

A Survey on: Comparative Study on Image Retrieval using CBIR

Mr. Lalit Gehlod¹ Aman Chouhan²

^{1,2}Department of Computer Engineering

^{1,2}Institute of Engineering & Technology, Devi Ahilya university, Indore, India

Abstract— The information retrieval is one of the most frequent techniques in data search for different formats. In this presented work the image based data retrieval technique is simulated. The image retrieval techniques can be divided into a number of kinds of applications but there are two major domain of image retrieval first based on text available in image data and second the content inside the image. When the techniques utilize the image contents then such kind of techniques are known as the content based image retrieval. Content based image retrieval technique consumes image features, these features are essential image attributes that are used to identify the image. Therefore there are three key features are used namely color feature, edge feature and their texture. The challenging topic in image processing is extracting accurate images from the data base according to the user defined query and objects available in database image. Therefore in this paper we described different technique for content based image retrieval and their functioning advantages. In addition of that it includes the investigation about the different recent approaches that are developed recently. We go through many technologies and made some comparisons between them.

Key words: CBIR, Image Retrieval

I. INTRODUCTION

Web is concentration of information and different data, which allow user to access the data as per their use. It has so many applications one of which is search engine. Search engines are playing important role to search and consume data. The data can be found in different formats and types. But now in these days' multimedia data based search engines are frequently accessed. As of rapid increase in demand of multimedia data on internet more accurately an improved technique is required.

Therefore studies on different techniques have been conducted on multimedia data search systems and a new model for image search is proposed. The proposed work presents a way to find the most relevant image as per the content in image using content based image search. Traditionally content based image search works with relevance feedback and re-ranking but these techniques produces additional delay to process results. Thus in order to reduce delay, image annotation technique is included to detect user search interest. The annotation based techniques includes text or object Tags with image to recognize the actual queried image by user. This will enable the user to search the image on the basis of image content and text too.

This paper contributes on the survey the different approaches and techniques developed in recent years. In addition of that that provides an overview of the proposed model for efficient and accurate image identification.

II. ANATOMY IMAGE RETRIEVAL

Image Retrieval system is computer system for searching, retrieving, browsing the image from the large database of

digital images. Easy way of image retrieval is text based. This technique is popular but needs very specific description of the query which is tedious and not always possible. Most traditional and common methods of image retrieval utilize some method of adding metadata such as captioning, keywords, or descriptions to the images so that retrieval can be performed over the annotation words. Manual image annotation is time consuming, laborious and expensive; to address this, there has been a large amount of research done on automatic image annotation.

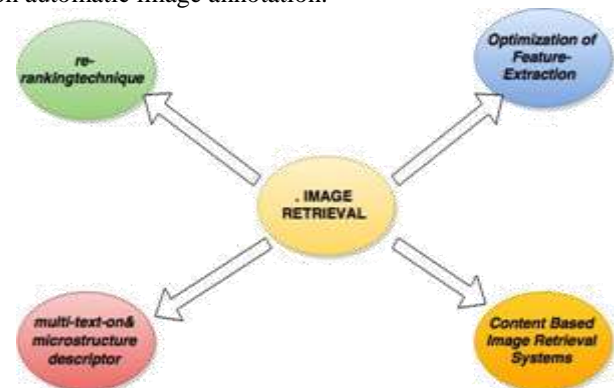


Fig. 1 Anatomy of Image retrieval

A. Image retrieval based on re-ranking technique

- Image retrieval is a key issue of user concern. Normal way of image retrieval is the text based image retrieval technique (TBIR). TBIR needs rich semantic textual description of web images. Therefore generally the process of image search includes searching of image based on keyword typed. The process that occurs in the background is not so simple though when query is entered in the search box for searching the image, it is forwarded to the internet. The server gets the URL's of the images based on the tagging of the textual word from the internet and sends them back to the client.
- Techniques based on CBIR are found to be more vibrant and are likely to be adopted for such applications. Most of the earlier technique used only visual features and didn't capture user's intentions. To bridge this semantic gap, method like active re-ranking has been proposed. The domain of image harvesting, retrieval and re-ranking offers a vast scope for exploration as well as innovation. This survey will prove to be beneficial to gain overview of the work done in this field. This scheme also has drawback as result of image is not accurate.

