Color matching in different color space

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Abstract

In the area of digital image processing color is the useful property of the image. We have seen there are many algorithms based on this powerful feature in image processing and related fields like image segmentation, object detection, etc. the challenge for this exercise is finding specific color in an arbitrary give image. In this paper we introduce a novel approach (you owe me if you doubt about it) based on the mean and standard deviation of values in each layer of template image (color).

Keywords: color matching, color feature, color space

1 Introduction

There are variety of application for color matching that make this task more important. For example (1) finding objects with specific color among others, like production line (2) in remote sensing color used for classifying different ground regions from aerial or satellite photographs (3) Codonics Medical Color Matching (MCM) that adjusts printed output colors to more accurately match CRT monitors.

For finding template color in an arbitrary image have propose different methods based on histogram and spatiogram. For example in [1] target colors are identified using a histogram-like structure called a Color Predicate and in [2] a technique based on histogram, spatiogram and bins have proposed.

2 Our Method

The color histogram is particularly well suited for the problem of recognizing an object of unknown position and rotation within a scene [3]. As we know histogram is a powerful representation for image data in a region. In this exercise we have used histogram for finding similar color in an image to template color and comparing histograms of given image and template image and matching the color content of one image with the other.

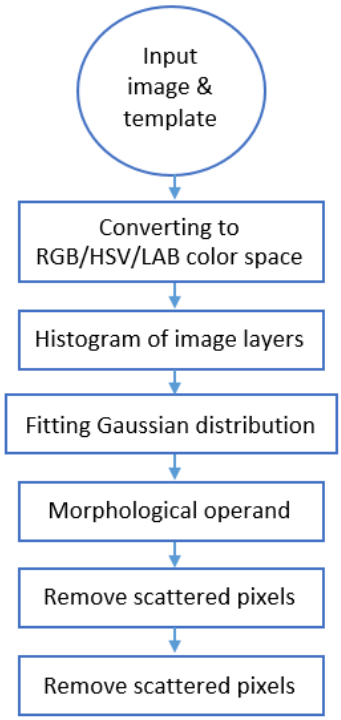


Figure 1: Architecture of the proposed method for color matching.

Figure 1 is Architecture of the proposed method for color matching.
(1) Converting given image and template image to RGB/HSV/LAB color space.
(2) Extracting histograms of each layer of template image, and fitting a gaussian distribution $N(\mu, \sigma)$ to data (figure 2). In this step we have obtained two parameters for each layer.

(3) For including all colors in template image and almost similar color to reference color it's better to choose a wider windows

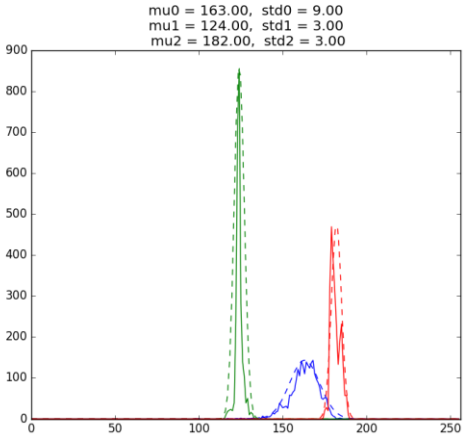


Figure 2: fitting a gaussian distribution

in each layer to cover all colors in histogram. Experimentally we have understood that different coefficient for each layer in different color space yield better result. In this step the condition for selecting a pixel as desired one is that every three values of pixels should be in corresponding window.

(4) Applying opening algorithm include erosion followed by dilation will remove disjoint pixels smaller than selected structured element.

(5) The image-like extracted from previous step has a lot of irrelevant scattered pixels in different part of image. For removing these pixels we have eliminated areas smaller than 40 pixels.

2.1 RGB color space

RGB is an additive color space that is defined by its primaries Red, Green and Blue, colors in this space can be represented as combinations of the primary colors.

2.2 HSV color space

HSV stands for hue, saturation, and value of brightness. This color space that is similar to human color perception is defined by three parameters Hue, Saturation and Value. In this model intensity and hue are separate, and its help encounter illumination effect in image processing.

2.3 LAB color space

A LAB color space that is designed to approximate human vision is a color-opponent space with dimensions L for lightness and A and B for the color-opponent dimensions.

