Chapter 5

Experiment results and Discussions

5.1 Introduction

The theoretical details of the illuminant estimation model and experimental procedures have been discussed in previous chapters. Two experimental results on the mean values of modified model in simulated image data and natural scene image data will be discussed in this section. Also, two experimental R and B gains as color temperature will be talked. Then, we will compare AWB performance with Gray world method and Canon G5 algorithm.

5.2 Simulated Result

According to Gaussian model, all of the mean values were found in the experiment. As shown in **Fig. 5-1**, mean values are varied largely from (0.218, 0.463) to (0.291, 0.359) in (r, b) chromaticity plane when color temperature is varied largely from 1800 K to 9800 K. In addition, the corresponding slope of those mean values is steady function of color temperature.

5.3 Real Scene Result

1920 natural scene pictures were processed by photoshop CS software and the color temperature estimated are varied from 2850 K to 7500 K with limited 50 K interval. The result is shown in **Fig.5-3**.

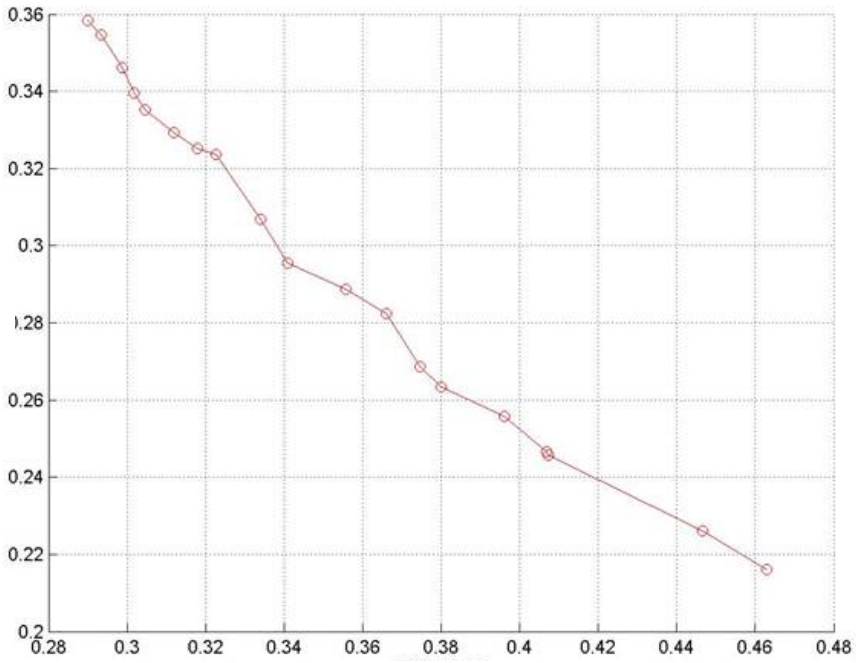

Fig. 5-1 Simulated mean value

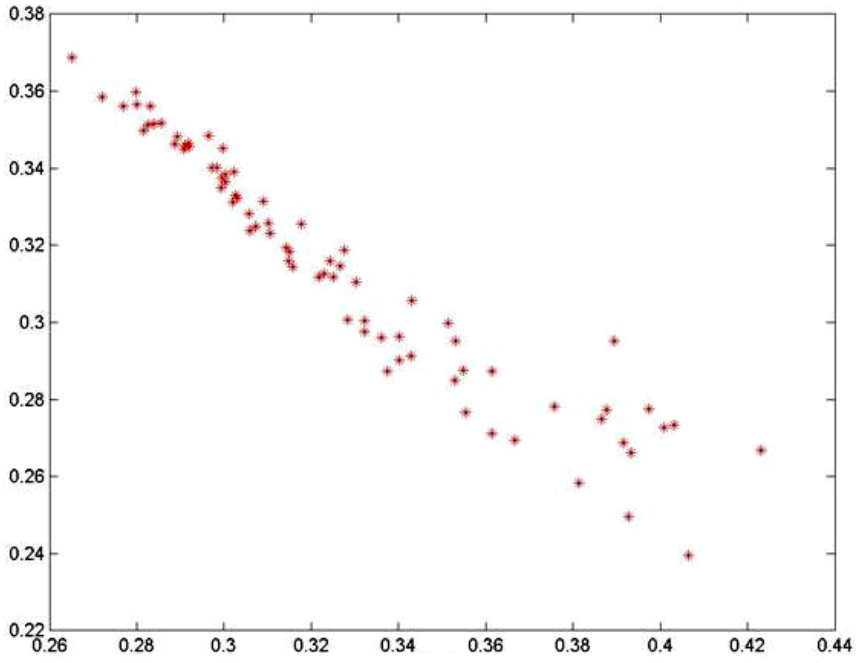

Fig. 5-2 Mean value of natural image data

