

# Image retrieval using block color characteristics and spatial pattern correlation

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## Abstract

*We propose a new content-based image retrieval using a block color co-occurrence matrix (BCCM) and pattern correlogram. In the proposed method, the color feature vectors are extracted by using BCCM that represents the probability of the co-occurrence of two mean colors within blocks. Also the pattern feature vectors are extracted by using pattern correlogram which is combined with spatial correlation of pattern. In the proposed pattern correlogram method, after block-divided image is classified into 48 patterns with respect to the change of the RGB color of the image, joint probability between the same pattern from the surrounding blocks existing at the fixed distance and the center pattern is calculated. Experimental results show that the proposed method can outperform the conventional methods as regards the precision and the size of the feature vector dimension.*

**Key Words :** *Block color co-occurrence matrix, spatial correlation, pattern correlogram*

## 1 Introduction

It is this rapidity of the sheep of multimedia data of digital image, the video and the audio data back with advancement of the computer and network communication and it is increasing, it follows hereupon and the user wants only the image where efficiently search and necessity of the image search techniques it will be able to select is demanded from in image of the double meaning data base inside which is huge. Specially the contents base image search method color, texture, and the shape from vision information of the back extracts and compares a feature vector from in image search technique of multi branch method. [1]-[7]

At 1991 M. J. Swain and D. H. Ballard<sup>[1]</sup> proposed the image search method which uses color histogram. Color histogram method is tough in rotation and size change of image and the embodiment is easy but there is a weak point which does not include the spatial correlation of image inside. At 1997 J.

Huang, S. R. Kumar, M. Mitra, Wei-Jing Zhu and R. Zabih<sup>[2]</sup> proposed the image search method which uses the color correlogram where the color histogram and spatial correlation is combined. The color correlogram method the method which uses the general histogram in order to show the spatial correlation of the color pair which it follows in distance change compared to the search efficiency is excellent. But the weak point of this method calculation quantity is many and also it means that the size of feature vector dimension becomes larger. At 2003 Qiu<sup>[3]</sup> proposed the image search method which uses BCCM (block color co-occurrence matrix) and the BPH (block pattern histogram).

The strong point of BCCM method calculates the concurrence probability of two representative mean colors inside the blocks with color method compared to is a possibility of reducing a calculation quantity plentifully. The BPH it uses training images from method and it buys a pattern. And it calculates histogram of those patterns with it extracts pattern feature vectors. But this method from the hazard which makes the cord book which is accurate the calculation quantity which is necessary is many. And There is a weak point where the many training image is necessary.

It proposes the contents base image search method which uses the BCCM and pattern correlogram from this dissertation. In the proposed method, the color feature vectors are extracted by using BCCM that represents the probability of the co-occurrence of two mean colors within blocks. Also the pattern feature vectors are extracted by using pattern correlogram which is combined with spatial correlation of pattern.

The pattern correlogram method follows the block which is divided at certain size in change of RGB value and after sharing in 48 patterns, the combination probability of the identical pattern which from the pattern where becomes the standard is to certain distance it calculates.

## 2. The image search algorithm which it proposes

### 2.1 Color feature vector extraction

In order to extract a color feature vector first it shares with the block which 44 size piles up an image. Against each pixel after that with the next numerical formula it buys RGB mean value  $ib(i, j)$  together

$$ib(i, j) = \frac{1}{3} (r(i, j) + g(i, j) + b(i, j)) \quad \forall i, j \quad (1)$$

And it changes each pixel of block inside with bit Map. Namely, inside the block bit Map  $bm(i, j)$  which is classified from location  $(i, j)$  it finds out with the next numerical formula.

$$bm(i, j) = \begin{cases} 1 & \text{if } ib(i, j) \geq T \\ 0 & \text{if } ib(i, j) < T \end{cases} \quad (2)$$

From here 1 the value which pixel dawns mean value of the block compared to shows the area where it dawns and 0 shows the dark area each. And threshold T

$$T = \frac{1}{m \times n} \sum_{i=1}^m \sum_{j=1}^n ib(i, j) \quad (3)$$

With it is same and it shows mean value of the block. From here  $m$  is a size of the block. After making bit Map, block mean value compared to with the area where it dawns against the dark area from inside the block it calculates a each mean. And with the area where each block of dawn area and dark area calculates the color mean . Each color mean value quantize J-color. And it makes the hash table. This time it calculates the BCCM from inside the block.

$$BCCM(i, j) = Pr(IHash\{Br\} = i | IHash\{Dk\} = j), \quad \forall i, j \in [0, J-1] \quad (4)$$

The  $Br$  is color average value of quantized dawn area. The  $Dk$  is color average value of quantized dark area.