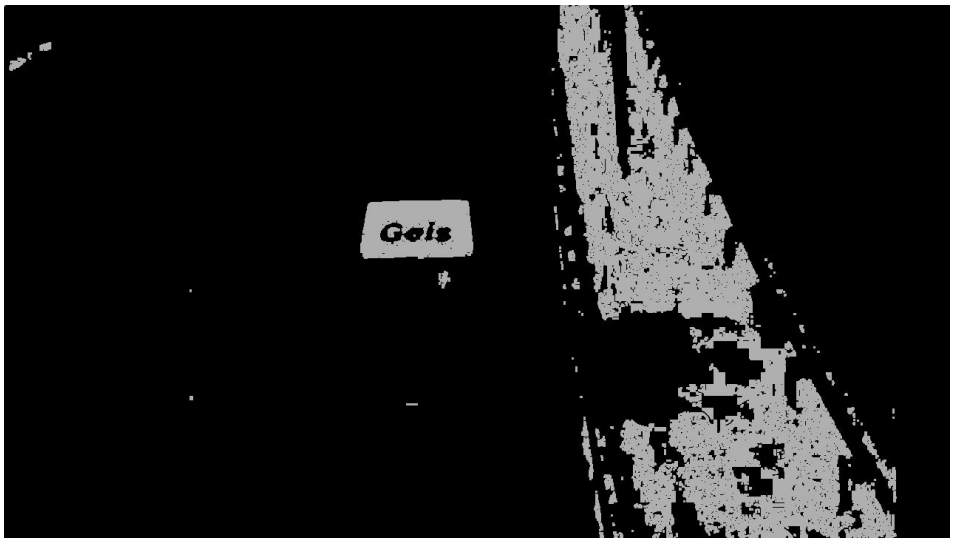
3 Results

We have applied our method on collection of images by several templates in different color spaces. By passing an image through different block of architecture, obviously every block remove the noise and irrelevant pixels. Figure 3 is image-likes from different step of block diagram, and figure 4 is showing results of algorithm for several input images and templates.

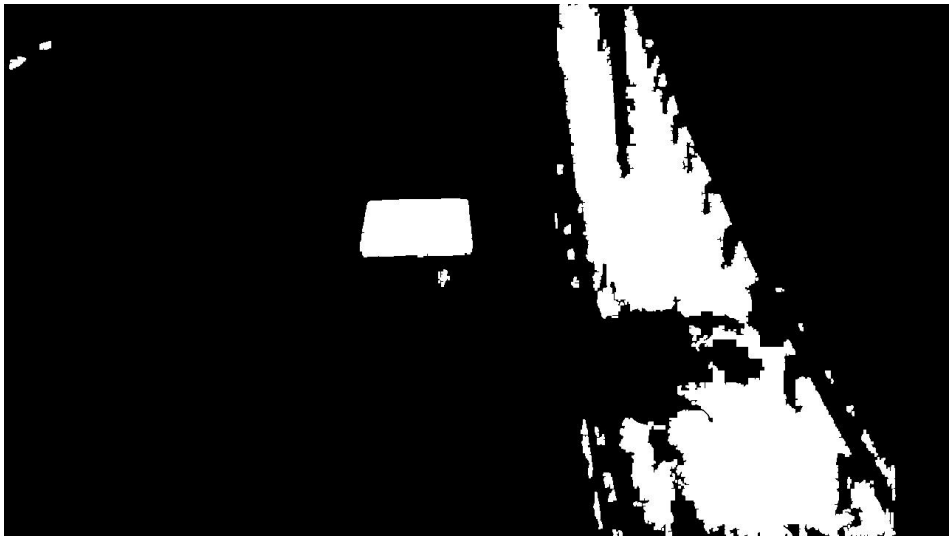
Conclusion

It can be observed from the resulted images that color matching based on histogram is a basic method by mediocre performance. By comparing various result in different color space it seems that the results are slightly different. By our results HSV color space is well suited for this method, this may because of separate layer for hue and illumination value in this color space. Between other color spaces it’s better to choose LAB instead of RGB as we can observe in results that this color space do better.

(a) raw image-like after applying masks



(b) image-like after applying morphological operation



(c) image-like after removing areas smaller than 40 pixels

Figure 3: different step of block diagram

(a) RGB color space

(b) LAB color space

(c) HSV color space

Figure 4: results in different color space

References

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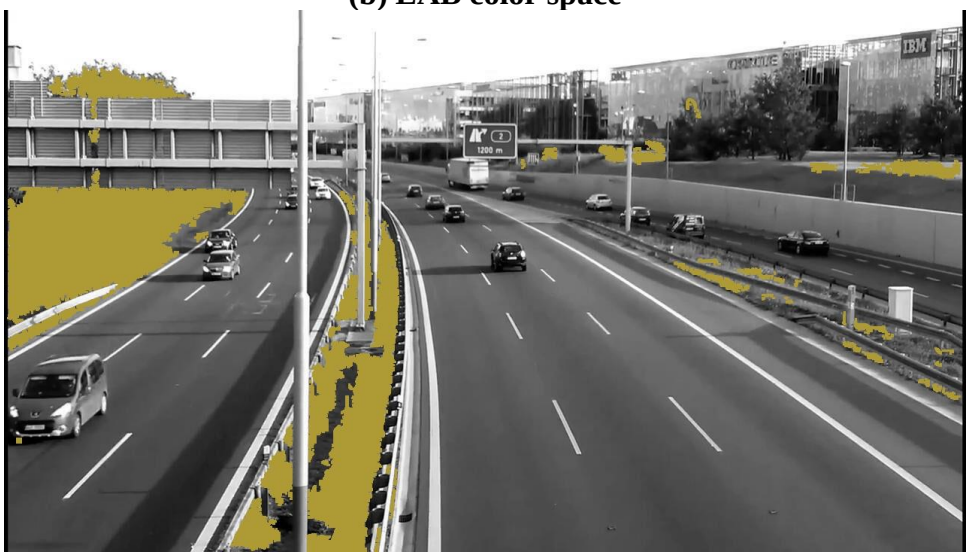
[3] Singh, Bikesh Kr, G. R. Sinha, and Imroze Khan. "Comparison of histogram and spatiograms for content based retrieval of remote sensing images." Information Processing and Management. Springer Berlin Heidelberg, 2010. 152-156.

[4]https://en.wikipedia.org/wiki/RGB_color_space

[5] https://www.researchgate.net/

(a) RGB color space

(b) LAB color space



(c) HSV color space