

A Study on Makeup Transfer and Aesthetic Prediction Techniques Combining BeautyGAN and ResNet

結合BeautyGAN與ResNet之妝容轉移與美感預測技術研究

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Abstract

As artificial intelligence becomes increasingly present in everyday life, personalized beauty recommendation and intelligent aesthetic evaluation systems powered by AI have emerged as a major development trend in the beauty industry. This study presents a hybrid system that combines **BeautyGAN** for facial makeup transfer and a fine-tuned **ResNet-based** model for aesthetic prediction.

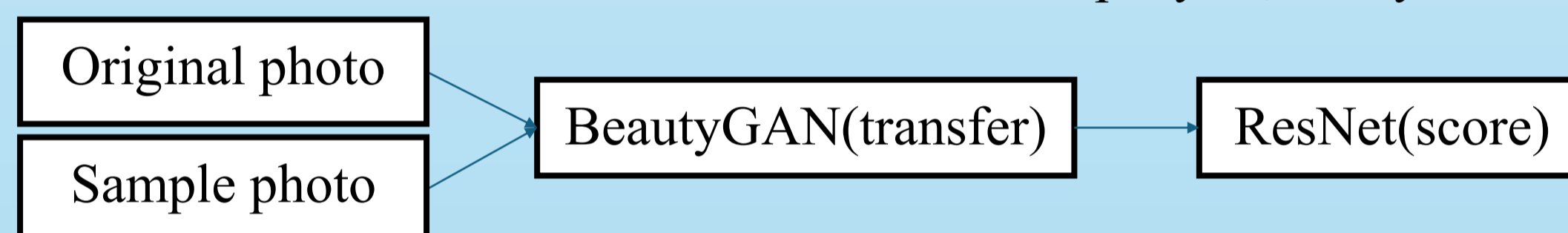
The system is divided into three stages:

First, the BeautyGAN model, which utilizes instance-level, is used to perform high-fidelity and detail-preserving makeup transfer between a reference image and a bare-face target image. **Second**, a ResNet-50 model is customized for aesthetic score regression by replacing the classification layers with a regression head. This model is trained and fine-tuned using the FBP5500 facial beauty dataset to ensure domain-specific accuracy in predicting human aesthetic perception. **Finally**, the system evaluates multiple makeup styles on the same face by feeding the generated images into the trained ResNet model, enabling comparing styles based on predicted scores. This allows the user not only to identify their most flattering look but also to understand aesthetic strengths and areas for potential improvement.

Methodology

The primary objective of this study is to develop a system that integrates Generative Adversarial Networks (GANs) and Convolutional Neural Networks (CNNs) to achieve facial makeup transfer and aesthetic score prediction. The system consists of three main stages:

- **Makeup Transfer:** BeautyGAN is a GAN-based model for facial makeup transfer, which uses a dual-generator structure to preserve facial identity while applying reference makeup. Its instance-level adaptation ensures that the makeup aligns naturally with the target face.
- **Aesthetic Score Prediction:** A fine-tuned ResNet-50 model is used to perform regression-based prediction of aesthetic scores.
- **Evaluation and Recommendation:** Based on aesthetic scores across different makeup styles, the system recommends the optimal makeup style to the user.



