THE STUDY OF MULTISPECTRAL IMAGES FROM EXISTING PRIMARY COLOR FILTERS

Hsing-wei Lee Hsi-min Chao

Associate Professor Instructor

Department of Surveying and Mapping Engineering
Chung Cheng Institute of Technology
Tao-yuan, Taiwan 335 Republic of China

ABSTRACT

With a personal computer based imaging processing system, 2 sets of primary color filters were used to the acquisition of multispetral images by photographing a color original. From statistical analysis of these images gray values under two different light sources, the effects of color vision from each set of filters can be evaluated for cartography and graphic arts applications.

KEY WORDS : Primary Color Filters, Multispetral Images, Color Composite

INTRODUCTION

Video camera and computer based imaging system have showed their capability and stability in photography at the present time. With separated bands information, many scientific and technological applications such as recognition, interpretation, classification can be achieved.

Since every single item of the imaging system played an important part in the operation, some existing primary color filters and light sources were adopted and tested by an economic imaging system. Then multispectral images were produced and processed for evaluation on cartography and graphic arts.

SYSTEM AND EXPERIMENT

Hardware

1. Video Camera : A General Electic model: GE4TE66 -1D was used.

2. Computer System: IBM compatible PC/AT with hard disk, Image Monitor (512 X 480 pixels) and PC vision Frame Grabber Card were installed.

3. Filters :

	Kodak	Marumi(Spectracolor)
Red	#25	Red
Green	#58	Green
Blue	#47B	Blue

Software

Both IMAGEACTION and ERDAS were applied to image processing. IMAGEACTION was used for data acquisition and analysis, ERDAS provided functions to read and display color composites.

Experiment

Filters were placed by hand one at a time in front of camera lens setting on a copying stand. A daylight flood bulb and a tungsten flood bulb were used as lighting source respectively during the multispectral images acquisition, images then stored in disk. Sample color original was provided by Wild Leitz from aerial photography.

RESULTS

There are 12 spectral images (numbered from Band 1 to Band 12) based on the same original collected in the experiment by 6 filters under 2 lighting sources. Statistical data of gray values for these 12 spectral images, such as mean, standard deviation were then computed as Table 1, variance-covariance matrix as Table 2, correlation matrix as Table 3.

Color composite was designed for each set of RGB image combination as Fig. 1. According to correlation matrix, the lowest correlated combination of band 6, 7, 8 was also performed and displayed in Fig. 1.

Bands 1, 2, 3 have slightly different orientation with the rest 9 bands, besides, the aperture for bands 1, 2, 3 was F/16 while the rest were F/1.4 . This makes bands 1, 2, 3 have relatively lower mean values than bands 4 to 12.

REMARKS

1. Aperture setting has effects on variance values and color saturation as color composite TFMA appeared.

2. Daylight Flood is not better than Tungsten flood in lighting when working with video camera.

3. Video camera and CCD camera are poored in resolution and sensing blue light.

4. The color of hardcopy is not consistent with monitor display in this system.

5. TFKD, DFKD are closed in hues to original in Fig 1 and monitor display .

6. Color composite of lowest correlation in hardcopy is not better than others.

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	TFMAR	TFMAG	TFMAB	TFKDR	TFKDG	TFKDB	DFMAR	DFMAG	DFMAB	DFKDR	DFKDG	DFKDB
	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8	Band 9	Band 10	Band 11	Band 12
Mean	162.83	123.41	151.08	173.57	166.97	173.70	189.79	156.96	185.67	188.84	184.47	187.58
Std. Dev.	46.99	42.65	45.11	41.14	40.49	38.87	33.77	44.33	30.14	34.40	32.51	28.27
Variance	2208.36	1819.01	2035.10	1692.47	1639.20	1511.25	1140.36	1965.57	908.30	1183.64	1056.75	799.35
Min.	71	42	67	69	66	82	93	42	96	89	82	99
Max.	255	227	250	255	242	248	255	246	245	255	245	243