B. Relevance feedback for CBIR on multi-text-on & microstructure descriptor

- Generally, the only way of retrieving these collections was by keyword indexing, or simply by browsing. Digital image databases however, open the way to content based searching. CBIR system is required such as shape of an object. The primary goal of the CBIR system is to construct meaningful descriptions of

physical attributes from image to facilitate efficient and effective retrieval. The performances of content-based image retrieval methods are still limited, especially in two aspects of retrieval accuracy and response.

- To be more profitable relevance feedback techniques are incorporated into CBIR such that more precise results can be obtained by taking user's feedbacks into account. The semantic gap between low-level features and high-level concept handled by the user is one of the main problems in image retrieval. On the other hand, the relevance feedback has been used on many CBIR systems such as an effective solution to reduce the semantic gap. The gap is reduced by using the Multi-text-on Histogram descriptor. In this paper, a novel framework method called Relevance feedback is used to achieve high efficient and effectiveness of relevance of CBIR in coping with the large-scale image data. For that reason this paper proposes a method of relevance feedback based on Multi-text-on Histogram descriptor (MSD) for efficient feature extraction of an image. By using this method, high quality of image retrieval on Relevance Feedback is reduced substantially by using the navigation patterns discovered from the user query log, which reduce the computational processing time.
- In this paper they proposed a new method to reduce the semantic gap by the relevance feedback image retrieval based on Multi-text-on Histogram descriptor.

C. Optimization of Feature-Extraction Technique for CBIR

- In CBIR, retrieval of image is based on similarities in their content, i.e., textures, colors, shapes etc. Which are considered the lower level features of an image. These conventional approaches for image retrieval are based on the computation of the similarity between the users query and image. In CBIR each image stored in the database has its features extracted and compared to the features of the query image. Thus broadly, it involves two processes via features extraction and feature matching.
- We will analyse six techniques one using a query image from each class of the WANG database. The six techniques are Average RGB, Color Moment, Co-occurrence, Local Color Histogram, Global Color Histogram and Geometric Moment. These six techniques will be evaluated using the parameters, Time, Accuracy and Redundancy factor, we will be planned in the next section.
- The goal is to find the optimum combination of techniques to be used for each class of query which result is the best possible Time, Accuracy and Redundancy Factor, as compared to using any single technique at one point of time.
- This scheme has also big challenge that is how to create a scalable and effective algorithm. There are huge amounts of image on the Web, and more and more new photo are uploaded to photo sharing. Hence, a scalable and effective algorithm is necessary to analyse both visual information and the tags of image.

D. Content Based Image Retrieval Systems

- As the network and development of multimedia technologies are becoming more popular, users are not

satisfied with the traditional information retrieval techniques. So nowadays the content based image retrieval are becoming a source of extract and fast retrieval technique. In this paper the techniques of content based image retrieval are discussed, analysed and compared. It also introduced the feature like neuro fuzzy technique, color histogram, texture and edge density for accurate and effective Content Based Image Retrieval System.

- The purpose of this survey is to provide an overview of the functionality of content based image retrieval systems. Most systems use color and textures few systems use shape feature, and still less use layout features. Fuzzy logic has been used extensively in various areas to improve the performance of the system and to achieve better results in different applications.

III. CONTENT-BASED IMAGE RETRIEVAL

Content Based Image Retrieval is a set of techniques for retrieving semantically-relevant Images from an image database based on automatically-derived image features [5]. That aims at avoiding the use of textual descriptions and instead retrieves images based on their visual similarity to a user-supplied query image or user-specified image features.

