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Virtual Makeup Application Using Image Processing Methods

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Abstract
Online shopping has become very popular recently. Despite the advantages of online shopping in terms of time and diversity, it is a disadvantage for users can't try products. This study aims to virtually try on products. Application developed for lipstick trial. User can see as if she tries on a lipstick on a monitor. We use face segmentation for detecting lips area, color segmentation for cutting lips and color space transformation for better result. In spite of some system delays, application works as realistic.

Keywords: *Virtual makeup, Image Processing, HSV color space, Online shopping, Color segmentation*

1. Introduction

With today's development, the image processing systems are used in many areas of our lives. One of them is the shopping area. Online shopping which is recently popularized has been reduced the loss of time and increased number of options.

The disadvantage of online shopping is customers can not get by trying the product. Recently there has been a lot of work to support in this regard to online shopping. For example we developed a system which people can try virtual garments on a monitor in previous study. We used Kinect Sensor for this application. When user moves his/her arms or legs, different poses of the garments are showed on the virtual mirror. Thus it increased sense of virtual reality [1]. Yang et al. presents a virtual try on system for design evaluation of footwear. The team used RGB-D (Red-Green-Blue-Depth) camera for providing augmented reality. They used iterative closest point (ICP) algorithm to follow that overlapped the captured depth data and predefined reference foot models [2]. Also Sabina et al. developed a virtual try on system taking into account the body shape of the users [3]. Meng et al. developed a garment design system. Then they placed this garment on the person body. Their system simulate the garment dynamically, taking into consideration human movement [4].

There are some papers about lip detection. Jang and Woo present an adaptive lip feature point detection algorithm for the proposed real-time smile training system using visual instructions [5]. Skodras and Fakotakis introduce a method using k-means color clustering with automatically adapted number of clusters, for the extraction of the lip area [6]. Kalbkhani and Amirani propose a new algorithm for lip detection [7].

In this paper, we propose a system which allows the user to interact the system for try on lipstick. User can select a color on a color scale and see as if she tries on this color of lipstick. For this system, our algorithm is organized as follows. Firstly, face area is detected, then face image is segmented and lip area is separated from the face image. The image of lips area is converted the HSV (Hue Saturation Validation) color space. After developing the color segmentation process, lips are detected by the system. Finally; lip's hue value is changed with the hue value of the color which is selected by the user. Finally it is converted to RGB color space and changed image is shown on the monitor.

The remainder of the paper is structured as follows. Section 2 describes virtual makeup application. Concluding remarks are in Section 3.

2. Virtual Makeup Application

The purpose of this study, it is provide to opportunity of trying of lipstick to the users. Image processing techniques are utilized for it. System runs real time and users can see original image and final image on monitor at the same time. No deterioration when the user turns his head. Block diagram of the study is shown in figure 1.

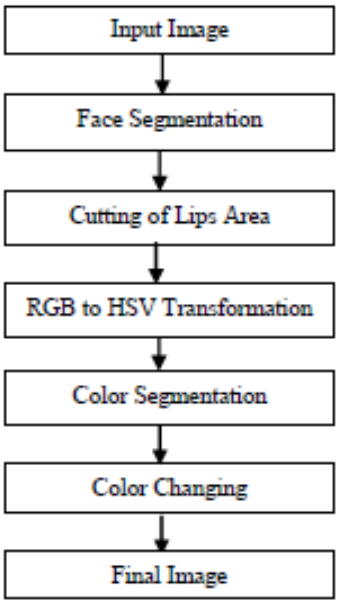

Fig. 1 Block Diagram of the System

2.1. Color Space Transformation from RGB to HSV

The transformation between HSV and RGB is nonlinear. The conversion from RGB to HSV is defined by the following equations (equation 1, equation 2, equation 3) [8].

$$V = m \tag{1}$$

$$S = \begin{cases} \frac{(m-n)}{m}, & if\ m \neq 0 \\ 0, & otherwise \end{cases} \tag{2}$$

$$H = \begin{cases} undefined, & if\ S = 0 \\ \frac{60\times(B-r)}{\delta}, & m = R \\ \frac{60\times(B-R)}{\delta+120}, & m = G \\ \frac{60\times(R-G)}{\delta}+240, & m = B \end{cases} \tag{3}$$

In the equations; *m* defines the maximum of the *(R, G, B)* values and *n* is equal to the minimum of those values and δ defines subtraction *n* from *m*.

