# 한 장의 포토기반 실사 수준 얼굴 애니메이션

## A photo-based realistic facial animation

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요약

We introduce a novel complete framework for contructing realistic facial animations given just one facial photo as an input in this paper. Our approach is carried on in 2D photo spacem not 3D space. Moreover, we utilize computer vision-based technique (digital matting) as well as conventional image processing methods (image warping and texture synthesis) for expressing more realistic facial animations. Simulated results show that our scheme produces high quality facial animations very efficiently.

## I. Introduction

Facial animation, the goal of which is to express the realistic appearance of a facial movement, plays an important role in various applications including film productions, games, advertisements, educations and recently mobile contents. Hence, the creation of realistic facial animation is one of the most difficult and challenging works in computer graphics and computer vision fields. Conventional 3D physics-based models in facial animations used computer graphics are based on a 3D anatomical model of the facial structure and a representation of its surface[1,2]. These jobs would be definitely laborious, time-consuming. In this paper we present a novel complete framework for creating realistic facial animations given only one neutral facial photo as an input and show high quality simulated results.

## II. Realistic 2D facial animation

Our 2D facial animation system consists of three parts : facial feature extraction, facial components extraction & reconstruction, and facial expression modules.

### 1. Normalization & features extraction

For 2D image-based facial animation system, it needs to extract the major feature points from an input face image firstly and then use it as a set of parameters for animating (i.e., image warping and components moving in here) facial movements. We semi-automatically extract the facial feature points from a neutral face image by incorporating SVM classifier with our manual editing procedure.

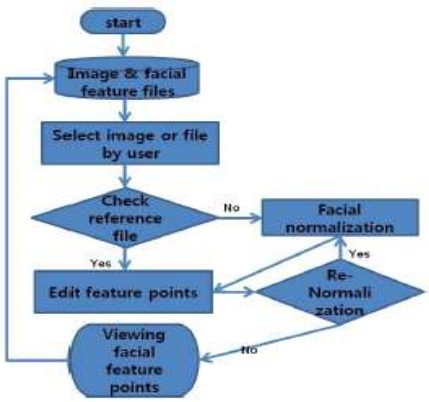


Fig.1. Module of facial normalization & feature extraction

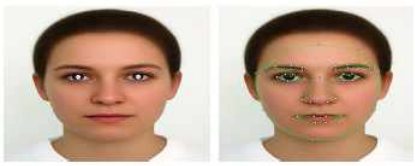

Fig.2. Input image & both eyeballs used for normalization(left) normalized image & pre-defined 61 facial features(right)

### 2. Facial components extraction & reconstructio

Once the defined feature points have been extracted semi-automatically, key facial components(e.g., lips and eyeballs) for making expressions are also segmented through a digital matting method[3]. However, it is hard to generate a perfect matte from a given image without any prior information(in here this is a trimap) because the matting problem is intrinsically ill-posed. Also, we exploit the extracted alpha matte for assigning pseudo-depth values to the facial component subregions. A texture sysnthesis method[4] is used for restoring the corrupted partial view.

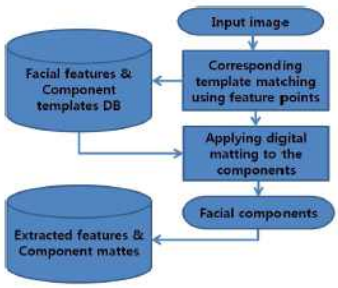


Fig.3. Module of facial components extraction

## 3. Facial expression

In order to express an independent movement of the lowe lip, the z values of the lip are defined as follows:

$$z_m = c * |\hat{y} - y_m|,$$

where $z_m$ and $y_m$ are coordinates of the lower lip. $c$ and $\hat{y}$ are a coefficient and jaw pivot potin(see. Fig.4), respectively. The lower lip region is separated from other regions by referencing the alpha values in their regions. Moreover, we define the lip opens with different angles $\gamma$ as follows:

$$\begin{bmatrix} \hat{z}' \\ \hat{y}' \end{bmatrix} = \begin{bmatrix} cos\gamma & -sin\gamma \\ sin\gamma & cos\gamma \end{bmatrix} \begin{bmatrix} \hat{z} \\ \hat{y} \end{bmatrix},$$

where $\hat{z}$ and $\hat{y}$ are coordinates of the closed lower lip, $\hat{z}'$ and $\hat{y}'$ are coordinates when opening the lip. After projecting the translated values to the given image space, we just consider $\hat{x}$ and $\hat{y}'$ values as a moving lip values. Similarly, the movements of both eyeballs would be defined as the translation.

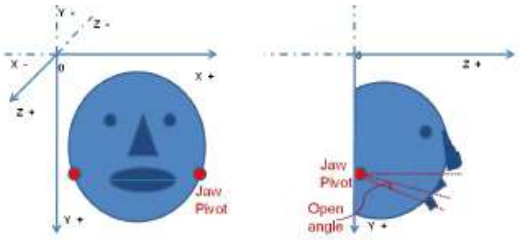


Fig.4. Description of lip opens

## III. Results and conclusions

Our system is developed in C++ with openCV lib. Fig.5. shows a variety of results generated from just one photo input of Fig.1. We have presented a realistic facial animation method with one 2D face image. The major contribution of our proposed method could be summarized as follows: it shows how the facial animation with various expressions can be generated realistically and easily, where main facial components extracted through the digital matting as well as pseudo-depth values inferred from the alpha mattes are exploited in the system. However, there are some room for improvement in this work. It is desirable to extend various facial poses form more realistic animations.

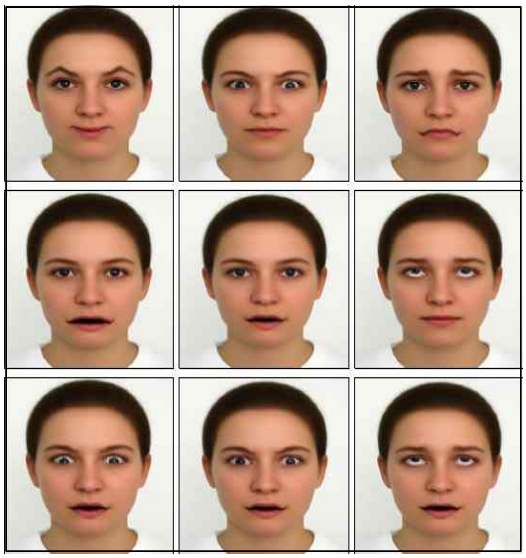

Fig.5. Simulated results

## References

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