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IMAGE CLASSIFICATION BASED ON COLOR DESCRIPTOR AND SVD

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Abstract

Content based retrieval and recognition of objects represented in images is a challenging problem making it an active research topic. A new method is proposed in this my work we used the dominant color descriptor that is widely applied in the image content extraction taken as one of MPEG-7 color descriptor. Dominant color describes the representative color distributions and features in an image or a region of interest through an effective and intuitive format. The descriptor combines the compactness of Dominant Color Descriptor and the retrieval accuracy of Color Structure Descriptor to enhance the retrieval performance in a highly efficient manner. The feature extraction of the descriptor are designed to address the problems of the existing descriptors while utilize the advantages of them and also we calculate the singular vector decomposition (SVD) for better recognition.

Index Terms—CBIR, SVD, Image Processing, Shape Descriptor, Color Structure.

I. INTRODUCTION

The MPEG-7 visual descriptors define and classification of a varied set of image features like landscape images which describe various aspects of visual contents [1]. These low-level descriptors include color, texture, and shape descriptors which describe different features of visual content of the landscape image object. Dominant Color Descriptor (DCD) is a color descriptor that describes the dominant colors of an image. It can specify a small number of dominant color values and their statistical properties including percentage and variance [2]. Based on single or several dominant color values, users can efficiently browse the image database or retrieve the similar images and after we use the Shape method that represent generally looks for shape features based on boundary information or boundary plus interior content and it has been studied that the curvature of a curve has perceptual characteristics that have proven to be useful for shape recognition and shape matching.

II. MPEG-7 COLOR DESCRIPTORS

MPEG-7 has defined a set of standard descriptors for description and storage of the most commonly used features [9]. This makes the extracted features more accessible. Since the required storage size is much smaller than compressed images files. Moreover, the format of the data is fixed, so the data can be used in any MPEG-7 compatible systems. Thus comparison between algorithms can be done easily if the implementations of the target algorithms are MPEG-7 compatible. In MPEG-7 visual standard, some color descriptors are defined, including several histogram based descriptors representing different color features, and a Dominant Color Descriptor (DCD). DCD describes color feature by a set of representative colors with their percentage and each color have at least a certain distance away in CIE*Luv* color space controlled by a threshold *Td*. It is very compact since there is no redundant information for non-existed colors, and similar colors are grouped into a palette color. Although DCD can describe color features in a compact and effective way, drawbacks of its default similarity measure method pull down the performance of DCD. DCD's similarity measure method (DCD-QHDM) is a modified Quadratic Histogram Distance Measure (QHDM). In which the upper bound of the distance is varied by different number of colors in the descriptors. DCD-QHDM does not have a certain upper-bound since the number of colors in QHDM is not fixed. Thus, DCD-QHDM cannot identify "completely different" images.

III. PROPOSED WORK

• Dominant Color Descriptor

The dominant color descriptor is widely used in the image retrieval and image matching taken as one of MPEG-7 color descriptors. DCD is one type of descriptor that describes the representative color distributions and features in an image or a region of interest through an effective, compact and intuitive format. A image retrieval and matching method based on the fixed number's of MPEG-7 dominant color descriptor.

• Region Based Shape Descriptor

Region-based shape descriptors are not only applicable to generic shapes, but also robust to noise and Distortions. I know that three region shape descriptors: Zernike moment descriptors (ZMD), grid descriptors (GD) and geometric moments descriptors (GMD).We use the shape descriptor aims to measure geometric attributes of an object to be used for classifying, matching, and recognizing objects.

- **SINGULAR VALUE DECOMPOSITION**

In linear algebra, the singular value decomposition (SVD) is a factorization of a real or complex matrix, with many useful applications in signal processing and statistics.

Formally, the singular value decomposition of an m×n real or complex matrix M is a factorization of the form

$$M = U\Sigma V^*,$$

where U is an m×m real or complex unitary matrix, Σ is an m×n rectangular diagonal matrix with nonnegative real numbers on the diagonal, and V* (the conjugate transpose of V) is an n×n real or complex unitary matrix. The diagonal entries $\Sigma_{i,i}$ of Σ are known as the singular values of M. The m columns of U and the n columns of V are called the left singular vectors and right singular vectors of M, respectively.

The singular value decomposition and the eigendecomposition are closely related. Namely:

- The left singular vectors of M are eigenvectors of MM*.
- The right singular vectors of M are eigenvectors of M*M.
- The non-zero singular values of M (found on the diagonal entries of Σ) are the square roots of the non-zero eigenvalues of both M*M and MM*.

STEP FOR OUR APPROACH

Step 1 This step getting the RGB value of the i , j co-ordinate of the image object

```
COLORREF cv = img.GetPixel (i, j);
r = GetRValue(cv);
g = GetGValue(cv);
b = GetBValue(cv);
r=r/255; g=g/255; b=b/255;
```

step 2 Find out the HSV value of the corresponding above RGB value

```
Max = max (r,g,b); Min = min (r,g,b);
v=max (r,g,b);
delta = max – min;
if (Max==0)
s = 0 ;
else s=delta/Max;
if (Max==Min) h=-1;
//Hue is undefined
else
{
if ( r==Max && g≠Min )
h = 60*(g-b)/delta;
else if (r==Max && g==Min )
h = 360+60*(g-b)/delta;
else if (g==Max )
h = 60*(2.0+ (b-r)/delta);
else
h=60*(4.0+(r-g)/delta);
}
```

Step 3 Color histogram of HSV space is used to describe the color features.

Step 4 DCD Extraction and Matching the images features with database image features. The dominant color descriptor is defined as
F={{Ci,Pi,Vi),S}
Ci=Is a 3D dominant color vector
Pi=Is the percentage for each dominant color
Vi=Is the color variance
S=Is a single number that represents The overall spatial homogeneity of the dominant color in the image.
N= Is the dominant colors number.

The image retrieval process based on MPEG7 DCD is shown as

(1) C = 9*H + 3*S + V; C∈[0 , 71] , H, S and V is combined to vector C.
(2) Calculate the quantified HSV space histogram, with Pi.
(3) Q_j expresses the percentage descending order to Pi, taking first M colors as the dominant colors, the non-dominant colors are no longer considered.

$$P_i = \begin{cases} P_i & P_i = Q_j \\ 0 & P_i \neq Q_j \end{cases}$$

i=0, 1,….., 71 j=0,1,….m-1

(4) Normalize the first *M* dominant colors corresponding percentage

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$$P_i' = \frac{P_i}{\sum_{j=0}^{M-1} Q_j}$$

J=01…..M-1

(5)

$$F_Q = \{C_Q i, P_Q i\} \text{ and } Fl=\{Cli, Pli\}$$

Image Q and I dominant color descriptor respectively ,

$$S(FQ,Fl) = \sum_{i=0}^{n} \min(PQi,Pli)$$

If the dominant color distributions of two images are more similar, the similarity is closer 1, else 0 .

Step 5 In this step we matching the shape between query image and image content from image content database.we apply some steps.

- Image Content Extraction Analysis
- Apply Edge Detect & Segmentation
- Calculate The Boundary Points
- Compute Distance Of Each Boundary Points & Normalized This Distances
- Calculate Polar Coordinates r & θ For All Boundary points
- Create Log Polar Histogram & Calculate The Shape
- Compute The Histogram We Count The Number Of Boundary Points Within Each Sector
- Compare The Both Histogram And Show The Matching Result
- Svd of the query image and all database image.

IV. CONCLUSIONS

In our work, we propose an approach of image classification based of the DCD and SVD process for extracting useful data from the images. My approach depends strongly on the quality and accuracy of the image classification.

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