A Survey on Image Retrieval System Based on Contents

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***Abstract*—In this paper a survey on content based image retrieval presented. Content Based Image Retrieval (CBIR) is a technique which uses visual features of image such as colour, shape, texture, etc…to search user required image from large image database according to user's requests in the form of a query image. Here comparison is based on local-descriptor, wavelets, scale-invariants feature, edge descriptor histograms (EDH), discrete cosine transform (DCT), discrete wavelet transform (DWT).**

Keywords* — *CBIR, EDH, SIFT, DWT, DCT, image retrieval system

I.INTRODUCTION

The term [CBIR] describes the process of retrieving desired images from a large collection on the basis of features (such as colour, texture and shape) that can be automatically extracted from the images themselves.Since 1990 with rapid growth of available multimedia, C.B.I.R come into existence. It has been an active and fast advancing research area.

It is a technique which uses visual contents to search image from large scale image database according to user's interest. The explosive growth of the internet and the wide use of digital content necessitate the development of effective ways of managing the visual information by its content and have increased the need for efficient image retrieval procedure.

Due to the rapid development of computing hardware, digital acquisition of information has become one popular method in recent years. Every day, G-bytes of images are generated by both military and civilian equipment. Large set of medical images, architectural and engineering designs, journalism and advertising, are worth mentioning.

Consequently, how to make use of this huge amount of images effectively becomes a highly challenging problem. As a result, studies on Content Based Image Retrieval (CBIR) have emerged and have been an active research from the past decade. Reasons for its development are that in many large image databases, traditional methods of image indexing have proven to be insufficient, laborious, and extremely time consuming.

These old methods of image indexing, ranging from storing an image in the database and associating it with a keyword or number, to associating it with a categorized description, have become obsolete. "Content-based" means that the search will analyze the actual contents of the image rather than the stored metadata such as keywords, tags, descriptions associated with the image.

CBIR system is used to find images based on the visual content of the images such as color, texture and shape without using any textual descriptions for the image and the retrieved results will have visually similar appearance to the query image.

Different methods have been evaluated for retrieving image based on contents such colour, texture and shape. Previous methods are lethargic to be used to retrieve image with the development of multimedia technology and the Internet, and massive growth of image data, the content based image retrieval (CBIR) is well-known field of research in the computer vision and image processing in which a large number of methods based on the image features such as color, shape, texture and so on. In the recent years, the method of local invariant descriptor has made significant progress in the object recognition and image matching. In 2004, the SIFT (Scale Invariant Feature Transform is proposed based on the image rotation and scale and robust across a substantial range of affine distortion by the David Lowe, and successfully applied to the object recognition. Wu Ruihang] successfully applied the SIFT to the retrieval image. Loupias et al. present the Discrete Wavelet Transform (DWT) using the feature points to test and get the better result. However, to DWT, the drawback is that do not have the robust to the translation and direction, and is a big obstacle to abstracting feature form the key points. To solve the problem, Kingsbury et al presented Dual-Tree complex wavelet transform (DTCWT) which is proved a good tool to the image analysis, and have Direction selective, gentle translation invariance, information lossless and so on.Fauqueur presented DTCWT to abstract the key points to attain the robust to direction and translation, and get the good result.

II .DIFFERENT METHODS FOR CBIR

A. Performance Evaluation of Local Descriptors-:

In the paper [1], we compare the performance of descriptors computed for local interest region,. Many different descriptors have been proposed in the literature. It is unclear which descriptors are more appropriate and how their performance depends on the interest region detector. The descriptors should be distinctive and at the same time robust to changes in viewing conditions as well as to errors of the detector. Our evaluation uses as criterion recall with respect to precision and is carried out for different image transformations. Furthermore, we observe that the ranking of the descriptors is mostly independent of the interest region detector and that the SIFT-based descriptors perform best.

