USER'S PREFERENCE-BASED COLOR TRANSFORMATION USING INTERACTIVE GENETIC ALGORITHM

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Abstract

In this paper, we propose a new color transform method in the image based on the user's preferences. To obtain general preferences for color, we first divided the images into two categories as favourable and unfavourable groups based on the users' evaluation. From the categorized groups of images, we compute color histograms to construct general templates for 8 primary colors. To reflect the user's own preference in the color perception, we adopted an interactive genetic algorithm. In the interactive genetic algorithm, each individual consists of three chromosomes for H, S, and V and the fitness value is computed from the user's input, which is then used as criteria to iterate Genetic Algorithm for learning the user's preference. Finally, a personalized individual is generated. By transforming the colors in the image with the personalized individual, a re-colorred image is generated according to the user own preference. Survey results show that re-colorred images from our proposed personalized color templates are more satisfying than the original images.

Categories and Subject Descriptors (according to ACM CCS): I.4.9 [Computer Graphics]: Image Processing and Computer Vision—Applications

1. INTRODUCTION

Currently, a large number of images are captured daily by digital cameras and mobile phones. Various tools have been developed to edit the images according to the user's own style. However, a few schemes like color harmonization[CSC*06] are developed to enhance the perception quality of the colors in the images. In fact, it is not an easy task to deal with perceived colors because the perception of colors is culture-related and depends on the personal preferences. If we can transform colors in the captured images into favorable and unfavorable colors, a user can easily create his own preferred images. Thus, it is desirable to design an effective method to reflect the user's own color preference in the images or media arts.

2. COLOR TRANSFORMATION

To create a color transformed image, we first generate templates for eight primary colors such as yellow, blue and etc. [PLU02]. From 150 color images, 32 students divided color images into two groups such as favourable and unfavourable. In each group, color images are classified according to the 8 primary colors. From classified images, we compute histograms in HSV color space. We used 36 quantization scheme as in Lei [LFB99] because this scheme shows good performance in representing color based on human perception. By intersecting histograms, general templates are constructed.

We obtain the personalized target template from the primary color groups using interactive genetic algorithm. The interactive genetic algorithm used in this paper is Genetic Algorithm where the evaluation part of it is subjectively handled by a user [SMH08]. The chromosome representation of the color image can be done by histograms of color space. For example, each color image (or individual) consists of three chromosomes such as H, S and V. As shown in Figure. 1, the initial transformed images for each primary color are evaluated by the user. In other words, the fitness value is set by the user. If the user is satisfied, final templates are constructed. Otherwise, the selection process is executed among

offsprings. On the selected offstprings, crossover, mutation and copy operations are executed. After the user's satisfaction, the final individual is obtained. Using the final individual, the preferred images are obtained.

The color transform method of hue in images using templates is similar to the one in Cohen-Or et al.[CSC*06]. The new hue value is computed by

$$H'(p) = C(p) + \frac{w}{2}(1 - G_\sigma(||H(p) - C(p)||)) \quad (1)$$

, where $C(p)$ is the central value of the sector associated with the pixel, and w is the arc width of the template sector, and$G_\sigma$is the normalized Gaussian function with standard deviation σ.

The brightness value and Saturation value at pixel p is transformed by

$$p' = T(p) = p + (t_{max} - i_{max}) \times e^{-|i_{max} - p|} \quad (2)$$

, where $t_{max}$is the maximum of target value and $i_{max}$is the maximum of input pixel.

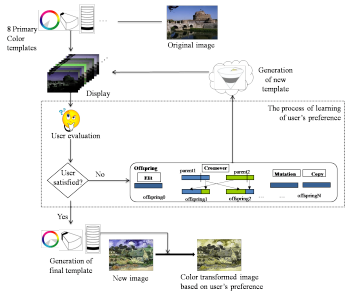

Figure 1: *The overview of our proposed method.*

3. EXPERIMENTAL RESULTS

We implemented our color transformed image using interactive genetic algorithm. Figure 2 shows one stage of the color transformed images. The user inputted his evaluation score from 0 to 4. If the user press the keep button, the image is transferred to the next stage. After a few number of iterations, the user can terminate the process and the most favorable image would be selected. From that image, the target color template is obtained. Using this template, we re-colored the image. Figure 3 shows the re-colored image using our proposed method. After testing 20 students, the satisfaction percentage of the transformed images compared to the original image was rated as 86%. The satisfaction rate has increased more than 10 % compared to the general color templates.

4. CONCLUSIONS

In this paper, we proposed a method to transform colors according to the user's own preference. Survey results show that desirable results are obtained from our proposed personalized color templates.

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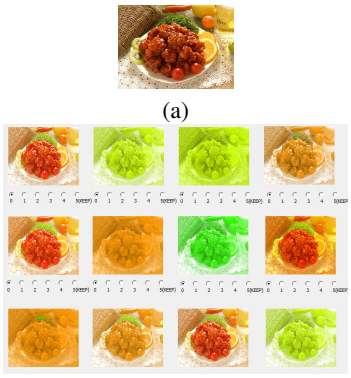

(a)

(b)

Figure 2: *(a) original image, (b)color transformed image*

(a) (b)

Figure 3: *(a) original image, (b)re-colored image (favourable)*