As shown in **Fig. 5-2**, mean values are varied from (0.241, 0.415) to (0.271, 0.371) in (r, b) chromaticity plane when color temperature are varied largely from 2850 K to 7500 K. Because it's difficult to collect pictures illuminated with low color temperature solar light source that the results here did not converge to idea value. Therefore, we classified these natural scene pictures with different color temperature interval. The processed color temperature intervals diagram from 100 K to 500 K are shown in Fig.5-3. Evidentially, the deviation is reduced and the accuracy is indeed increased.

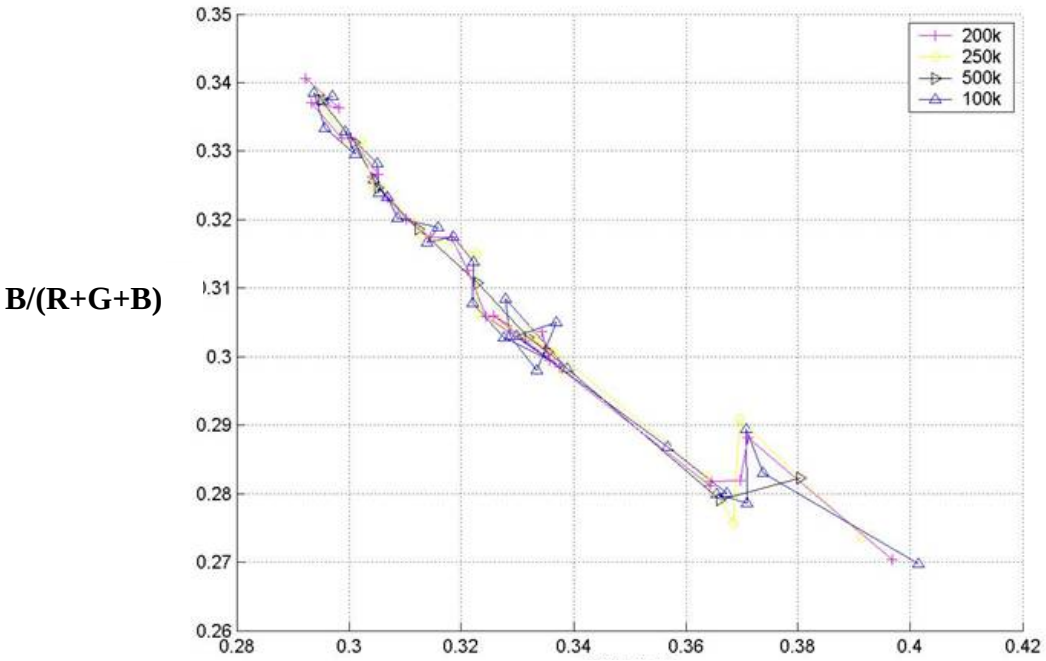

Fig. 5-3 Mean values in different color temperature intervals.

5.4 Comparison of Simulated and Real Scene Result

For comparison the simulated and real scene results were summarized in Fig.5-4. Here, two simulations were proposed: A solar light source was utilized and Kodak color filter film was inserted in front of light source to obtain 15 different classifications (kadok data); the other is used two solar light sources and Fuji color filter film was inserted in front of camera lens to obtain 19 classifications (Fuji data). These two lines plotted in Fig.5-4 are nearly parallel. The real scene result is converged to simulated result.