Result-: Fig 1(a) and 1(b) shows local descriptor

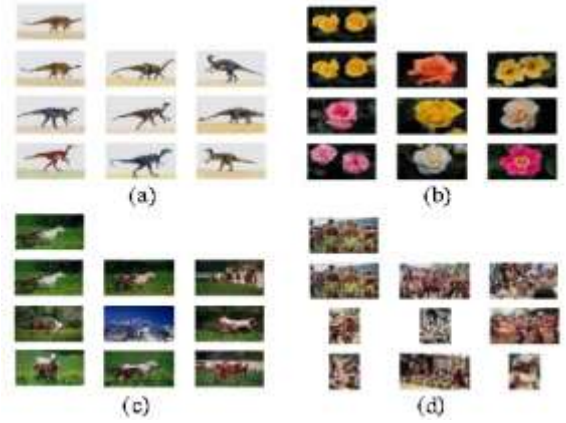
In this, we have presented an experimental evaluation of interest region descriptors in the presence of real geometric and photometric transformations. The goal was to compare descriptors computed on regions extracted with recently proposed scale and affine-invariant detection techniques. Note that the evaluation was designed for matching and recognition of the same object or scene

B. Effective Content-Based Image Retrieval: (Combination of Quantized Histogram Texture Features in the DCT Domain)

Effective Content-Based Image Retrieval (CBlR) [2] is based on efficient low level features extraction for indexing and on effective query image matching with indexed images for retrieval of similar images. Feature extraction in compressed domain is an attractive area because at present almost all the images are represented in the compressed form using the DCT (Discrete Cosine Transformation) blocks transformation. Some critical information is removed in compression and only perceptual information is left which has significant attraction for information retrieval in the compressed domain.

In this paper [2] the statistical texture features are extracted from the quantized histograms in the DCT domain using only the DC and first three AC coefficients of the DCT blocks of image having more significant information. We study the effect of combination of texture features in effective image retrieval. We perform experimental comparison of combination of various statistical texture features to get the optimum combination of features for the effective image retrieval in terms of precision.

RESULT-: Fig.2 show Query results of (a) dinosaurs (b) roses (c) horses and (b) people



In this a CBIR algorithm is proposed in which the statistical texture features are extracted from quantized histograms in DCT domain and are used in different combination for similar image retrieval. Only OC and first three AC coefficients are selected in each OCT block to get the quantized histogram statistical texture features. These features are combined in different combinations to get feature vectors of query and database images. These vectors are used by distance metric to retrieve similar images. The experimental comparative results of combinations of features are analyzed for 1000 image database in terms of precision of image retrieval. We conclude that the combination of more and more statistical texture features give good performance in terms of precision in OCT domain for compressed images instead of using single or combination of less than three features combinations of textures features.

C.Content-based image retrieval using the combination of the fast wavelet transformation and the color histogram

In this study [3], an attempt has been made to study an image retrieval technique based on the combination of Haar wavelet transformation using lifting scheme and the colour histogram (CH) called lifting wavelet-based color histogram. The color feature is described by the CH, which is translation and rotation invariant. The Haar wavelet transformation is used to extract the texture features and the local characteristics of an image, to increase the accuracy of the retrieval system. The lifting scheme reduces the processing time to retrieve

images. The experimental results indicate that the proposed technique outperforms the other schemes, in terms of the average precision, the average recall and the total average precision/recall

D.An effective image retrieval scheme using color, texture and shape features

In this paper [4], we present a new and effective color image retrieval scheme for combining all the three i.e. .color, texture and shape information, which achieved higher retrieval efficiency. Firstly, the image is predetermined by using fast color quantization algorithm with clusters merging, and then a small number of dominant colors and their percentages can be obtained. Secondly, the spatial texture features are extracted using a steerable filter decomposition, which offers an efficient and flexible approximation of early processing in the human visual system. Thirdly, the pseudo-Zernike moments of an image are used for shape descriptor, which have better features representation capabilities and are more robust to noise than other moment representations. Finally, the combination of the color, texture and shape features provide a robust feature set for image retrieval

E. wavelet based salient point for image retrieval

In this paper [5], we present a salient point detector that extract points where variations occur in the image, whether they are corner-like or not. The detector is based on wavelet transform to detect global variations as well as local ones. The wavelet-based salient points are evaluated for image retrieval with a retrieval system using texture features. In this experiment our method provides better retrieval performance comparing with other point detectors. The use of interest points in content-based image retrieval allows image index to represent local properties of the image. Classic corner detectors can be used for this purpose. However, they have drawbacks when applied to various natural images for image retrieval, because visual Features need not be comers and corners may gather in small regions.