After this transformation, H value is converted to H value of color which is claimed by the user. Color corresponding of H value is showed in Table 1 [9].

Table 1: H value of colors

Angle Value	Color
0-60	Red
60-120	Yellow
120-180	Green
180-240	Cyan
240-300	Blue
300-360	Magenta

2.2 Face Segmentation and Lips Detection

The rectangular lips area is cropped from face image as shown in Figure 2 using Matlab Functions.

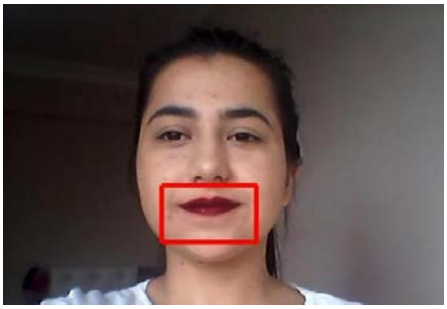

Fig. 2 Lips Area Detection

Then, this region is segmented looking for the color. To change the lips color, first the color space is converted to HSV from RGB, so we don't lose saturation and brightness of lips. The lips color is seek at the image and then it is marked as black at Figure 3. Thus; lips are detected by the system. Then we can change the color of this region.

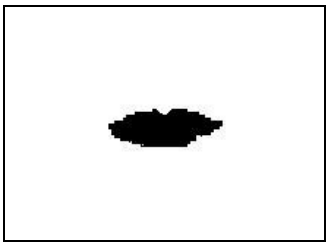

Fig. 3 Lips Detection

After changing the color at HSV color space the image is transformed to RGB color space.

Original image and final image are shown on the monitor in real time (Fig. 4).

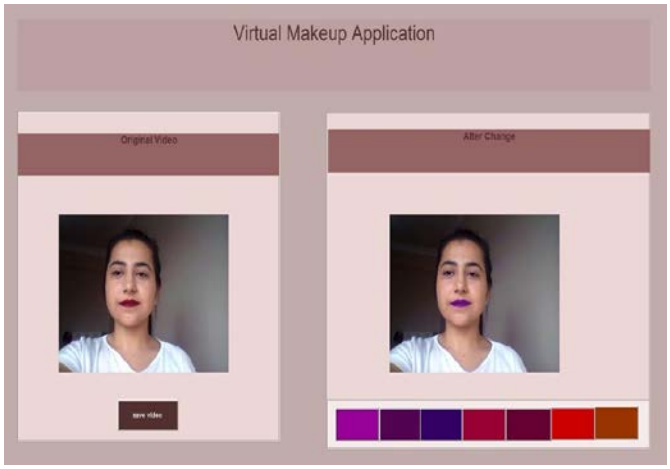

Fig. 4. Virtual Makeup Application

The change of lips color is shown in Fig. 5. The user can chose any color from list and can see how it is seem.

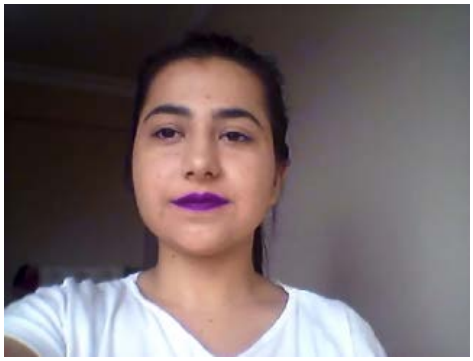

Fig. 5. The change of lips color

4. Conclusions

We have presented an approach to realize real-time virtual try-on of lipstick by user interaction. Our method is based on image processing methods. The system works realistic, but sometimes it can be temporal delays. One of the advantages of the system is cheapness. The user only needs to have a camera and a computer to use the system.

Sometimes synchronization disorders occur in the system. For example, if the user light-skinned, lip and skin colors are confused by the system. So, the color of wrong area changes.

In the future, it can be added to the system another makeup products. Also it can be provided system interaction with hand gestures.

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