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RGB Color Correlation Index for Image Retrieval

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Abstract

The contents-based image retrieval (CBIR) is general type of retrieval which has been an active area of research for many years. The areas of image processing and pattern recognition used standard statistical techniques to estimate the degree to which two given patterns are correlated. The main focus of this study is on an image retrieval scheme that is based on the concept of maximum RGB color correlation index between images with promising results. The study sample included 1000 images of an image database. The algorithm is easy to implement. The data were analyzed by means of percentage average precision and recall. In summary, the image with maximum RGB color correlation index is the relevance image.

Keywords: Correlation index; Image Retrieval; Color correlation

1. Introduction

Image retrieval has been a very action research topic. The similarity retrieval is important for applications such as digital library, computer aided design, and multimedia publication. The objective of content – base image retrieval (CBIR) is to retrieve image relevant to a query from a data base in rang order have paid attention [6]. Many researcher used color feature to search for similarity images from database [1]-[8].However, The color histogram is a simple and popular solution for CBIR and the histogram of the image color is the feature vector .The histogram of the image color refinements for content-based image retrieval. Some researchers analyzed the color feature to new method for image retrieval [9]. Fuzzy color histograms and its use in color image retrieval.

In this paper, we propose a solution for retrieve the similarly images with RGB color correlation index. The proposed method retrieves the images on the basis of maximum correlation so that the images with more similarities and, hence, exhibiting maximum correlation with each image is the index for retrieved accordingly.

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2. Propose RGB Color Correlation Index

A Blackground

The correlation r is one of the most common and most useful statistics. A correlation is a single number that describes the degree of relationship between two variables. The detail of correlation r search is found from website http://www.socialresearchmethods.net/kb/statcorr.php.

In this paper, the correlation r is a correlation between query image and retrieved images. When A is a query image and B is a retrieved image. There are reduced to the matrices of the same size. The correlation r is defined as follows:

$$r = \frac{\sum_m \sum_n \left(A_{mn} - \bar{A}\right)\left(B_{mn} - \bar{B}\right)}{\sqrt{\left(\sum_m \sum_n \left(A_{mn} - \bar{A}\right)^2\right)\left(\sum_m \sum_n \left(B_{mn} - \bar{B}\right)^2\right)}} \tag{1}$$

Here $\bar{A}$ is the average of matrix element A and $\bar{B}$ is the average of matrix element B.

An RGB image, sometimes referred to as a true colour image, is stored in *m*-by-*n*-by-3 data array that defines red, green, and blue colour components for each individual pixel. RGB images do not use a palette. The colour of each pixel is determined by the combination of the red, green, and blue intensities stored in each colour plane at the pixel's location. Graphics file formats store RGB images as 24-bit images, where the red, green, and blue components are 8 bits each. This yields a potential of 16 million colours. The distribution of pixel colours in an image generally contains a lot of interesting information [1]-[10].

Many researches present the method for content-base retrieval (CBIR) with correlation between query image and retrieved images [1]-[4].The papers were shown the performance of each method in the term retrieval precision and recall with the same image database.

This paper will use RGB colour components and correlation statistic to index similarity image for image retrieval.

B. Propose Algorithm

In their scheme, each pixel in the classified image was represented by vector in tree primary color spaces red(R), green (G), and blue (B).

Let $A = query\ image\ ;\quad size\ \ (256x256)$ and $B = retrieved\ image$

$$A = \begin{bmatrix} R = f(xi,yi) \\ G = f(xi,yi) \\ B = f(xi,yi) \end{bmatrix} \tag{2}$$

(xi, yi) be the ith pixel of the classified image. $for\ (p = 1\ to\ \ n\ (number\ of\ picture))$

$Bp = resize(retrieved\ image\ p\ order)\ ;\ size\ \ (256x256)$

$$Bp = \begin{bmatrix} R' = f(xi,yi) \\ G' = f(xi,yi) \\ B' = f(xi,yi) \end{bmatrix} \tag{3}$$

$for\ (q = 1\ to\ \ n\ (number\ of\ pixcel\ =\ 256\ x\ 256))$

$$correlation(r)A,Bp = \begin{bmatrix} R = f(xi,yi) \\ G = f(xi,yi) \\ B = f(xi,yi) \end{bmatrix}, \begin{bmatrix} R' = f(xi,yi) \\ G' = f(xi,yi) \\ B' = f(xi,yi) \end{bmatrix} = \begin{bmatrix} r_R' \\ r_G' \\ r_B' \end{bmatrix} \tag{4}$$