Different retrieval features and image databases are used in [6] to compare point's detectors. Here we present results with an image retrieval system2 based on texture features [7].The best way to evaluate point's detectors for image retrieval is to compare retrieval results obtained with each detector. The retrieval system is constituted by the indexing (points extraction and computation of local features to build image indexes) and the querying (based on a similarity measure between indexes). Loupias et al. [5] present the discrete wavelet transform using the feature points to test and get the better result. However, to DWT, the drawback is that does not have the robust to the translation and direction and is a big obstacle to abstracting feature from key points.

F. C.B.I.R based on DWT and EHD

Content Based Image Retrieval (CBIR) based on Discrete Wavelet Transform (DWT) and Edge Histogram Descriptor (EHD) feature. The proposed algorithm is explained for image retrieval based on shape and texture features only not on the basis of color information. Here input image is first decomposed into wavelet coefficients. These wavelet coefficients give mainly horizontal, vertical and diagonal features in the image. After wavelet transform, Edge Histogram Descriptor is then used on selected wavelet coefficients to gather the information of dominant edge orientations.

The combination of DWT and EHD techniques increases the performance of image retrieval system for shape and texture based search. The performance of various wavelets is also compared to find the suitability of particular wavelet function for image retrieval. The proposed algorithm is trained and tested for image database. The results of retrieval are expressed in terms of Precision and Recall and compared with various other proposed schemes to show the superiority of our scheme.

III. Benefits Of Using DWT and EHD over other methods

The proposed approach [8] achieves 15% to 20% improvement rates in terms of precision and recall. The results of proposed scheme are also compared with various other techniques. the EHD method is applied directly on the image and the maximum efficiency of result produced by this method gives the precision rate 86% for the image in the image category 'Bus', while in our method maximum result for the same image category is 100%. both color and texture features are used but the result for the same image category 'Bus' is only 50%.

In the precision rate for image categories 'Rose' and 'Horse' are83.33% and 80% respectively, while in our method the precision rate is 100% and 90% respectively. Generally an image database collects variety of images. The collected images may contain various features, such as texture, shape, and color.

It is difficult to achieve precise and satisfactory retrieval results by using only a single feature descriptor. In order to satisfy human perception completely in retrieving process, the combination of multiple feature descriptors or use of more advanced retrieving techniques such as relevance feedback should be considered.

However, in this paper, the aim is to develop an effective and efficient image retrieval scheme which utilizes the shape and texture features. Simulation results show that proposed Wavelet and EHD based scheme is better than other similar schemes.

IV. Description of DWT and EHD

DWT and EDH mainly involves two processes

- First is Training process i.e. Feature extraction and
- Second is Testing process i.e. Feature matching process

(a). Training Algorithm

The Training process extracts the image features to a distinguishable extent and prepares a database of feature vectors. These feature vectors are obtained by the wavelet transform and then applying EHD on selected wavelet coefficients. The overall training process is shown. the main steps of tree algorithm are as follow-:

- Step 1: Input image (I) of size M*N.
- Step2: Resize image (I) in a size where both M and N are divisible by four due to requirement of EHD.
- Step 3: Take 2 Level Discrete Wavelet Transform of the input image (I).
- Step 4: The two-level DWT gives the four matrices, 2, and 2 of wavelet coefficients at level 2.
- Step5: Calculate Edge Histogram of the approximation coefficients and detailed coefficients and while leaving detail coefficients as it mainly contains noisy details rather than the meaningful information. The EHD gives85 information points as 80 points are obtained from standard bins and 5 additional points are obtained by global bin.Therefore, the length of the feature vector ( ) is 85 for one wavelet coefficient matrix and overall length of feature vector for , and is 85 3=255.
- Step 6: Calculate feature vector ( ) for each image in the database and arrange all these feature vectors in a database. The size of database image is number of rows * columns.

