AAM-based Facial Image Beautification

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Abstract – In this paper, we present a new image processing system for human frontal face beautification. The proposed method is largely divided into two steps: facial feature detection and 2D mesh warping. In particular, after obtaining facial features from an AAM-based facial tracker, we modify their positions in automatic and manual modes. Then, changed features are used to generate the output face image via mesh warping. Our system was tested on multiple real facial images. Experimental results show that the proposed method demonstrates the ability to beautify the face while keeping it look natural.

Keywords: image processing, face detection;

1 Introduction

Since development of photography, people continuously have tried to improve the result and got more beautiful faces by applying various retouching and debleshing techniques. In the era of digital photography, many methods of facial image beautification were developed.

We can classify facial image beautification techniques into three categories. The first category is based on image filtering techniques, where image filters are applied to the whole image or some parts of the image for improving skin color and removing blemishes [1]. The second one pertains to the 2D image warping [2], where facial features are moved to slightly different locations based on some judgment. The last one utilizes image synthesis techniques where some parts of image are synthesized or extracted from another image and blended with existing one [3]. Of course, it is possible to sequentially apply a number of different methods.

The proposed method belongs to the second category and is based on 2D mesh warping. The goal of our work is to provide users with ability to automatically beautify facial image in “1-click”, while keeping their faces look natural.

2 Algorithm description

For the input image, we calculate facial features position and orientation by the active appearance model (AAM)-based facial tracker [4]. Based on AAM feature points, we define a 2D mesh on the image. Fig.1 shows an example of AAM feature points for the facial image on the right and corresponding 2D mesh on the left.

In the mesh we define a subset of mesh points corresponding to each facial feature. Then, we define parameters that control movement of certain mesh points to control the size of particular face features, such as eyes, mouth, nose, and chin. Each parameter identifies change amount for relative facial feature size.

Parameters can be set either manually by a user or determined by comparison of user facial features with reference facial data, where reference facial image also can be selected by the user. If the second mode is selected, parameters are set in the way that size of user’s facial features becomes similar to the reference.

After all parameters are defined, we perform a 2D mesh warping operator to obtain the output image. Fig. 2 presents
the algorithm data flow for the proposed facial beautification system.

![Input image and result image](image)

Fig.3. Right: Input image, Left: Result image

In our system we implement following control parameters: mouth width and lip thickness, eye size, nose width and length, eyebrow position and chin shape. Moreover, we add a function to control a smile expression by moving mouth corners up or down. In order to avoid artifacts and keep image look natural, we apply limitation to control parameters so mesh points are not change position dramatically. Limits were derived experimentally for each parameter by subjective evaluation of image change noticeability and naturalness.

After image warping, we need to solve two major difficulties: background distortion and eyeglass distortion. In order to reduce such effects, we apply following concealment methods. In particular, we extract rectangular area around the user face and blend it with original input image. It may result in slightly blur image in the blending area, but make background distortion much less visible. For eyeglass distortion reduction, we utilize a method described in [5], where mesh points near to eyeglass frame are preserved.

3 Experimental result

We have tested our algorithm on a bunch of images taken by a commercial digital camera, web camera, and downloaded from internet. All images have a variety of resolutions and different head positions. Fig.3. shows result of our proposed algorithm for various head positions and facial expressions. In the majority of cases, our method works fine, as shown in Fig. 3, even when head is slanted or turned up or down. For the best result, we recommend to use frontal facial images with X or Y rotation angle limit of ±15°. In some images, facial features were not able to be detected due to blur or low contrast or false detected, but the ration of such images in our database is relatively low.

4 Conclusion

In this paper, we have implemented a facial image beautification algorithm. The proposed method is robust even when AAM feature points are not detected very precisely. We believe that beauty standards may vary from person to person, so our algorithm provides a user-friendly control mechanism on the warping parameters, so everybody can get a satisfied result. We expect that our algorithm will be adopted in the photo-editing software in PC or mobile devices.

5 References


[5] Dowan Kim, Sungjin Kim, Ying Huang, Jianfa Zou, JunJun Xiong and Jongsul Min; AAM-based Face Reorientation Using a Single Camera", ICCE 2013