## 2.2 Pattern feature vector extraction

An image divide 2 by 2 block For Pattern feature extraction and each RGB value of block inside make bit Map. It compares the RGB value and RGB block mean value of each pixel of block inside each. If RGB value higher than RGB block mean value that pixel classifies dawn area, else that pixel classifies dark area. Namely, inside the block (i, j) from location each RGB bit Map  $bmR(i, j)$ ,  $bmG(i, j)$ , and  $bmB(i, j)$  comes to be expressed each with the next numerical formula.

$$\begin{aligned} bm_R(i, j) &= \begin{cases} 1 & \text{if } r(i, j) \geq T_R \\ 0 & \text{if } r(i, j) < T_R \end{cases} \\ bm_G(i, j) &= \begin{cases} 1 & \text{if } g(i, j) \geq T_G \\ 0 & \text{if } g(i, j) < T_G \end{cases} \\ bm_B(i, j) &= \begin{cases} 1 & \text{if } b(i, j) \geq T_B \\ 0 & \text{if } b(i, j) < T_B \end{cases} \end{aligned} \quad (5)$$

From here 1 the value which pixel dawns mean value of the block compared to shows the area where it dawns and 0 shows the dark area each. And threshold  $T_R$ ,  $T_G$ , and  $T_B$  is expressed with the next numerical formula.

$$\begin{aligned} T_R &= \frac{1}{m \times n} \sum_{i=1}^m \sum_{j=1}^n r(i, j) \\ T_G &= \frac{1}{m \times n} \sum_{i=1}^m \sum_{j=1}^n g(i, j) \\ T_B &= \frac{1}{m \times n} \sum_{i=1}^m \sum_{j=1}^n b(i, j) \quad \forall i, j \end{aligned} \quad (6)$$

This numerical formula shows RGB each block mean value. It makes with bit Map and the 48 patterns are same from with Figure 1.

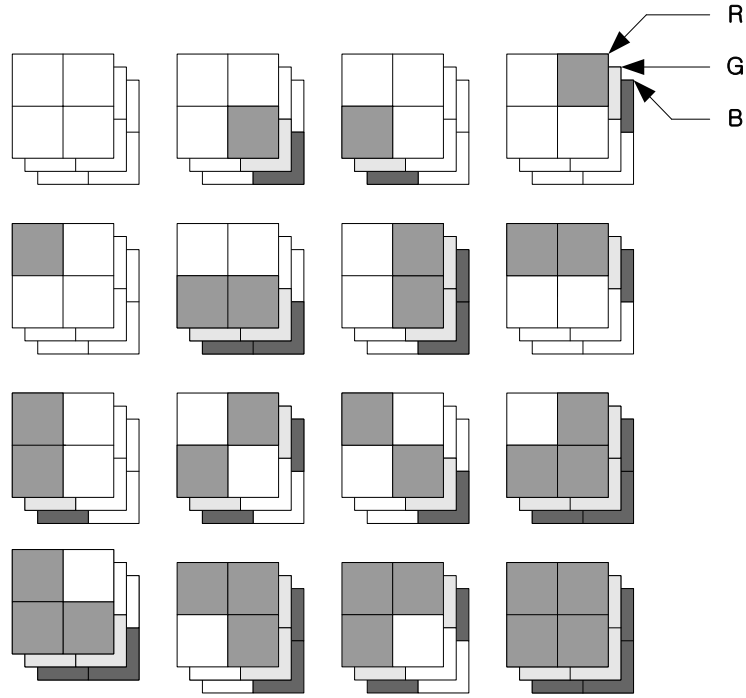


Figure 1. The block pattern which is classified by the RGB changing

After bit Map creating, it calculates pattern correlogram. The pattern correlogram each RGB pattern from the location where becomes the standard and surroundings block of the pattern it is a combination probability where the certain distance inside identical RGB pattern will appear. Namely, the pattern correlogram PC is expressed with the next numerical formula.

$$\begin{aligned}
 PC &= Pr(BP_c(x, y) \cap BP_s(i, j)), c \text{ and } s \in \{1, 2, \dots, 16\}, \\
 &1 < x < a \text{ and } 1 < y < b, \\
 &x - k < i < x + k \text{ and } y - k < j < y + k
 \end{aligned} \tag{7}$$

The  $BP_c$  is pattern from the location where becomes the standard. The  $BP_s$  is pattern of  $BP_c$  circumference. It uses the numerical formula which calculates the distance between the  $BP_c$  and the  $BP_s$ . From here the  $x_1$  and the  $y_1$  show the location of the  $BP_c$ . The  $x_2$  and the  $y_2$  shows the location of the  $BP_s$ .

### 3. Implementation Results

For evaluating the efficiency of image search method which it proposes, we did a computer simulation.