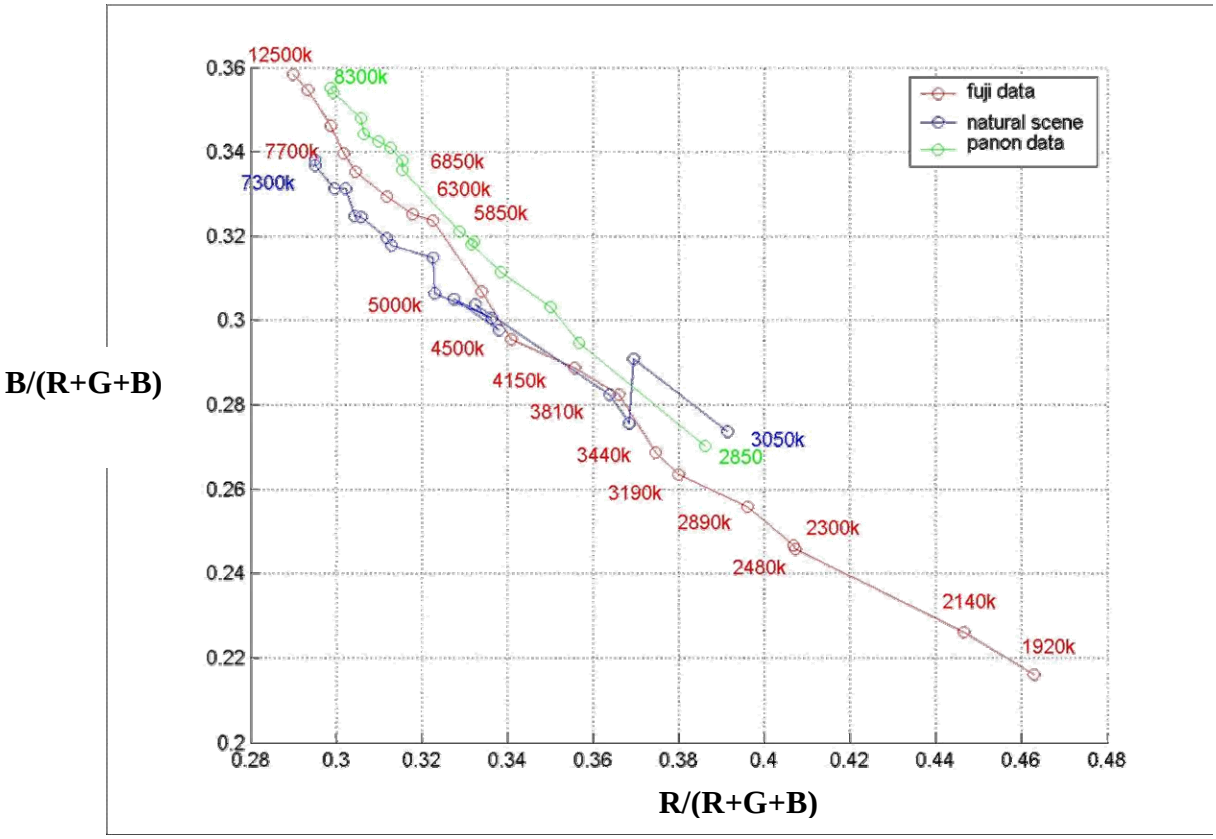

Fig.5-4 Comparison of mean value in simulated and natural scene image data.

5.5 Results of Gain Table

The color correction method is based on summarizing the ratio of R, G, and B sensor responses under different illuminants. Both of R and B gains are defined as a function of color temperature and a gain table built up, respectively. The first simulation result is shown in Fig. 5-6. The blue line stands for B gains when red line shows R gains. The deviation between ideal and measured color temperature is about 654 (K). The second simulated result is shown in Fig. 5-7. The deviation between ideal and measured color temperature is about 594 (K). Due to the light condition in second simulated method is more stable, the result is better than the first one.

