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Content Based Image Retrieval

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Abstract: This document describes Content based Image Retrieval(CBIR) is a technique for retrieving images on the basis of automatically-derived features like edge for database images. It shows how Edge Histogram Descriptor of MPEG-7 can be efficiently utilized for matching of images. In this paper, we propose to use the global and semi-local edge histograms generated directly from the local histogram bins to increase the matching performance. Then, the global and local histograms of two images are compared to evaluate the similarity measure. Thus we exploit the absolute locations of edges in the image as well as its global composition. The proposed matching method is considered to be a more image content-based retrieval.

Keywords: Image retrieval, edge feature, edge histogram, similarity matching.

I. INTRODUCTION

Histogram is the most commonly used to represent the global feature composition of an image. It is invariant to translation and rotation of the images. The normalization of histogram leads to scale invariance property. As the histogram is considered to be very useful for indexing and retrieving images.

Human eyes are sensitive to edge feature for image perception. Thus, edges are considered important feature as content for CBIR system. The MPEG-7 is designed for local edge descriptor.

The users generally prepare query image and present to the system. The proposed system automatically extract the visual attributes of the query image in the same mode as it does for each database image and then identifies images in the database whose feature vectors match those of the query image, and sorts the best similar images according to their similarity value.

II. LITERATURE SURVEY

The techniques, tools and algorithms that are used, originate from the fields, such as statistics, pattern recognition, machine learning, signal processing and computer vision. CBIR is the most important and effective image retrieval method and widely studied in both academia and industry. Many of the so far proposed retrieval techniques adopt methods, in which more than one feature types are involved. For example, color and texture features are used in the QBIC [1], SIMPLIcity [2] and MIRROR [3] image retrieval systems.

The descriptors that were proposed by MPEG-7, for indexing and retrieval, maintain a balance between the size of the feature and the quality of the results. In order to extract the color information, a set of fuzzy rules undertake the extraction Of a Fuzzy-Linking histogram that was proposed in [4]. This histogram stems from the HSV color space. Twenty rules are applied to a three-input fuzzy system in order to generate eventually a 10-bin quantized histogram. Each bin corresponds to a preset color. The number of blocks assigned to each bin is stored in a feature vector. Then, 4 extra rules are applied to a two input fuzzy system, in order to change the 10-bins histogram into 24-bins histogram, importing thus information related to the hue of each color that is presented. Next, the 5 digital filters that were proposed in the MPEG-7 Edge Histogram Descriptor [5] are also used for exporting the information which is related to the edges of the image.

III.LOCAL EDGE HISTOGRAM DESCRIPTOR

We divides image space into 4x4 sub-images for localizing edges distribution of certain image area. For each sub-images, we generate an edge histogram to represent edge distribution in the sub-image as shown in fig.1. The sub-image is divided into small square blocks called image-blocks for defining different edge types.

(0,0)	(0,1)	(0,2)	(0,3)
(1,0)	(1,1)	(1,2)	(1,3)
(2,0)	(2,1)	(2,2)	(2,3)
(3,0)	(3,1)	(3,2)	(3,3)

Fig1. Definition of sub-image

A. Edge Types

There are five edge types are defined in the edge histogram descriptor as shown in fig 2. They are four directional edges and a non-directional edge. Four directional edges are vertical, horizontal, 45 degree, and 135 degree diagonal edges. These directional edges are extracted from the image-blocks. If the image-block contains an arbitrary edge without any directionality, then it is classified as a non-directional edge.

B. Formation of local edge bins

We can define five histogram bins for five edge types. Since, there are 4x4=16 sub-images. So we have total 80(=16x5) bins histogram for each sub-image. After the edge extraction from image-blocks, we count the total number of edges for each edge type in each sub-image

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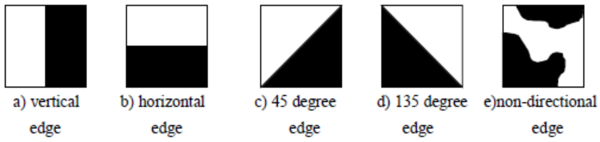

Fig2. Edge types

C. Normalization of Bins

We need to normalize each bin of histogram by dividing its total number of image blocks of edge in considered sub-image. This can be done by after generating local edge histogram for 4x4=16 sub-images.
The formula for normalization is shown in section IV.
Bins values are non-linearly quantized. The normalized value ranges from 0 to 1.

IV. EDGE FEATURE EXTRACTION METHOD

We divide the sub-image into a fixed number of image-blocks for extracting edges. That is, the size of the image-block is proportional to the size of original image to deal with the of image block images with different resolutions .The splitting of image block is shown in fig 3. The size of image-block is considered as a multiple of 2. If it is not a multiple of 2, we can simply ignore some outmost pixels so that the image-block becomes a multiple of 2.

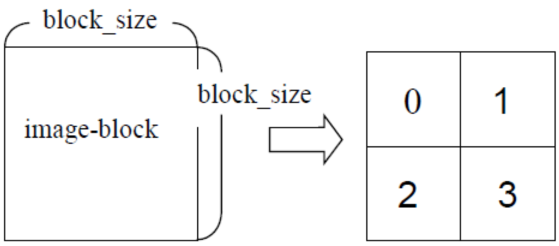

Fig 3. Images block and sub-block labeling.