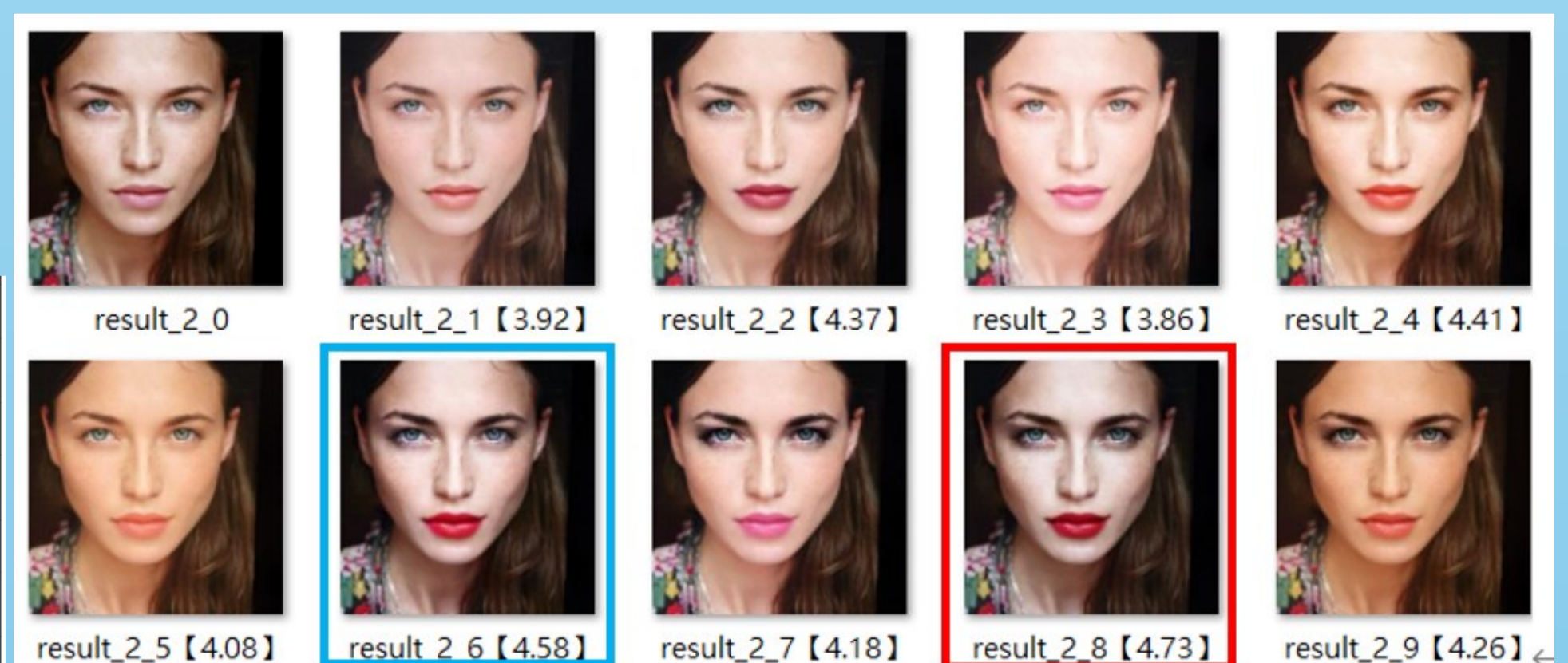
Results and Conclusion

During the experiments, the pre-trained BeautyGAN successfully transferred various makeup styles while preserving the structural integrity of facial features such as the eyes, nose, and lips. The model effectively blended the transferred makeup into the target face without compromising facial identity. Below are visual comparisons of original and makeup-transferred images:



Ten randomly selected images were tested to assess the model's aesthetic prediction accuracy. Despite some prediction gaps, the results were reasonably accurate, with a moderate MAE of 0.387 considering the subjectivity of beauty scoring.

The results are shown below. The highest predicted score was marked **in red**, while the image I subjectively considered the most aesthetically pleasing was marked **in blue**. Although there is a discrepancy between the model's predictions and my personal aesthetic judgment, the results suggest an interesting trend: images with higher predicted scores often exhibit more pronounced facial contrast **and deeper contours**.



The model tends to favor **stronger facial contours**, reflecting trends in higher-rated FBP5500 samples and modern aesthetics. However, this linear preference may overlook the nuanced and bounded nature of human beauty perception.

Reference

- [1] Li, Y., Liu, S., Yang, J., & Yang, M. H. (2018). *BeautyGAN: Instance-level facial makeup transfer with deep generative adversarial network*. Proceedings of the 26th ACM International Conference on Multimedia.
- [2] *Deep residual learning for image recognition*. Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 770–778.
- [3] Liang, L., Lin, L., Jin, R., Chen, Z., & Yan, S. (2018). *SCUT-FBP5500: A diverse benchmark dataset for multi-paradigm facial beauty prediction*. IEEE Transactions on Multimedia, 21(11), 2820–2830.
- [4] Zhou, S., Zhao, H., Zhang, K., & Li, J. (2018). *Data augmentation for deep learning: A survey*. arXiv preprint arXiv:1812.04606.