REPORT

Digital Face Makeup by Example

1. Introduction

This implementation creates face makeup upon a face image *I* with another image *E* as the style example.

Original Image with no makeup

(*I*)

Example Image

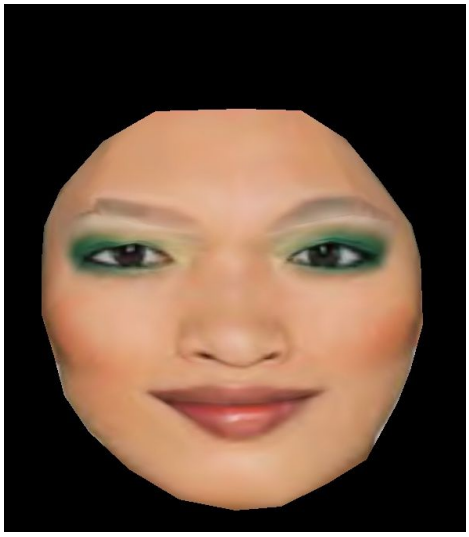
(*E*)

2. Face Alignment

For face alignment, warping of *E* to *I* is done in the following steps:

a. We manually mark the control points for both the faces, exactly 80 points each. These control points are stored in two text files namely *input.jpg.txt* and *makeup.jpg.txt*. Then both points for I are taken as input and the delaunay triangles are generated using MATLAB libraries and are stored in a text file called *tri.txt*.

b. Using OpenCV C++, we warp *E* into *I* by reading *input.jpg.txt* and *makeup.jpg.txt* files for control points and *tri.txt* for the triangle points in both the images. The algorithm takes triangles on both the images corresponding to the set of triangle points and warps each triangle of E into corresponding triangle of I using affine transformation. Thus we get the final warped image as *makeup.jpg*.



Warped Image

3. **Layer Decomposition**

We shift RGB colour space of images to CEILAB colour space. We then apply the WLS Filter on the luminance channel of resultant images to get the base and detail layers.

a. ***Face Structure Layer*** :

The base layer after applying WLS Filter on the luminance channel of CEILAB color space. The layer for *I* is *Is* and for *E* is *Es.*

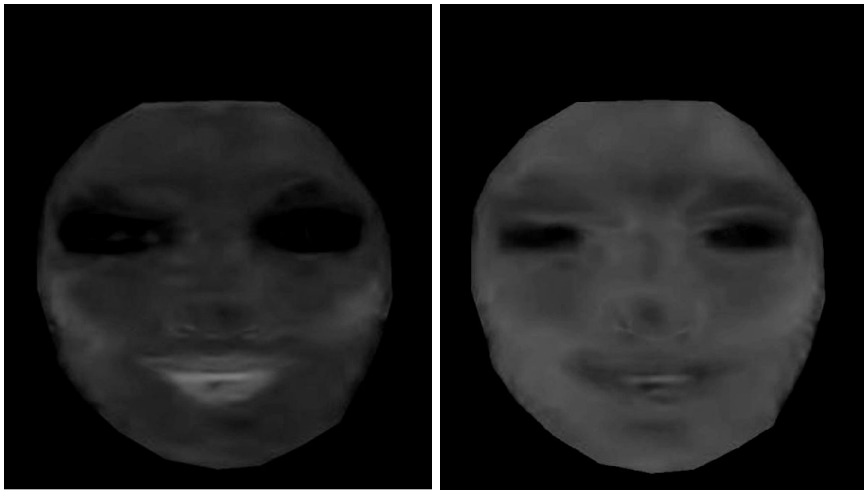
Face Structure Layer of Original and Example image (Is and Es)

b. ***Skin Detail Layer*** :
The detail layer after applying WLS Filter on the luminance channel of CEILAB color space. The layer for *I* is *Id* and for *E* is *Ed.*

Skin Detail Layer of Original and Example image (Id and Ed)

c. ***Color Layer*** :
The *a* and *b* channels of the CEILAB channels together are considered to be the Color layer components. The layer for *I* is *Ic* and for *E* is *Ec.*

Color layer of Original Image (Ic)



Color Layer of Example Image (Ec)

4. **Skin Detail Transfer**

We obtain the skin details of resultant image (*Rd*) from the weighted sum of *Id* and *Ed* as an output for this section. The weights are *delta_i* and *delta*_e.

$$Rd = delta\_i * Id + delta\_e * Ed$$

The results obtained while varying the weights are explained as below.