The main goal of CBIR is efficiency during image indexing and retrieval, thereby reducing the need for human intervention in the indexing process [6]. The computer must be able to retrieve images from a database without any human assumption on specific domain (such as texture vs. non texture). One of the main tasks for CBIR systems is similarity comparison, extracting feature of every image based on its pixel values and defining rules for comparing images. These features become the image representation for measuring similarity with other images in the database. Images are compared by calculating the difference of its feature components to other image descriptors. Research Centre, extracts several features from each image, namely color, texture and shape features [5]. These descriptors are obtained globally by extracting information on the means of color histograms for color features; global texture information on coarseness, contrast, and direction; and shape features about the curvature, moments invariants, circularity, and eccentricity. Similarly, the Photo book system features [7] to represent image semantics. These global approaches are not adequate to support queries looking for images where specific objects in an image having particular colors and/or texture are present, and shift/scale invariant queries, where the position and/or the dimension of the query objects may not relevant [8]. Most of the existing CBIR systems consider each image as a whole; however, a single image can include multiple regions/objects with completely different semantic meanings. A user is often interested in only one particular region of the query image instead of the image as a whole. Therefore, rather than viewing each image as a whole, it is more reasonable to view it as a set of regions. The features employed by the majority of Image Retrieval systems include color, texture, shape and spatial layout. Such features are apparently not effective for CBIR, if they are extracted from a whole image, because they suffer from the differing backgrounds, overlaps, occlusion and cluttering in different images and they do not have adequate ability to

capture important properties of objects, as a result most popular approaches in recent years is to change the focus from the global content description of images into the local content description by regions or even the objects in images. RBIR is a promising extension of the classical CBIR: rather than deploying global features over the entire content, RBIR systems partition an image into a number of homogenous regions and extract local features for each region then features of regions are used to represent and index images in RBIR. For RBIR, The user supplies a query object by selecting a region of a query image and then the corresponding similarity measure is computed between features of region in the query and a set of features of segmented regions in features database and the system returns a ranked list of images that contain the same object. The content-based approach can be summarized as follows: Computer vision and image processing techniques in are used to extract content features from the image. Images are represented as collections of their prominent features. For a given feature, an appropriate representation of the feature and a notion of similarity are determined. Image retrieval is performed based on computing similarity or Dissimilarity in the feature space, and results are ranked based on the similarity measure.

IV. CLASSIFICATION OF CONTENT BASED IMAGE RETRIEVAL

From a practical point of view, content-based image Retrieval techniques can be divided into two main domains: pixel and compressed domain techniques. Figure 4.1 exhibits the hierarchy of the techniques. In the pixel domain, the values of individual pixels in the image matrix are used directly for making visual indexes. On the other hand, in the compressed domain, transformed data, which is the result of mapping the original image matrix into another domain, is employed for feature extraction and retrieval. Different approaches for visual content analysis, representation, and their application indexing and retrieval is brief. Image retrieval techniques, promising directions, and open issues are surveyed. Image coding algorithms will provide the capability of producing image features in compressed domain. Pixel domain and compressed domain techniques are explained with more details in the following subsections.

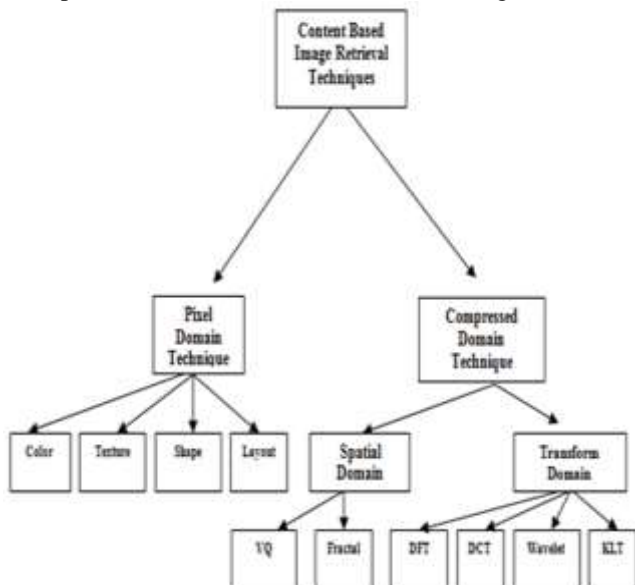


Fig. 2: Classification of Content based image retrieval

A. Pixel Domain Technique

1) Color:

Color feature is one of the most widely used features in low level feature. Compared with shape feature and texture feature, color feature shows better stability and is more insensitive to the rotation and zoom of image. Color not only adds beauty to objects but also more information, which is used as powerful tool in content-based image retrieval. In color indexing, given a query image, the goal is to retrieve all the images whose color and texture compositions are similar to those of query image. In color image retrieval there are various methods, but here we will discuss some prominent methods.