Table 1 Univariate Statistics
T F : Tungsten Flood
D F: Daylight Flood

	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8	Band 9	Band10	Band11	Band12
Band 1	2208.3											
Band 2	1945.8	1819.0										
Band 3	1907.3	1726.7	2035.1									
Band 4				1692.4								
Band 5				1582.0	1639.2							
Band 6				1384.8	1494.2	1511.2						
Band 7				1188.3	1059.7	859.11	1140.3					
Band 8				1433.9	1335.8	996.22	1407.0	1965.5				
Band 9				1107.1	1064.8	944.24	975.12	1215.5	908.30			
Band 10				1226.6	1089.0	876.02	1154.1	1435.8	985.26	1183.6		
Band 11				1154.8	1143.7	959.62	1030.0	1372.3	939.26	1051.4	1056.7	
Band 12				1027.0	1062.5	1008.0	813.82	1016.8	812.07	826.52	853.57	799.35

Table 2 Variance-Covariance Matrix

	Band 1	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8	Band 9	Band10	Band11	Band12
Band 1	1.0000											
Band 2	0.9708	1.0000										
Band 3	0.8997	0.8975	1.0000									
Band 4				1.0000								
Band 5				0.9498	1.0000							
Band 6				0.8659	0.9494	1.0000						
Band 7				0.8554	0.7751	0.6544	1.0000					
Band 8				0.7862	0.7442	0.5780	0.9398	1.0000				
Band 9				0.8929	0.8727	0.8059	0.9581	0.9097	1.0000			
Band 10				0.8667	0.7819	0.6550	0.9934	0.9414	0.9502	1.0000		
Band 11				0.8636	0.8690	0.7594	0.9390	0.9522	0.9587	0.9401	1.0000	
Band 12				0.8830	0.9283	0.9171	0.8524	0.8112	0.9530	0.8497	0.9287	1.0000

Table 3 Correlation Matrix

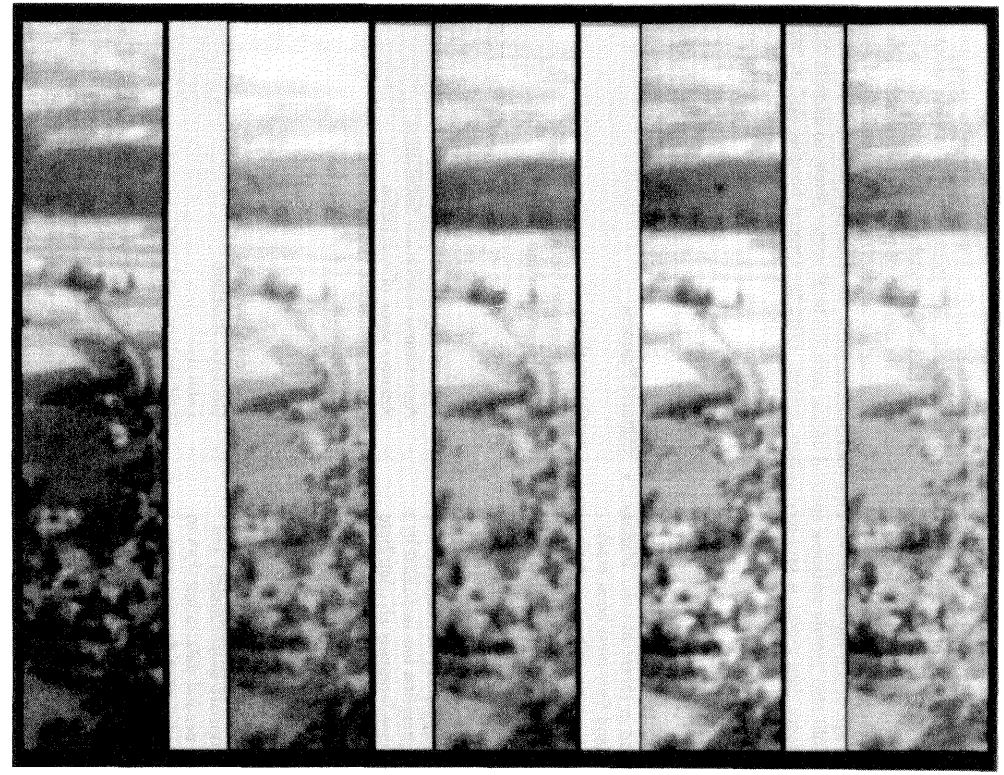

Figure 1 Color Composite : From left to right, TFMA , TFKD
Lowest Correlation, DFMA, DFKD