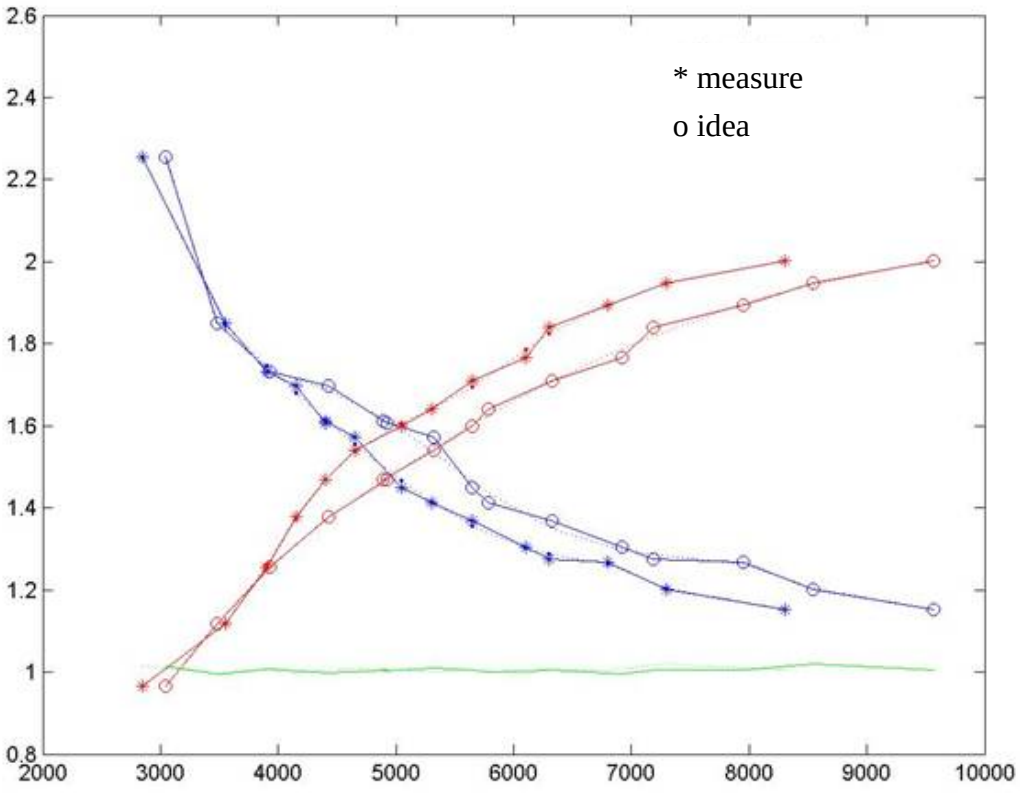

Fig.5-6 Kodak gain table

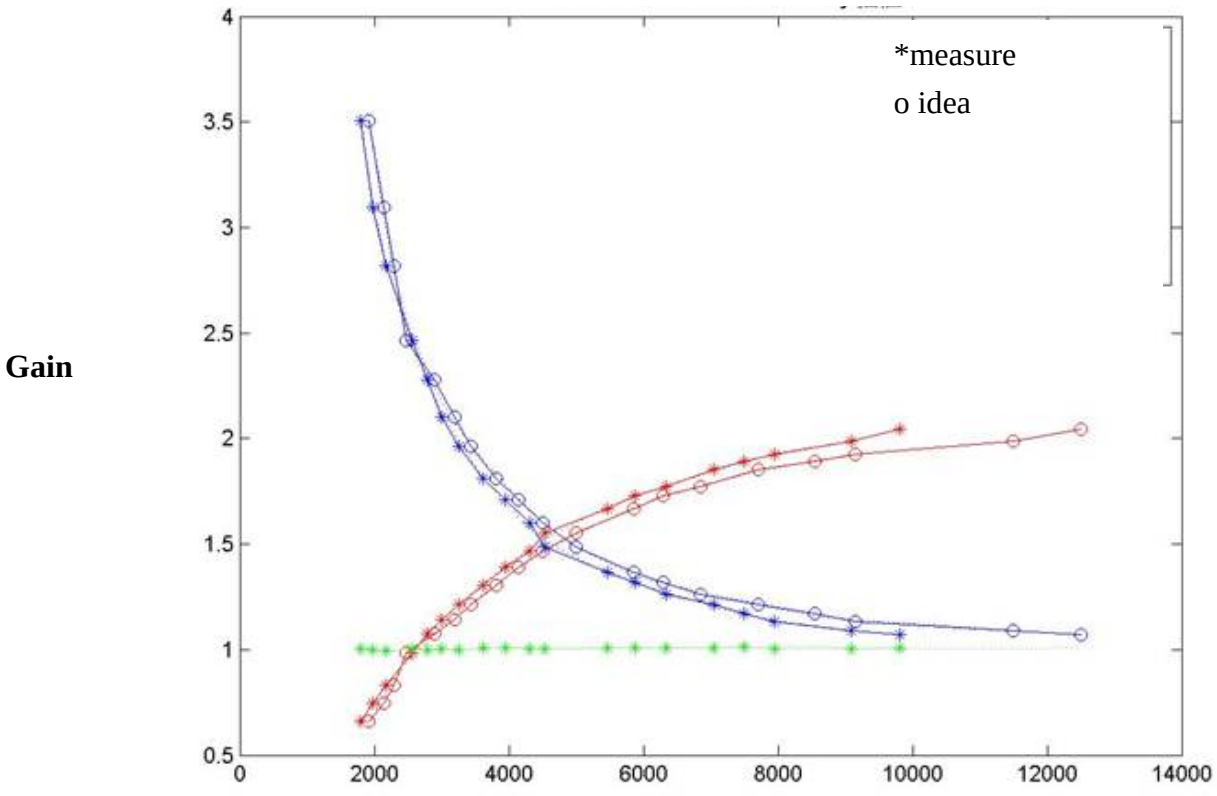

Fig.5-7 Fuji gain table

5.6 Illuminant Estimation Results

56 natural scene pictures were collected under different weather and daytime as testing images. The results compared with three illuminant estimation method are shown in Table 5-1 and Table 5-2, repectively. In Table 5-1, the errors of three illuminant estimation methods are illustrated by average deviation reciprocal color temperature (MK^{-1}). The errors are about when it's 38 MK^{-1} to 58 MK^{-1}. The performance of our modified method is 63% when illuminant estimation error bellowed 24(MK^{-1}) (Table 5-2). Evidentially, Finlayson's method is successfully simplified by our modified method.

