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International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 10 October, 2014 Page No.8798-8805

A Novel Image Retrieval Approach for Digital Images Based On Pseudo-Zernike Moment Invariants

P.Ramjee[1], S Srividya[2]

[1](PG Scholar) Department of ECE, Chaitanya Institute Of Science and Technology, JNTU (K)
(mahitaj@gmail.com)
[2]Associate Professor, Department of ECE, Chaitanya Institute Of Science and Technology, JNTU (K)
(srividyacist@gmail.com)

Abstract

In this paper we propose a new and effective image retrieval scheme using color, texture and shape features based on pseudo-Zernike moment. Image is predefined by using fast color quantization algorithm with cluster merging. A small number of dominant colors and their percentage can be obtained. The spatial features are extracted using steerable filter decomposition. This offers an efficient and flexible approximation of early processing in the human visual system (HVS). Sharp descriptor of an image uses pseudo-Zernike moment. It provides better feature representation and more robust to noise then other representations. Finally, the combination of the color, shape and texture feature provides a robust feature set for image retrieval. Experimental result shows that the proposed method provides a better color image retrieval. It provides accurate and effective in retrieving the user-interested images.

KEY WORDS: Image retrieval, pseudo-Zernike moment, color quantization, Human visual system.

I.INTRODUCTION

Nowadays, due to the increase of digital image available on internet, efficient indexing and searching becomes essential for large image archives. Traditional annotation heavily relies on manual labor to label images with keywords, which describe the diversity and ambiguity of image contents. Hence, content-based image retrieval (CBIR) [1] has drawn substantial. CBIR usually indexes images by low-level visual features such as texture, color and shape. The visual feature cannot completely characterized semantic content, but they are easy to integrate into mathematical formulations [2]. Extraction of good visual feature which compactly represent a query image is one of the important task in CBIR.

Color is most widely used in the low-level features and is in variant to image size and orientation [1]. Color histogram, color correlogram and dominant color descriptor (DCD) are the features used in CBIR. Color histogram is used for color representation, but it does not include any spatial information Li et al [3] proposed a novel algorithm based on running sub blocks with different similarity weights for object –based on running sub blocks the color region information and similarity matrix analysis are used to retrieve image under the query of special object. Color correlogram provides the detail about the probability of finding color pairs at a fixed pixel distance and provides spatial information. Color correlogram provides better retrieval accuracy compared with color histogram. Color autocorrelation is a subset of color correlation. It captures the spatial correlation between identical colors only and it provides significant computational benefits over color correlogram, it is more suitable for image retrieval. DCD is MPEG-7 color descriptors [4]. DCD provides the detail about the salient color distribution in an image and provides a compact, effective and intuitive representation of color presented in an image. DCD matching does not fit human perception very well, and it will cause incorrect ranks for images with similar color distribution. [5, 6]. yang et al. presented a color quantization in [7] and computation. Lu et al. [8] used color distributions, standard deviation and the mean value to represent the global characteristics of the image, to represent the global characteristics of the image for improving the accuracy of the system.

Texture is an important feature in the visual feature. It is an essential surface property of an object and their relationship to the surrounding environment. Many objects in an image can be distinguished solely by their textures without any other information. Texture may consist of some basic primitive. It provides the detail about the structural arrangement of a region and the relationship of the surrounding regions [9]. Conventional texture feature used for CBIR, there are statistic texture feature using gray-level co-occurrence matrix (GLCM) Markov random field (MRF) model, simultaneous auto-regressive (SAR) model, Edge histogram descriptor (EHD), World decomposition model, and wavelet moments [2].

BDIP (Block difference of inverse probabilities) and BVLC (block variation of local correlation coefficients) have been presented effectively measure local brightness variation and local texture smoothness [10]. These feature exhibits the better retrieval accuracy over the compared conventional features. In [11], texture is modeled by the fusion of marginal densities of subbands image DCT coefficients. In this approach one can extract samples from the texture distribution by utilizing small neighbor of scale-to-scale coefficients. To improve the image retrieval accuracy Kokare et al. [12] designed a new set of 2D rotate wavelet by using Daubechies' eight tap coefficient. Han et al. [13] presented a rotation-invariant and scale-invariant Gabor representation, where each representation only requires few summations on the conventional Gabor filter impulse response, and the texture feature are then from the new representations for conducting scale-invariant texture and rotation-invariant image retrieval. Human can recognize the object from its shape thus shape feature provides the detail about the image retrieval. The shape carries semantic information and shape features are different from other elementary visual features such as texture or color feature. Shape representation methods are Fourier descriptors, B-splines, deformable templates, polygonal approximation and curvature scale space (CSS) [2]. Techniques were developed for whole shape matching, i.e. , closed planner curve matching. CSs shape representation method is selected for moving picture expert group (MPEG)-7 standardization [14]. Fourier descriptor is more efficient than the CSS in a review of shape representation and description techniques [15]. Xu et al. [16] proposed a innovative partial shape matching (PSM) technique using dynamic programming (DP) to obtain the spine X-ray images. In [17] Wei proposed a novel content-based trademark retrieval system with a feasible set of future descriptors. It is capable of depicting global shapes and interior/local feature of the trademarks.