End

$$r_R = \sum_{q=1}^{q=n} r_{Rq} \tag{5}$$

$$r_C = \sum_{q=1}^{q=n} r_{Cq} \quad (6)$$

and

$$r_B = \sum_{q=1}^{q=n} r_{Bq} \quad (7)$$

End

$Rindex$ is the vector summation of RGB correlation

$$Rindex = \sqrt{r_R{}^2 + r_C{}^2 + r_B{}^2} \quad (8)$$

The algorithm of RGB correlation index is shown in Figure 1.

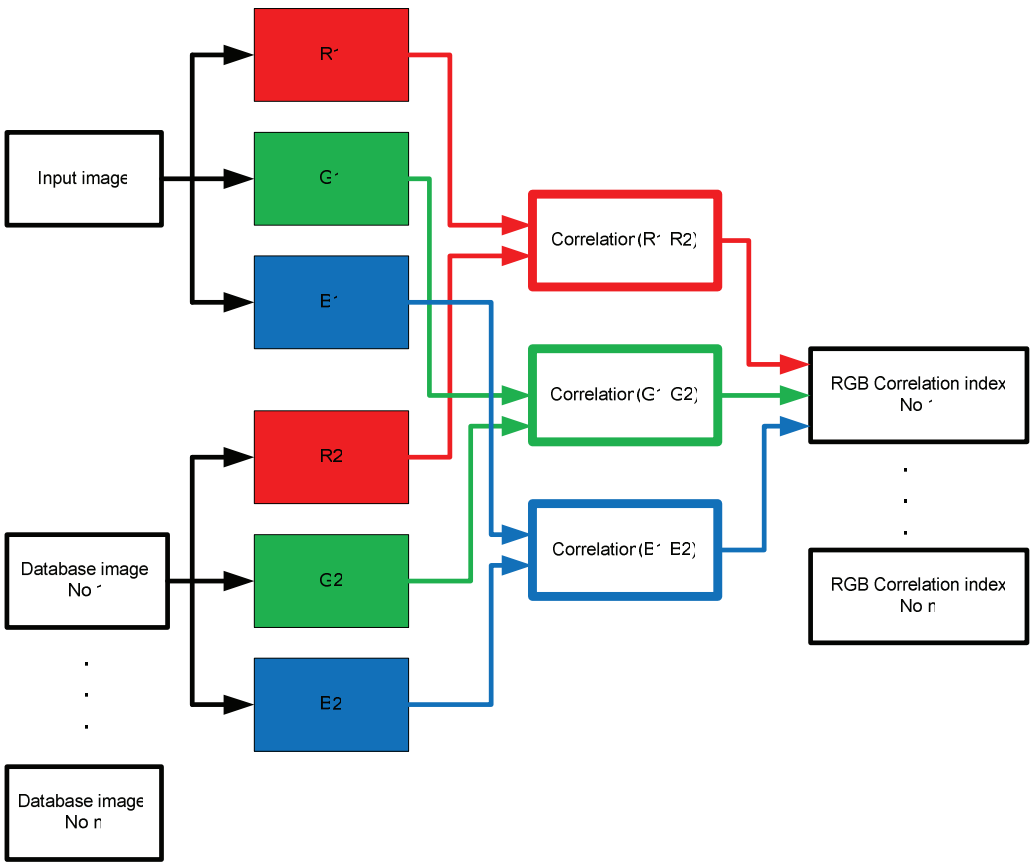

Fig 1. An algorithm of the RGB correlation index

C. Image similarity measure

We use the symbol r to stand for the correlation. Through the magic of mathematics it turns out that r will always be between -1.0 and +1.0. If the correlation is negative, we have a negative relationship; if it's positive, the relationship is positive. In same character, when $i = 1$ *to number of images from the database* $Rindex$ is RBG color correlation index for a query and a retrieved image. Any value in between is an indication of the degree of correlation, and depending on application, can be used to make a proper retrieval decision.

The images are order with RBG color correlation index to show the corresponding images.