Table 5-1 A comparison of illuminant estimation method on real scene result. With different classified intervals, the errors of two illuminant estimation methods are illustrated by reciprocal color temperature (MK^{-1})

Database	Kodak	Fuji	Natural
Proposed	53 (MK^{-1})	38 (MK^{-1})	39 (MK^{-1})
Finlayson	39 (MK^{-1})	32 (MK^{-1})	31 (MK^{-1})

Table 5-2 Algorithm performance

AWB Method / ΔMK^{-1}	Gray word	Proposed	Finlayson
<24	49%	63%	66%
24~48	30%	19%	25%
>48	21%	18%	9%
Performance	△	○	○

5.7 AWB Performance Test

There are four images captured with Canon G5 camera; the raw data,, the image rerendered using the illuminant estimate recovered by our new algorithm, the image rerendered using the Gray-World estimate, and the processed image by Canon G5 camera. It is clear that the image rerendered using the new algorithm's estimate of the illuminant is a very close to that obtained using the measured illuminant. In contrast, the performance of Gray-World is worse than the others.

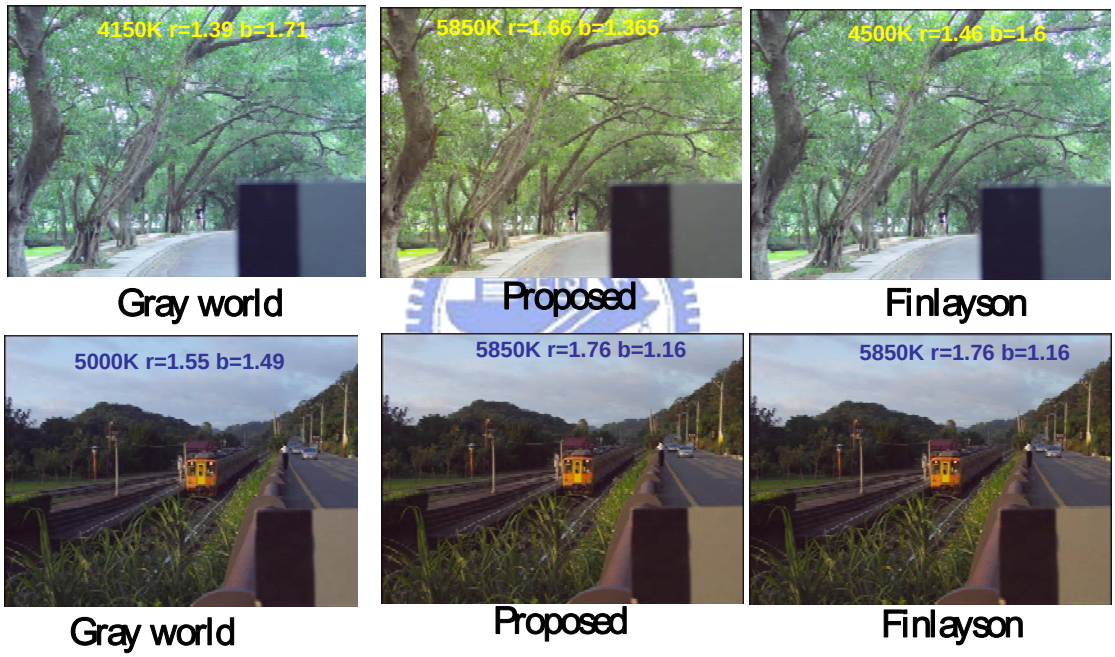

Fig.5-8 Correction based on; Gray-World, Proposed method and Canon G5 camera. Images were taken under daylight light.

5.8 Summery

Using reciprocal color temperature to classify solar illuminants is a simply method. In addition, in our simulated results it can be superior to 38 mired when human equal color perception is 24 mired. The performance of our modified method is 63% when illuminant estimation error bellowed 24 mired. We have successfully simplified Finlanson's work and make AWB more easier to utilize in digital still camera.