CBIR uses only a single feature among various color, texture, and shape feature. Therefore it difficult to obtain the satisfactory retrieval results by using a single feature. In [18], two-dimensional or one-dimensional histogram of the CIELab chromaticity coordinates is chosen as color feature, and variances extracted by discrete wavelet frames analysis are chosen as texture features. In [19] Haar or Daubechies wavelet moment is used as texture feature and the color histogram is used as a color feature. In these methods, their feature vector dimension is not taken into account as a important factor in combining multiple feature. It exhibits that such a combination of the feature without increasing the feature vector dimension and it does not always guarantee better retrieval accuracy [20].

Chun et al [9] presented a CBIR method uses the combination of the color autocorrelation of hue and saturation component images and BDIP and BVLC moments of value components image in the wavelet transform domain. In [21. 22] proposed a paper on the novel retrieval framework for combining the color, texture and shape information. Shape information is captured terms of edges images are capture using gradient vector flow fields. For advance CBIR, it is necessary to select efficient feature that are complementary to each other. so as to improve retrieval performance and to combine selected effectively without increase of feature vector dimension. In this paper a brief introduction about the effective color image retrieval scheme which uses the combination of dynamic dominant color. Steerable filter texture feature, and pseudo-Zernike moments shape descriptor.

II. Color Feature Representation

The HSV stands for the Hue, Saturation and Value, is sometimes referred to as HSI for hue, saturation and intensity or HSB for hue, saturation, and brightness provides the perception representation according with human visual feature. The HSV model, defines a colour space in terms of three constituent components: Hue, the colour type range from 0 to 360 relative to the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then back to red at 360°. Saturation, the "vibrancy" of the colour: Ranges from 0 to 100%, and occasionally is called the "purity". Value, the brightness of the colour: Ranges from 0 to 100%.

HSV is cylindrical geometries, with hue, their angular dimension, starting at the, In our system, we employ the HSV colour space instead of the RGB colour space in two reasons. One is the lightness component is independent factor of images and second is the components of hue and saturation are so closely link with the pattern of human visual perception To decrease the number of colors used in image retrieval, we quantize the number of colors into several bins. J.R. Smith [9] designs the scheme to quantize the colour spac into 166 colors. Li [12] design the non-uniform scheme to quantize into 72 colours. We propose the scheme to produce 15 non-uniform colours. The formula that transfers from RGB to HSV is defined as below:

$$H = cos^{-1}\frac{\frac{1}{2}[(R-G)+(R-G)]}{\sqrt{(R-G)^2+(R-B)(G-B)}} \quad (1)$$

$$S = 1 - \frac{3}{R+G+B}(\min(R,G,B)) \quad (2)$$

$$V = \frac{1}{3}(R+G+B) \quad (3)$$

The R, G, B represent red, inexperienced and blue elements severally with worth between 0-255, wherever H stands FO Hue, S stands for saturation, V stands for worth. so as t get the worth of H from 00 to 3600, the worth of S and from zero to one, we have a tendency to do execute the remodeling calculation The planned theme for HSV area contains 3 phases initial of all we have a tendency to size all pictures to scale back the dimensions of image and interval. second we have a tendency to convert every element o resized image to quantal color code. Finally we have a tendency to compare the quantal color code between the question image and info image. In standard schemes[3][4][5], the extract the image feature vector from pictures use descriptors like color histogram Intersection and Minkowski Metric (LM norm) to live the similarity of image for matching between a question image and image from info. once matching process is completed, results square measure sorted in ascending order and retrieval pictures square measure conferred. Minkowski Metric equation has been extended in equation (4), wherever histogram Intersection is outlined in equation five.

