A Comparitive Study on CBIR Technique Using Color and Shape Feature

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Abstract- *Digital era has produced large volume of images which created many challenges in computer science field to collect, retrieve and manage images efficiently and effectively. The main challenge is retrieval of image by finding it from large digital library of image database. Several different researcher studies is going to efficiently retrieve image result. CBIR is a method in which search a user required image from large database on visual feature of image. In this paper, we present a survey on CBIR techniques using different feature extraction techniques.*

Keywords- CBIR; Color; Texture, Shape feature.

I. INTRODUCTION

As the internet and technology is growing, enormous number of images are being capture from kinds of devices such as (digital camera, digital video, scanner, the internet etc.) which generates technical computer systems issues to collect/transmit and manage/index image data efficiently to create such collections easily accessible [1]. This influences the more research into image retrieval systems (irs). In this system a group of images provided from collection of images in database that matches the users' requirements in similarity estimations such as edge, color and content similarity. Early retrieval system searches the required images on the basis of keywords matching that are given manually to each image [2].

II. CONTENT BASED IMAGE RETRIEVAL

CBIR is the method of retrieving images from digital library of images or database according to image visual content. In another way, is the process of retrieving similar feature images such as content of colors, textures and shapes. In human communication, images plays an important role from its roots. The communication process with images is interesting, descriptive, comprehensive and transparent. In CBIR system, combining the image features into three regions as color, texture and shape [3]. Ideally, combining these feature to get better result in the comparison process. In CBIR system, color is one of the visual feature primarily used due to the ease of extracting color information from images [4, 5]. After the primary filtering performed by color features, extract the information from shape and texture [6] feature are costly and difficult tasks.

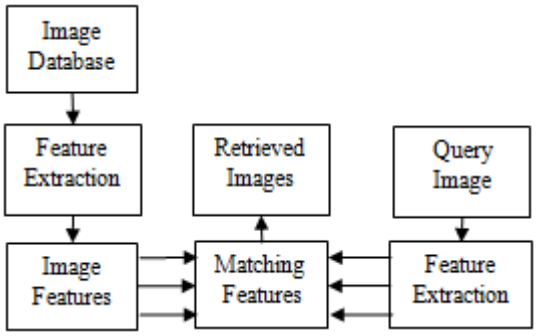

Figure1. Basic Diagram of CBIR System

In image retrieval systems (irs), a query image is given or a keyword query that is associated with a group of representative images, the goal is to retrieve from a reference library, matching related to similar images whose semantic value is much close to query, irrespective of its visual appearance. Despite the fact that, extraction calculations for low-level images highlights characterize capture difference between colors, global color layouts, statistic and deterministic textures, dominant color distributions, etc., are open problem in concept of link between such low-level primitives and high-level semantic concepts remains [7, 8], such type of problem is referred to as "the semantic gap."

III. TECHNIQUES BASED ON FEATURE EXTRACTION

A. Color Feature

In CBIR systems, the mostly used feature is color feature, due to its simplicity and fast computation [9]. Color is one of the visual attributes feature in CBIR provide more information related to visual content of an image [10]. This is a compact demonstration of the color feature to characterize a color image [11]. Color is the important feature of an image, which depicts much of the information from the image. RGB shading model is very little identify with human method for perceiving the colors. In this way, RGB space don't filter the luminance segment from the chrominance ones. Therefore, HSV color space is mostly used in image retrieval systems

(irs), because in HSV model each component correspond directly to visual perception [12], [13].

- **Color histogram**

Color histograms (CH) [14] is method of expressing color information of images in CBIR systems. In CH, color are defined in form of bars in a bar graph. In this technique each bar denotes a different color of the color space being used. Statistically, a color histogram (CH) is a measure to calculate the joint probability of the three color channels. The general method of obtaining histogram is by partitioning the range of data into equally sized bins. For an image, the no. of color pixels fall into each bin are totaled and normalized to total points. This gives us the likelihood of a pixel falling into that bin. The problem with color histogram (CH) is no use of the spatial information of pixel. This can be consider the different images as similar as two images have similar color distributions.

- **Color Moments**

To avoid the quantization drawbacks, normally we use the color moments approach [15]. Color moments is one of the statistical moments of the probability distributions of colors. It have been efficiently used in lots of image retrieval systems (irs). The mean, variance and the skewness have been very effective in describing the color distributions of images but Color moments are not feasible to encode any of the spatial information surrounding the color content within the image. That's why this also suffer from similar problems as we consider in color histogram approach.

B. Texture Feature

Texture is most important property in human vision that explains visual pattern for each image contains the property of homogeneity. A texture is defined as intensity properties (tones) and spatial relationships (structural). This feature defines different physical composition of a surface. The different texture correspond to properties by human eyes are ex: directionality, smoothness, regularity and coarseness. Image textures have useful applications in image processing. This include: identifying or recognize image regions using texture properties known as texture classification [16], recognize of texture boundaries using texture properties known as texture segmentation, texture synthesis, and generation of texture images from known texture models. For all types of textures there is no single method which gives best result [17]. The general methods used for texture feature description are statistical, model-based and transform-based methods.

