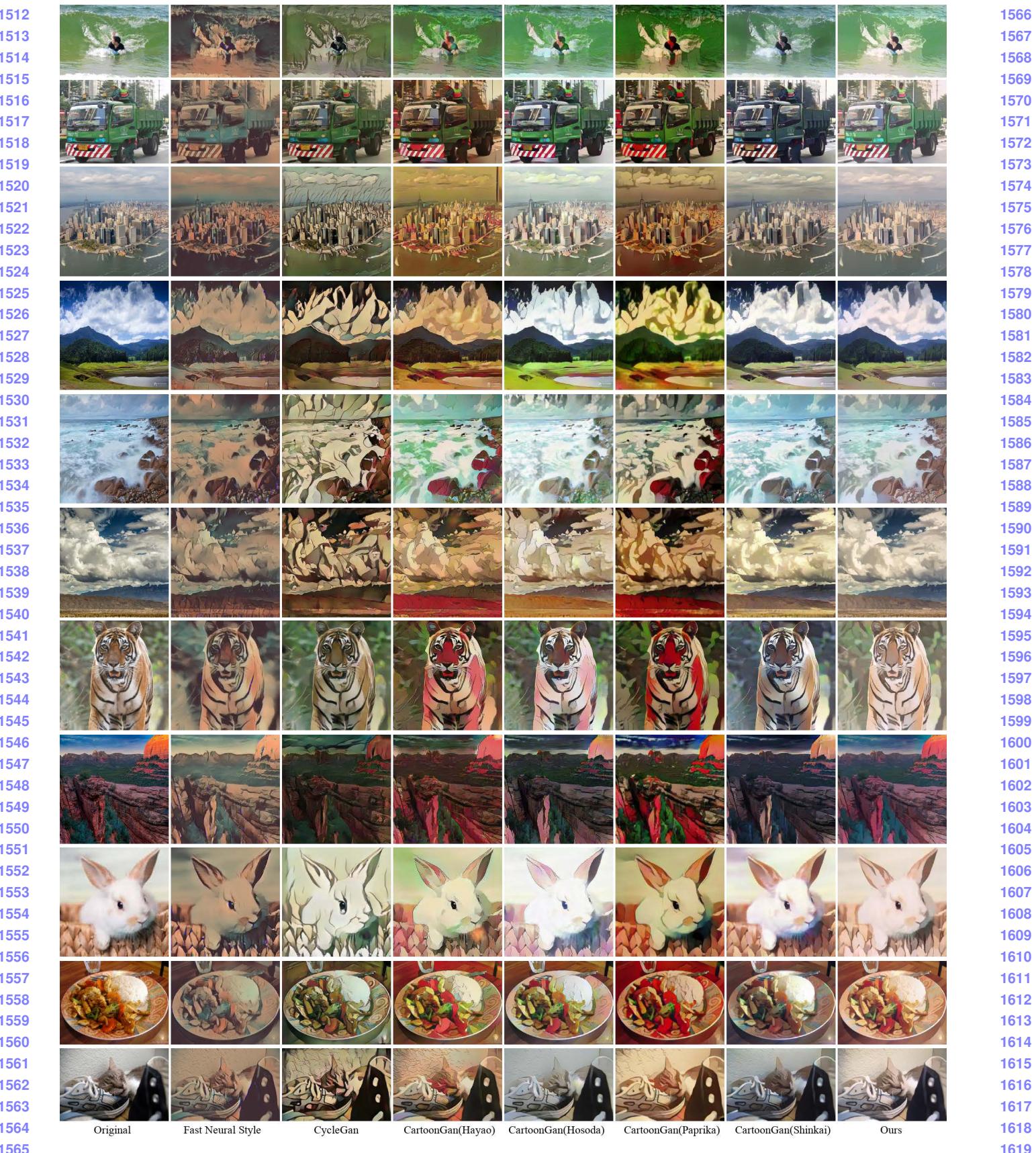


Figure 14. Images shown in the user study.