III. **Edge Histogram Descriptor**

The Edge histogram Descriptor in Mpeg-7 [13] represent local edge distribution within the image that obtained by partitioning the complete image into 16(4 x 4) sub-images as shown in figure one. Edges altogether sub-images square measure classified into 5 varieties, four directional edges named vertical, horizontal,45 degree and one hundred thirty five degree and one non-directional edge. To generate the histogram of every sub-image, a complete of eighty histogram bins (16 x five, 16-sub-images and 5 forms of edges) as shown in Table 1. the sting histogram Descriptor captures the abstraction distribution of edges. every of the sixteen sub-images is split into image blocks to get the sting histograms. every sub-image block treated as a 2·□2 element image-block. we have a tendency to use the filters for edge detection shown as figure two to calculate corresponding edge intensity values of every sub-image. If intensity values of the sting exceed a given threshold, then the corresponding image block is taken into account to be a foothold block.[15]

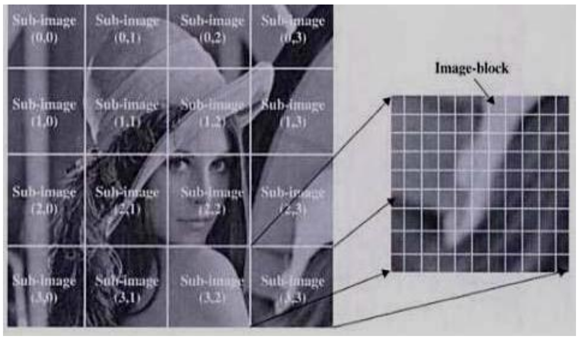


Fig. 1. Definition of sub-image and image-block

$$\begin{bmatrix} 1 & -1 \\ 1 & -1 \end{bmatrix} \quad \begin{bmatrix} 1 & 1 \\ -1 & -1 \end{bmatrix} \quad \begin{bmatrix} \sqrt{2} & 0 \\ 0 & -\sqrt{2} \end{bmatrix} \quad \begin{bmatrix} 0 & \sqrt{2} \\ -\sqrt{2} & 0 \end{bmatrix} \quad \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$$

Fig 2. Filter for edge detection

IV.**METHODOLOGY**

In standard schemes[3][4][5], they extract the image feature vector from pictures use descriptors like color histogram Intersection and Minkowski Metric (LM norm) to live the similarity of image for matching between a question image and image from info. [6][7][8] once matching process is completed, results square measure sorted in ascending order and retrieval pictures square measure conferred. Minkowski Metric equation has been extended in equation (4), wherever histogram Intersection is outlined in equation (5).

$$d(i,j) = \left(\sum_{k=1}^{p} |x_i^k - x_j^k|^M \right)^{\frac{1}{M}} \quad 1 < i < n \qquad (4)$$

Where P is the dimension of the vector x_i

$$d_{hi}(Q,T) = 1 - \frac{\sum_{i=0}^{N-1} \min(Q_i, T_i)}{\min(|Q|, |T|)} \qquad (5)$$

wherever letter of the alphabet indicates question, T indicates Target . we have a tendency to planned associate economical theme to retrieve pictures. initial of all to size all pictures to 20x20 pixels normalized size. All frames of image square measure resized by the bicubic interpolation

technique as delineate in Gonzalez et al. [11]. we discover that every color's scope is inhomogeneous from hue panel of HSV colour area. The 3 primary colors of R, G and B possess additional scope than the opposite colors. we have a tendency to section the scope of into six non-uniform category as well as 3 primary color and scope of the hue that the parts of HSV color scope of the hue that the parts of HSV color

space or area possess additional scope than the opposite colors. we have a tendency to section the the scope interposed between 2 primary colors, every category betting on price|the worth} of saturation of the parts of HSV color area divides 2 taxonomic category along side {the color|the color} of "white" and "black" in step with the worth on saturation and value of the parts of HSV colour area, the overall is fourteen category. every picture element of the pictures from question and info assigned the amount color code. Compare amount color code between every picture element of 3 parts of HSV color area of the pictures (20x20 pixels) from question and info, we have a tendency to get the burden of the amount color code has compared. we must always alter the burden worth between 2 retrieval options as a result of 2 characteristic options which incorporates RGB color area and texture options.