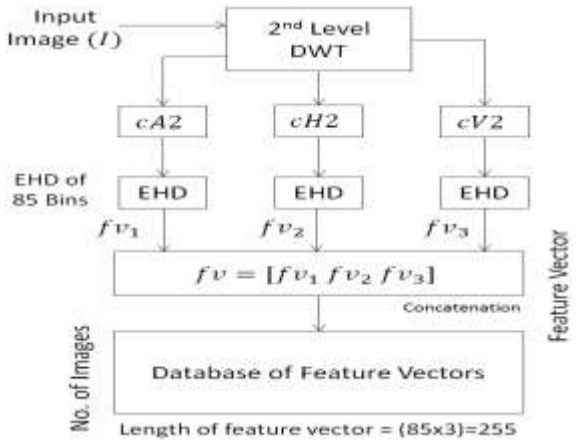


Fig .3(a) shows Training algorithm

(b) Testing Algorithm

The testing process is required to validate the performance of proposed algorithm. This process involves matching of feature vector obtained from query image with feature vectors stored in the database to yield the images that are visually similar. The figure shows the overall testing process. The steps of this testing process are given as follows

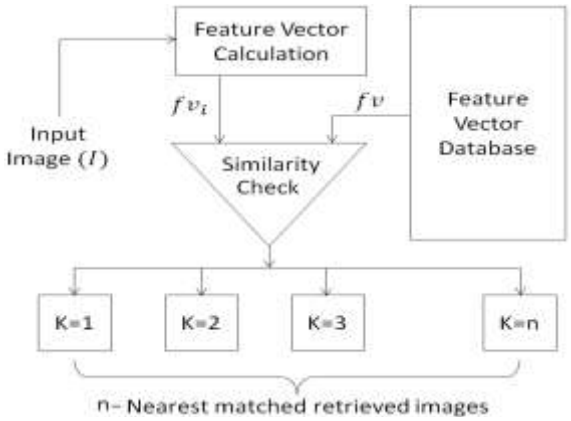


Fig .3 (b) shows Testing Algorithm

Steps involved in testing algorithm

- Step 1: Input image ( ) of size.
- Step 2: Calculate its feature vector using the same procedure used in the training process as shown in figure.
- Step 3: Perform a similarity check which compares feature vector of query image with each of the feature vector present in the database. Where and are the feature vectors of the query and database image respectively and is the length of feature vector. It is obvious that the distance of an image from itself is zero. The distances are then stored in increasing order and the first matches are retrieved as output image

V. Survey Result of EDH and DWT

The aim of this section is to test the behavior of the Wavelet based descriptor using EHD and it also includes the comparisons among the performances of different wavelets. *Database* is used for experiment which contains a set of 1000 images. The database consists of 100 images of every class. From which 800 images (80 images from each category) are used for the training purpose and 200 images (20images from each category) are used for testing.

A query image is provided by the user. Then similar images from database are selected and displayed. For testing purpose, total 10 test images are used to show the performance of the proposed scheme. Out of these 10 test images, 5 images are taken from database, while other 5 images are taken from other sources. These test images are shown in figure. The first row

of the figure 4 shows the test images from Database and second row shows the images from other sources.

Fig .4(a) shows image database

The query test image number 652.jpg of category 'Rose' of database and 15 retrieved images from the database are shown in figure. Similarly the retrieval results are shown in Next figure for query image of category 'Dinosaur' taken from other sources.
To measure the retrieval effectiveness for our proposed technique of CBIR, this paper uses standard parameters such as precision and recall. The standard definitions of these two measures are given by equations (1) and (2) respectively.

Precision = No/Nr

Recall = No/Nd

Where, No=Number of relevant images retrieved.
Nr=Number of total images requested.
Nd=Total number of relevant images in database.

Fig .4 (b) Shows retrieved image for Rose (query image 608).jpg

Fig .4.(c) shows retrieved result for dinosaurs

VI. Conclusion

In this paper, a content based image retrieval algorithm is presented mainly for texture and shape based features. Here color features are not considered just to show the efficiency of proposed scheme for texture and shape features.
The strengths of wavelet transform and Edge Histogram Descriptor (EHD) are utilized to obtain better efficiency in image retrieval. Experimental results validate the strength and superiority of the proposed scheme as compared to only EHD for texture and shape capturing.
The effectiveness of various wavelets is also investigated for the image retrieval. Results show that wavelet function performs better than other wavelets, hence most suitable for schemes similar to the proposed scheme.

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