(i) ***delta_i = 0*** **and** ***delta*****_e = 1 :**
Complete Foundation Effect. The skin of *E* is transferred completely.
(ii) ***delta_i = 1*** **and** ***delta*****_e = 0 :**
No Foundation Effect. The skin of *I* is transferred completely.
(iii) ***delta_i = 0.5*** **and** ***delta*****_e = 0.5 :**
Partial Foundation Effect. The skin of *I* is retained and some effect of *E* is added

Resultant detail layer (Complete foundation effect)

5. Color Transfer

We obtain the colour details of resultant image (*Rc*) from the weighted sum of *Ic* and *Ec* as an output for this section. The weight is *gamma* whose value is 0.8.

$$Rc = (1 - gamma) * Ic + gamma * Ed$$

The results obtained while varying the weights are explained as below.

(i) ***gamma = 1* :**

Complete Color Effect. The color of *E* is transferred completely.

(ii) ***gamma* = 0.8 :**

Partial Color Effect. The color of *E* is transferred partially while retaining certain color of *I*.

(iii) ***gamma* = 0 :**

No Color Effect. The color of *I* is transferred completely.\

Image with Partial Color & Complete Foundation

6. **Highlight and Shading Transfer**

   We calculate the gradient of the input image and warped makeup image *I* and *E.* The base layer of the luminance channel of the input image is reconstructed from its new gradient according to the beta values by using a poisson solver.

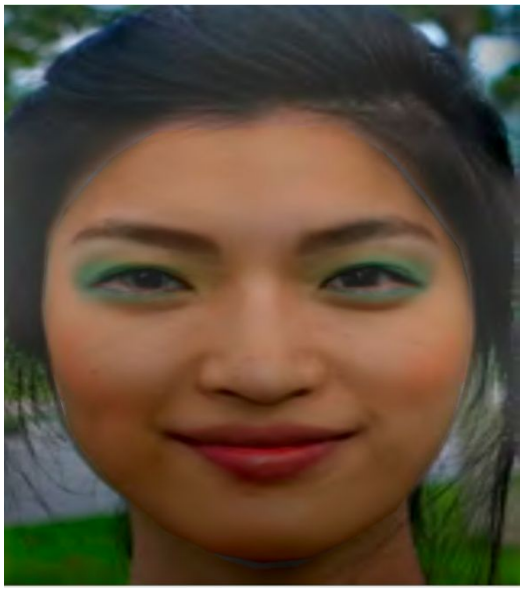


Image after Highlight and Shading Transfer

7. Lip Makeup

As physical makeup just adds colour to the lips and retains the texture of the lip, we assign values to face structure of resultant image (*Rs*) with values of *I* guided by values of *E* according to the formula mentioned in the paper.

Lip Region after lip makeup

FINAL OUTPUT

Partial Foundation & Complete Makeup

Images after Experimentation

Changing values of gamma and alpha for color transfer and skin detail transfer sections:

Original Image and Resultant Image (Complete Foundation & Complete Makeup)

Original Image and Resultant Image (Complete Foundation & Partial Makeup)

Original Image and Resultant Image (Complete Foundation & No makeup)

Original Image and Resultant Image (Partial Foundation & Complete Makeup)

Original Image and Resultant Image (Partial Foundation & Partial Makeup)

Original Image and Resultant Image (Partial Foundation & No Makeup)

Beard Transfer on different images:

Original Image with no beard(I) & Example Image with a beard (E)

Warped image of the area to be transferred

Final Image with a beard taken from the example image