The quantitative relation of half-dozen to four between the similarity measuring of RGB color area and Edge histogram Descriptor obtained higher performance through experiments. Finally kind the burden worth of similarity feature vector and also the retrieval pictures square measure conferred if looking is completed. The performance of associate info retrieval system is measured in terms of its recall and exactitude. exactitude is that the fraction of retrieved documents that square measure relevant to the search, Recall in info retrieval is that the fraction of the documents that square measure relevant to the question that square measure retrieved properly

V.THE PSEUDO-ZERNIKE MOMENTS BASED SHAPE DESCRIPTOR

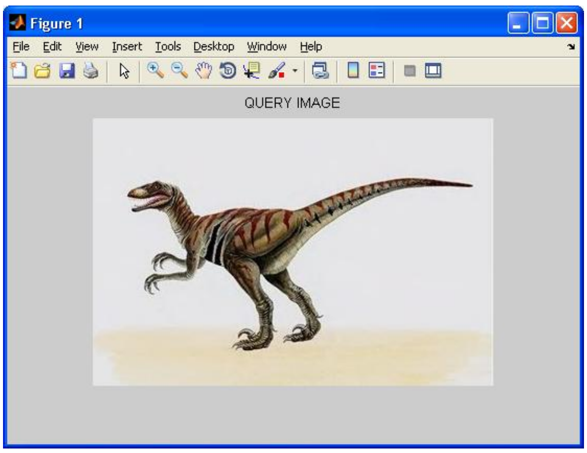
Shapes play an important role in human recognition and perception. Object shape feature provides a powerful clue to object identity. Human can recognize object by its shapes. Image shape descriptor, as used in existing CBIR systems, can be broadly categorized into two groups, namely, contour and region based descriptor [2]. Most commonly used approaches for region-based shape descriptors moment and function of moments have been utilized as pattern feature in a various application [1, 2]. Theory of moments, including Hu moments, wavelet moments Zernike moments, Krawtchouk moments and legendre moments, provides useful series expansions for the representation of object shapes. Pseudo-Zernike moments have set of orthogonal and complex number moments [24] which have very important properties. The pseudo-Zernike moments are invariant under image rotation. Second, pseudo-Zernike moments are less sensitive to image noise. In this paper, the pseudo-Zernike moments of an image are used for shape descriptor, which have better features representation capability and more robust to noise than other moment representation.

V. EXPERIMENTAL RESULTS

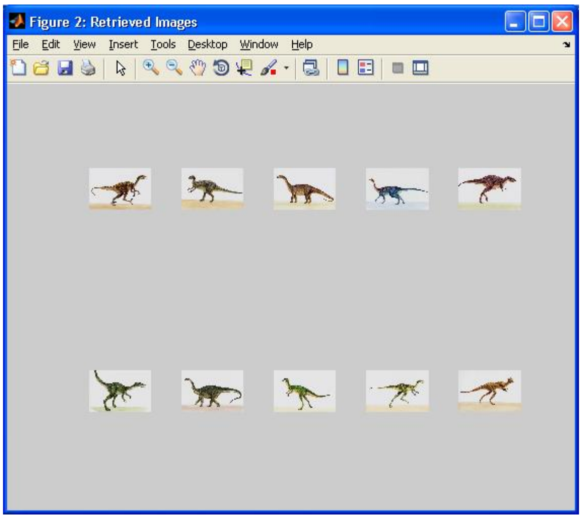
The experimental database contains 1200 images including animals, sceneries, plants and flowers taken from internet and 1000 test images from SIMPLIcity paper[14] of Wang's image database. The outcome of the experiment can be achieved by the scheme we proposed. Experimental examples are shown from Figure 3 through Figure 7. Comparing the results of the project [7] and our previous X-RGB colour space scheme our scheme performs better than project [7] and our previous scheme

SIMULATION RESULTS

Input image



Retrieved images



VII. CONCLUSION

In conventional approaches we used to follow the META data approach for image retrieval process. But due to inappropriate retrieval process we opts for advanced CBIR approach for data retrieval approach. In this paper we propose a new and effective image retrieval scheme using color, texture and shape features based on pseudo-Zernik moment. Image is predefined by using fast color quantization algorithm with cluster merging. A small number of dominant colors and their percentage can be obtained. The spatial features are extracted using steerable filter decomposition. This offers an efficient and flexible approximation of early processing in the human visual system (HVS). Sharp descriptor of an image uses pseudo-Zernik moment. It provides better feature representation and more robust to noise then other representations.

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