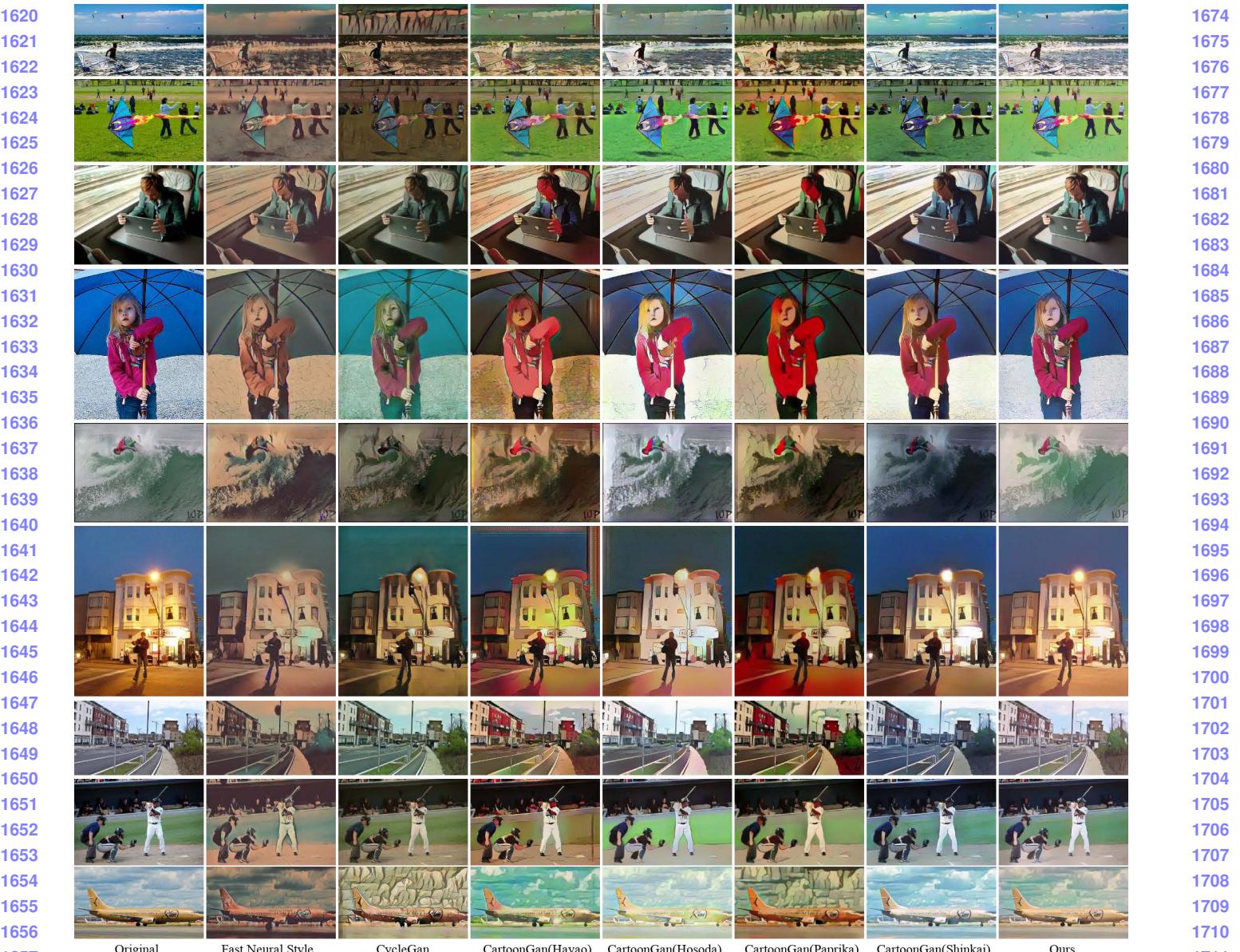


Figure 15. Images shown in the user study.