- In statistical method evaluate the grey values of spatial distribution by computing local features of image at every point and create various set of statistics from the dissemination of local features. It includes method such as autocorrelation function, co-occurrence matrix, statistical moments, and grey level run lengths.

- Model-based texture methods capture the process that generated the texture. In this method, consider a part of image and different estimation algorithm is used to set the parameters of the model. In this three important model methods: Markov random fields, fractals, and the multi-resolution autoregressive features.

- In transform domain features such as discrete wavelet transforms (DWT), Fourier transform and Gabor wavelets, analyses the image frequency content to find texture features. In wavelet transform divides a signal into two parts as shifted and scaled versions of the original wavelet and which refers to decomposition of a signal into a family of basic functions derived through translation and dilation of a special function. Moments of wavelet coefficients in several frequency bands are effective for representing texture [17].

C. Shape Feature

Shape is also the important content in CBIR and it usually collected verbally as well as in figures, and people use terms such as oval, rounded or unshaped etc. In Computer-based processing of shape, it is essential to describe even very complicated shapes precisely. Many shape description methods exists, but no general accepted methodology of shape description. It is one of the most important visual and primitive feature for image content description and contains all the geometrical information of an object in the image. Image information does not change generally even when orientation or location of the object are changed [18].

- **Zernike moments (ZM)**

The complex Zernike moments (ZM) are derived from orthogonal Zernike polynomials so that Zernike Moment is known as orthogonal moments. Zernike polynomials are the complete set of complex valued functions. Zernike moments (ZM) are invariant to the rotation and they are robust to noise. They have minimum information redundancy because they based on orthogonal. The issues with Zernike moments (ZM) are the nonstop integrals approximated by discrete summations [17].

- **Eccentricity**

It is defined as the measure of aspect ratio. The ratio between major axis to minor axis length. Eccentricity method is calculate using principal axes and minimum bounding rectangle method. In Principal axes method a shape is defined as two segments of lines that cross each other orthogonally in the centers of the shape and represent the directions with zero cross-correlation. Minimum bounding rectangle, in which shape every point comprises with smallest rectangle so that it known as minimum bounding box [17].

IV. SIMILARITY DISTANCE MEASURE

The similarity distance (SD) computation is important in image retrieval system. The efficiency of retrieving image rely on the specific distance metric select by the user. Image matching among two images (the query image and target image in database) can be performed by evaluating the similarity distance (SD) between their feature descriptor. If system completes similarity distance (SD) calculation & returns a group of image based on the increasing order of the similarity distance score. Lower score on similarity distance signifies more degree match between two images and vice versa. The similarity distance (SD) between the two images i.e. the query and target image, described under various distance metric are as follows [19].

- **Sum of absolute difference (SAD):** SAD is simple method to search for similar image in the database to given query image automatically. Main limitation are Sensitive towards the consequence of background issues of image such us variation in color, size, illumination.

$$D = \sum_{i=1}^{n} |Qi| - |Di|$$

- **Euclidian distance (L2):** It is mostly used method for similarity measurement due to its effectiveness and efficiency. But the calculation of square root is expensive one.

$$D = \sqrt{\sum_{i=1}^{n} (|Q_i - D_i|)^2}$$

- **City block distance(L1) or Manhattan distance:** Distance function computationally less expensive because only the absolute difference in each feature consider give large value for the two similar image which create dissimilarity between similar image.

$$D = \sum_{i=1}^{n} |Q_i - D_i|$$

V. APPLICATIONS

- **Security Check:** It is used in security for access privileges with use of Finger print or retina scanning
- **Medical Diagnosis:** CBIR is used in medical area to diagnosis problem by identifying similar past medical images from its database.
- **Crime prevention:** CBIR method is used to prevent crime by recognition of automatic face by police.
- **Intellectual Property:** In this use of CBIR is to avoid fake property registration, where a similarity of ownership identity is matched with new candidate mark to previous mark

VI. LITERATURE REVIEW

In 2014, Yasmin et al. [20] proposed an efficient technique based on decomposing and edge detection for image search and retrieval. They have classified pixels based on the edge and inner pixels for the feature selection. They have achieved 66 %-100 % precision and recall results.

In 2014, Jenni et al. [21] proposed a CBIR method for efficient image representation and database classification. It is based on support vector machine (SVM) classifier. Color string coding is used for feature extraction. This string comparison is beneficial in reducing the computational complexity.

In 2014, Choudhary et al. [22] proposed a hybrid CBIR method for extraction of color and texture feature. The extraction of color feature is done by color moment and texture feature is done by local binary pattern (LBP) on the grayscale image. It is then combined for a feature vector formation. Then based on Euclidian distance similarity measure the database images are compared with the query images. This joined methodology provides precise and effective framework.

In 2015, Kumar et al. [23] used CBIR technique for efficient searching user's intended information on image database. Authors have suggested that it also overcome the semantic gap. Authors have explored the gaps and the current trends in this area and highlighted the advantages.