The 5 digital filters that were proposed by the MPEG-7 Edge Histogram Descriptor [5], are shown in figure 4. These filters are used for extracting edge information. They are able to characterize the edges being present in their region as one of the following types: vertical, horizontal, 45-degree diagonal,135-degree diagonal and non-directional edges. Similarly, we can represent the filter coefficients for other edge filters as shown in fig 4 – a), b), c), d) and e).

1	-1
1	-1

1	1
-1	-1

$\sqrt{2}$	0
0	$-\sqrt{2}$

0	$\sqrt{2}$
$-\sqrt{2}$	0

2	-2
-2	2

a) Vertical b) Horizontal c) 45 diagonal d)135 diagonal e)non-directional

Fig 4. Filter coefficients of edge detection

Each image block is divided by 4 sub blocks. The average gray level of each sub-block at (i,j)th image-block is defined as $A_k(i,j)$ for corresponding filter coefficient.

Where k=0,…,3 represents the location of the sub block. The respective edge magnitudes are for the (i,j)th image block can be obtained as follows:

$$ver\_edge\_stg(i,j) = \sum_{k=0}^{3} \left| A_k(i,j) \times ver\_edge\_filter(k) \right|$$

$$hor\_edge\_stg(i,j) = \sum_{k=0}^{3} \left| A_k(i,j) \times hor\_edge\_filter(k) \right|$$

$$dia45\_edge\_stg(i,j) = \sum_{k=0}^{3} \left| A_k(i,j) \times dia45\_edge\_filter(k) \right|$$

$$dia135\_edge\_stg(i,j) = \sum_{k=0}^{3} \left| A_k(i,j) \times dia135\_edge\_filter(k) \right|$$

$$nond\_edge\_stg(i,j) = \sum_{k=0}^{3} \left| A_k(i,j) \times nond\_edge\_filter(k) \right|$$

Then max value is calculated,

max=MAX(ver_edge_stg(i,j),hor_edge_stg(i,j) dia45_edge_stg(i,j),dia135_edge_stg(i,j), nond_edge_stg(i,j))

And normalization of magnitudes are calculated,

m_v'=ver_edge_stg(i,j)/max

Similarly calculated normalize value for each edge type.

Each area corresponds to a region as follows: Non Edge, Horizontal Edge, Vertical Edge, 45-Degree Diagonal and 135-Degree Diagonal. The way that the system classifies the Image Block in an area is the following: Initially, the system checks if the max value as shown in is greater than a given threshold fig 5.

Threshold values were selected to be: Tedge=14, T0=0.68, T1=T2=0.98. If m' value is greater than the threshold in the line in which it participates, the Image Block is classified in then particular type of edge. Thus the Image Block can participate in more than one type of edge.

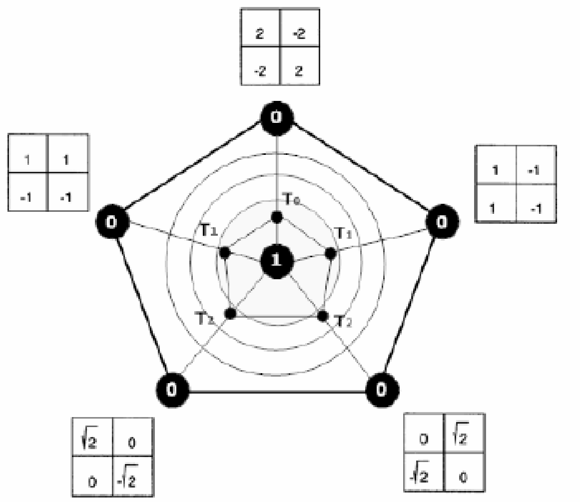

Fig5. Edge threshold type diagram

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V. NON NORMATIVE GLOBAL EDGE HISTOGRAM

To achieve a high retrieval performance, the local histogram alone may not be enough. Rather, we may need an edge distribution information for the whole image space is called global histogram as shown in fig 6. That means there are five cluster formation takes place. The global edge histogram also has five bins Bin value is calculated from local histogram. There are total 80 (Local histogram)+5(Global bin)=85 bins .

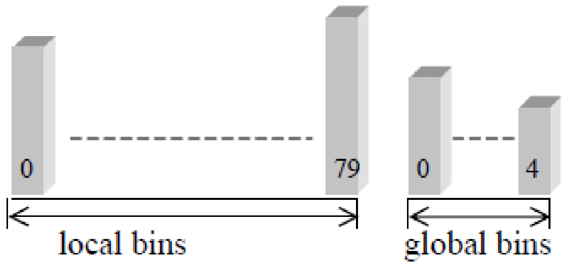

Fig 6: Histogram semantics

VI. ACKNOWLEDGMENT

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VII. CONCLUSIONS

In this paper, we show how to construct global edge histogram bins from the local histogram bins. From various possible clusters of sub-images, we retrieved images from matching performances of global and local edge histogram. This extra histogram information can be obtained directly from the local histogram bins. Experimental results in fig 7 show global histograms and the local histogram bins help to improve the retrieval performance.

a) Retrieval using local histogram

b) Retrieval using global histogram

Fig7. Retrieved Results

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