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Color Calibration for Multi-Camera System without Color Pattern Board

K. Yamamoto and J. U

MONASH UNIVERSITY

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Abstract

We have reported the color calibration approach by using a color pattern board [1]. In this approach, the colors used for creating look-up table are restricted on the color pattern board. This restriction somethimes reduced the calibation quality in some area such as bright background. In this document, we will introduce the color calibration approach without a color pattern board to tackle this issue. Experimental results show improvement in such area.

1 Introduction

In [1], the colors used for creating look-up table are restricted on the color pattern board. This restriction somethimes reduced the calibation quality. One approach to tackle this issue is to use vivid color pattern board and capture it at bright area. But if the place where a color pattern board is located is darker than other places, this approach is impossible. Another approach is to use the colors for creating look-up table not only on the color pattern board but also at whole captured images. In this case color pattern board is not necessary. In other words, another approach is to use the colors at whole captured images. In this document, we will introduce this another approach.

This approach consists of following steps.

1. abstraction of colors
2. calculation of the look-up tables that indicates the modification from captured videos to color calibrated videos.
3. modification of the videos.

The last two steps are same with the step in [1]. Therefore we mention the first step and experimental results in this documents.

In [1], there are two approaches to calculate look-up tables, linear interpolation approach and energy function approach. In this document we use the latter approach.

2 Abstraction of Colors

In [1], one of the reasons to use a color pattern board is to escape the abstraction of corresponding colors, because to find correspondences is very complex problem even if we use the color calibrated image. In this case, we must find correspondences from color uncalibrated images.

Bright spot of this approach is that outliers do not influence so much. If the number of outliers are small or if the colors of outliers distribute without bias, outliers do not influence at the look-up tables calculation step, because that step uses summation of error function.

In this approach we use SIFT algorithm [2] to find correspondences. SIFT can detect the features that are invariant to image scale and rotation, and are shown to provide robust matching across substantial range of affine distortion, change in 3D viewpoint, addition of noise, and change in illumination.

3 Experimental Result

To confirm this approach, we conducted an experiment. The conditions are same with [1]. Figure 1 and figure 2 represent the captured color pattern board and human beings respectively. Figure 3 and figure 4 depict the images color calibrated by [1]. Figure 5 and figure 6 depict the images color calibrated by this approach.

4 Conclusion

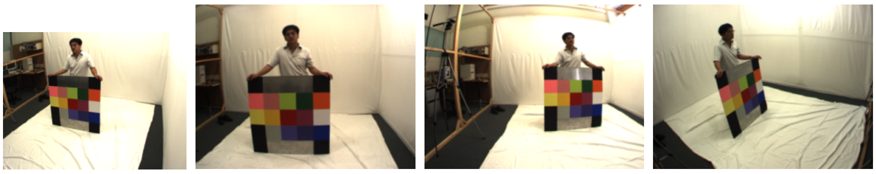
In this document, we introduced the color calibration approach without a color pattern board to tackle this issue. Distinct point of this approach is that outliers do not influence so much if the number of outliers are small or if the colors of outliers distribute have no bias. Experimental results show that this approach is better than the approach by using color pattern board in some areas.

To show the stability of this approach, we have to certify the SIFT algorithm's precision in our application as well as the influence of outliers.

References

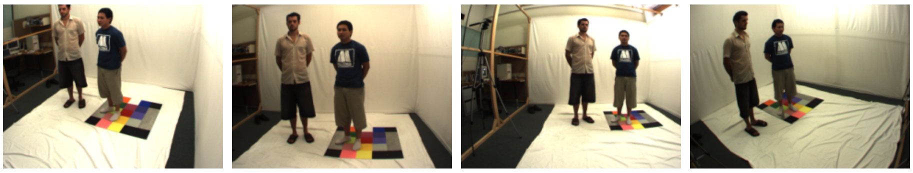
[1] Kenji Yamamoto and James U: “Color Calibration for Multi-Camera System by using Color Pattern Board,” ECSE Technical Reports MECSE-3-2006 (2006)

[2] David G. Lowe: “Distinctive Image Features from Scale-Invariant Keypoints,” International Journal of Computer Vision, vol.60, no.2, pp. 91-110 (2004)



(a) camera #0 (b) camera #1 (c) camera #2 (d) camera #3

Figure 1: Captured Color Pattern Board

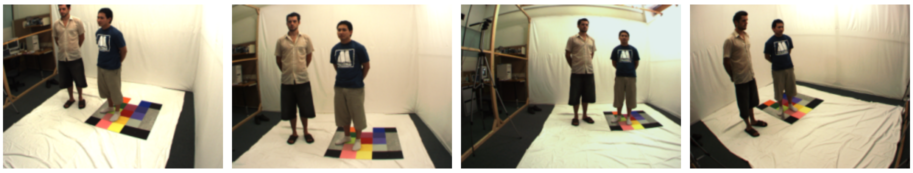


(a) camera #0 (b) camera #1 (c) camera #2 (d) camera #3

Figure 2: Captured Human Beings

(a) camera #0 equals to the captured image. (b) camera #1 (c) camera #2 (d) camera #3

Figure 3: Color Pattern Board Calibrated by [1]

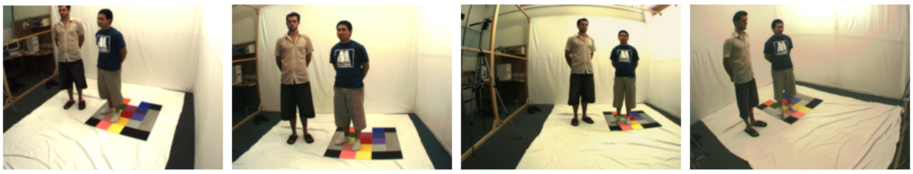


(a) camera #0 equals to the captured image. (b) camera #1 (c) camera #2 (d) camera #3

Figure 4: Human Beings Calibrated by [1]

(a) camera #0 equals to the captured image. (b) camera #1 (c) camera #2 (d) camera #3

Figure 5: Color Pattern Board Calibrated by this approach



(a) camera #0 equals to the captured image. (b) camera #1 (c) camera #2 (d) camera #3

Figure 6: Human Beings Calibrated by this approach