D. Image retrieval system

The retrieved image were arranged by $Rindex$ values in order i and. The first order is the maximum $Rindex$ value and Image similarity for query image .The CBIR system performance measurement is based on the Precision

and Recall. The recall rate of an image indicates the percentage of the relevant image retrieved. This parameter is defined as:

$$Recall = \frac{number\ of\ relevant\ retrived\ images}{number\ of\ retrieved\ image\ in\ the\ category} \quad (9)$$

The precision rate of an image presents the average rank of the retrieved relevant image . This parameter is defined as:

$$Precision = \frac{number\ of\ relevant\ retrived\ images}{number\ of\ retrieved\ image} \quad (10)$$

3. Experimental and Results

The performance precision and recall of correlation method, which is used the same image database Lin et al [2], Jhanwar et al. [3] and Huang Dai [4] and M.E. ElAlami [1]. Image for research purposes are employed, and proposed results are compared with the results of Lin et al. [2], Jhanwar et al. [3] and Huang Dai [4] and ElAlami [1]. Image database downloaded from http://wang.ist.psu.edu/docs/related/ . The database consists of 1000 images. These imaged are group in to 10 clusters with each cluster contain 100 images.

This experiment used each image in each class as a query image. The experiment was carried out with the number L of retrieved images set as 20 to compute the precision P of each query image and finally obtain the average precision p/100 (100 image of a class)

The experiment results from RGB correlation index and the other four method are show in Table I and Table II. The average precision were presented in Table I and the average recall were presented in table II . It is obvious that RGB correlation method has achieved a batter average precision of various images than the other four methods. The precision performance of RGB correlation method is 100 %.All correspond image were correct to all query image. The precision results indicate to the recall performance that the recall were maximum value to 0.2 for this experiment L = 20.

Clusters	Semantic name	A sample of the images in the each cluster
1	African people village	
2	Beach	
3	Building	
4	Busses	
5	Dinosaurs	
6	Elephants	
7	Flowers	
8	Horses	
9	Mountains and Glaciers	
10	Food	

Fig 2. A sample of the images in 10 clusters

Table 1. The average precision of these methods

Semantic name	Present method	M.E. ElAami [1]	Chuen et al.[2]	Jhanwar et al. [3]	Hung and Dai's [4]
African people village	1.00	0.703	0.6830	0.4525	0.4240
Beach	1.00	0.561	0.5400	0.3975	0.4455
Building	1.00	0.571	0.5615	0.3735	0.4105
Busses	1.00	0.876	0.8880	0.7410	0.8515
Dinosaurs	1.00	0.978	0.9925	0.9145	0.5865
Elephants	1.00	0.675	0.6580	0.3040	0.4255
Flowers	1.00	0.914	0.8910	0.8515	0.8975
Horses	1.00	0.834	0.8025	0.5680	0.5890
Mountains and Glaciers	1.00	0.536	0.5215	0.2925	0.2680
Food	1.00	0.741	0.7325	0.3695	0.4265
Average	1.00	0.739	0.7270	0.5264	0.5324

Table 2.The average recall of these methods

Semantic name	Present method	M.E. ElAami[1]	Chuen et al. [2]	Jhanwar et al. [3]	Hung and Dai's[4]
African people village	0.20	0.153	0.141	0.115	0.126
Beach	0.20	0.198	0.192	0.121	0.113
Building	0.20	0.182	0.174	0.127	0.132
Busses	0.20	0.116	0.121	0.092	0.099
Dinosaurs	0.20	0.098	0.101	0.072	0.104
Elephants	0.20	0.156	0.149	0.132	0.119
Flowers	0.20	0.118	0.112	0.087	0.093
Horses	0.20	0.139	0.134	0.102	0.103
Mountains and Glaciers	0.20	0.228	0.213	0.135	0.152
Food	0.20	0.138	0.132	0.129	0.122
Average	0.20	0.152	0.146	0.111	0.116

4. Conclusion

In this paper, the RGB correlation index of query image and retrieved image can effectively retrieve images. The RGB correlation index method can be used to make a proper retrieval decision and has a maximum precision and recall rate. The propose image retrieval system has a high detection rate with RGB correlation index. This method is new image retrieval model which maximum precision rate for high detection. However, The images must were resized before compute the correlation of them. There were reduced to the matrices of the same size. Cause in difference sizes of comparison images, search times were increase.

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