In 2015, Bhad et al. [24] used color dominant, texture and histogram features for image retrieval. For texture extraction Gray Level Co-occurrence Matrix (GLCM) have been used. Shading histogram is the most essential shading representation variable used as a part of picture handling. Shading histogram yields better recovery precision. Histogram figures out the quantity of pixels in dim level. They have applied Euclidean separation, Neural Network, Target look techniques calculation and K-implies bunching calculation for

recovery of pictures from the database and making a correlation based methodology between them to see which strategy helps in quick recovery of pictures.

In 2016, Padmashree et al. [25] proposed paper is measuring the performance of three CBIR systems based on wavelet decomposition using threshold, morphology operators and LBP. The performance of system is compared using average precision. Results indicate that performance of CBIR systems using wavelet decomposition give better results than simplicity and FIRM, also wavelet decomposition with (LBP) exhibit better retrieval efficiency compared to wavelet decomposition using threshold and morphological operators.

In 2016 Muhsina et al. [26] proposed an efficient image retrieval system (irs) based on combination of color moments and Gabor texture feature. For color feature, separate the image into three equal horizontal sub images and calculate the first two moments (mean, standard deviation) of each color channel from each sub image so as to get feature vector of length 18. The experiment also shows that only color or only texture features are not sufficient to describe an image. So combining color and texture features, there is a considerable increase in retrieval efficiency.

VII. PERFORMANCE MEASUREMENT

Both color and shape retrieval algorithms are implemented in MATLAB2012Ra with the database of 600 images. All the images are stored in JPEG format with size 384 × 256 or 256 × 384. There are six different categories: African, Bus, Rose, Elephant, Horse, and Beach. The efficiency of image retrieval algorithm is evaluate by use of two most well-known parameters; precision and recall.

A. Precision

It is the ratio between no. of relevant images retrieved to the total no. of retrieved images.

$$\text{Precision}=\frac{\text{Number of relevant images retrieved}}{\text{Total number of images retrieved}}$$

B. Recall

The ratio between no. of relevant images retrieved to the total no. of relevant images.

$$\text{Recall}=\frac{\text{Number of relevant images retrieved}}{\text{Total number of relevant images}}$$

The precision and recall is calculated on system executed 10 images from each of six categories. The results obtained using shape and color based for different category of images is shown in Table1 and Table2. Retrieval result images with query image of shape and color based are shown in Figure 2 and Figure 3. The combination of color and shape for different types of images is given in Table3 and corresponding result images are shown in Figure 4.

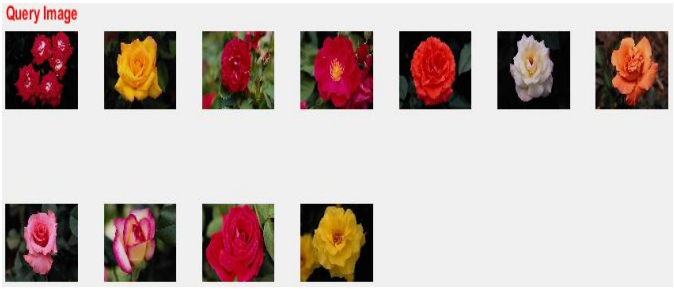

Figure 2. Shape based Feature Results on Rose Images

Figure 3. Color based Feature Results on Elephant Images

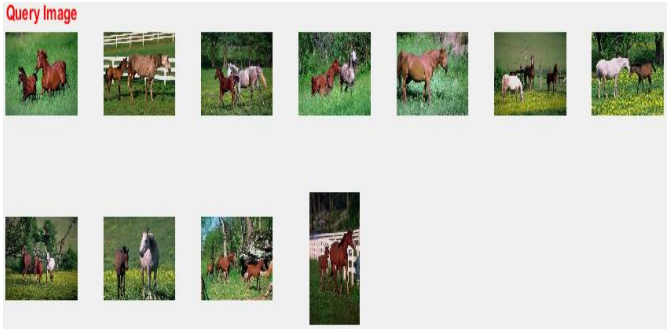

Figure 4. Combination of Color and Shape based feature results on Horse Image

Table1. Result Analysis on Shape Feature

Category	Precision	Recall
Rose	0.875	0.18
Horse	0.8	0.13
Bus	0.75	0.07
Elephant	0.51	0.06

Table2. Result Analysis on Color Feature

Category	Precision	Recall
Rose	0.76	0.18
Horse	0.91	0.22
Bus	0.69	0.16
Elephant	0.65	0.15

Table3. Result Analysis on Color and Shape Feature using Histogram Method

Category	Precision	Recall
Rose	0.45	0.11
Horse	0.61	0.14
Bus	0.33	0.08
Elephant	0.45	0.1

VIII. CONCLUSION

With the advent of various search engines, image searching has become an easier task. But every search engines use text based retrieval techniques. Though CBIR is a happening topic, we cannot expect the entire upheaval of existing techniques with CBIR. Although, in CBIR certain improvement have been done to provide efficient result from existing method. The CBIR methods presented herein use low-level features to generate results. In this paper, we present a survey on CBIR and comparative study on color and shape feature image to evaluate performance retrieval in terms of precision and recall.

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