Table 1. The image class which is used in test

Class number	Class name
1	AFRICA PEOPLE AND VILLAGE
2	BEACH
3	BUILDINGS
4	BUSES
5	DINOSAURS
6	ELEPHANTS
7	FLOWERS
8	HORSES
9	MOUNTAINS AND GLACIERS
10	FOOD

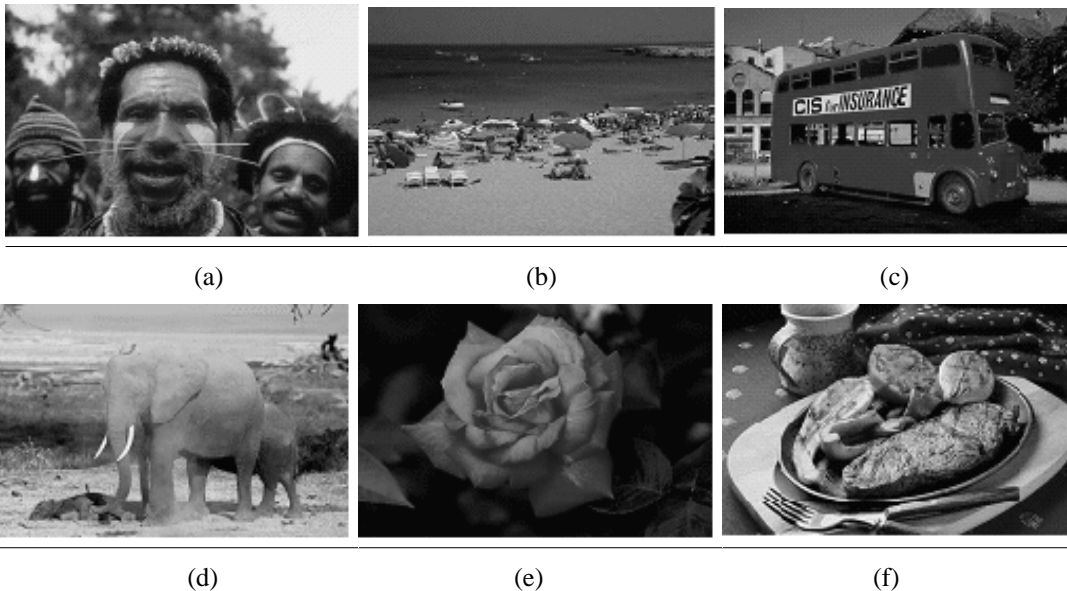


Figure 2. Example of the image which is used in test (a) AFRICA PEOPLE AND VILLAGE, (b) the BEACH, (c) the BUSES, (d) the ELEPHANTS, (e) the FLOWERS and the and (f) the FOOD

Table 2. The search result accuracy which it follows in ranking

Rank	Precision %				
	Histogram	Correlo-gram <sup>[2]</sup>	BCCM <sup>[3]</sup>	BCCM+BPH <sup>[3]</sup>	Proposed method
10	51.72	62.86	62.36	68.36	72.51
20	46.77	56.53	56.36	62.78	66.99
30	43.57	52.02	53.11	58.82	63.14
40	41.10	48.51	50.49	55.90	59.93
50	39.21	45.35	48.23	53.43	57.36
60	37.59	42.58	46.37	51.37	54.99
70	36.18	40.26	44.76	49.52	52.82
80	34.78	38.24	43.35	47.95	50.75
90	33.57	36.47	42.06	46.34	48.93
100	32.32	34.93	40.66	44.79	46.96

It used 1,000 images<sup>[4]</sup> which had become JPEG coding of 256384 size. The image which is used in test is classified with the class of 10. Each class has the image of 100. Table 2 shows the accuracy comparison of the color histogram method, the color correlogram method proposed by Huang<sup>[2]</sup> and the method proposed by Qiu<sup>[3]</sup>. The search accuracy shows came to be higher the others methods the method which it proposes from table 2. And it shows the size of the feature vector dimension which is used in test in table 3. Color value of RGB from histogram method quantize 8 level. Color value of RGB from color correlogram method which is proposed by Huang<sup>[2]</sup> quantize 3 level. Using BCCM and BPH method which is proposed by Qiu<sup>[3]</sup> quantize the color average of the dawn area and the dark area at 3 level.

Table 3. Size of feature vector dimension

Vector dimension				
Histogram	Correlo-gram <sup>[2]</sup>	BCCM <sup>[3]</sup>	BCCM+BPH <sup>[3]</sup>	Proposed method
512	729	729	985	777

## 4. Conclusion

It proposes the contents base image search method which uses the BCCM and pattern correlogram from this dissertation. From the method which it proposes the hazard which extracts a color feature vector it shares the block at certain size. With the area where it dawns in standard it classified color mean value the inside the block with the dark area. And it quantizes a each color mean with it calculated the BCCM which is a concurrence probability of two mean colors. Also it proposed the pattern correlogram method which uses the spatial correlation of the pattern which extracts a pattern feature vector. From the pattern correlogram method which it proposes it makes the block which is divided at certain size with bit Map. After that it calculated the combination probability of the pattern where becomes the standard and certain distance inside identical pattern.

Performance appraisal of the method which it proposes the result which does a hazard computer simulation from the others method feature vector dimension and the accuracy the method which it proposes it shows a better efficiency it confirmed.

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