2) Texture:

Texture is another feature that can help to segment images into regions of interest and to classify those regions. In some images, it can be the defining characteristic of regions and critical in obtaining a correct analysis.

3) Shape:

Shape is the most important for recognizing objects. In this section, we introduce a new shape representation method that is invariant to translation, rotation, and scaling, and also has high tolerance to complex, occluding, or even deformed images.

4) Layout:

A color descriptor is a numeric quantity that describes a color feature of an image. In the current paper, the CLD descriptor was extracted to represent the color content of an entire image. The CLD is a very compact and resolution-invariant representation of color for high-speed image retrieval and was designed to efficiently represent the spatial distribution of colors.

B. Compressed domain technique

1) Spatial Domain:

These techniques are based on grey level mappings, where the type of mapping used depends on the criterion chosen for enhancement. It is divided into two level VQ and fractal.

a) Vector Quantization:

Vector quantization represents a mapping that assigns to each input vector a codebook vector achieving compression by setting the size of the codebook small relative to the possible gamut of input vectors.

b) Fractal:

Fractal compression is a lousy compression method for digital images, based on fractals. The method is best suited for textures and natural images, relying on the fact that parts of an image often resemble other parts of the same image [11].

2) Transform Domain:

Transformation or frequency domain techniques are based on the manipulation of the orthogonal transform of the image rather than the image itself. Transformation domain techniques are suited for processing the image according to the frequency content. The principle behind the frequency domain methods of image enhancement consists of computing a 2-D discrete unitary transform of the image, for instance the 2-D DFT, manipulating the transform coefficients by an operator M, and then performing the inverse transform. The orthogonal transform of the image has two components magnitude and phase. The magnitude consists of the frequency content of the image. The phase is

used to restore the image back to the spatial domain. The usual orthogonal transforms are discrete cosine transform, discrete Fourier transform, Hartley Transform etc. The transform domain enables operation on the frequency content of the image, and therefore high frequency content such as edges and other subtle information can easily be enhanced.

a) DFT:

In mathematics, the discrete Fourier transform (DFT) converts a finite list of equally spaced samples of a function into the list of coefficients of a finite combination of complex sinusoids, ordered by their frequencies, that has those same sample values [10].

b) DCT:

The discrete cosine transform (DCT) is a technique for converting a signal into elementary frequency components. It is widely used in image compression. Here we develop some simple functions to compute the and to compress images.

c) Wave Let:

A wavelet is a mathematical function useful in digital signal processing and image compression. The use of wavelets for these purposes is a recent development, although the theory is not new. The principles are similar to those of Fourier analysis, which was first developed in the early part of the 19th century[9].

d) KLT:

The DCT is better than DFT for compressing information into a few components - is there some theoretically optimum method of compression? Answer is the Karhunen-Loeve

Transform (KLT), also known as the Hotelling transform or Principal Component Analysis (PCA). The KLT analyses a set of vectors or images, into basis functions or images where the choice of the basis set depends on the statistics of the image set - depends on image covariance matrix.

V. STUDY AND COMPARE OF DIFFERENT IMAGE RETRIEVAL TECHNIQUE

The key aim of the proposed work is to investigate the traditional methods of CBIR and providing an accurate and efficient technique for the content based image retrieval. Therefore the following works are included in this study.

- Study of various image retrieval techniques: in this phase of study various methods available for image retrieval is investigated and some essential methods are recovered by which the relevancy of image is improved.
- Study of performance improvement techniques: in this phase various performance improvement techniques are investigated by which the search results are improved during image search.
- Design and implementation of user query relevance technique for image search: in this phase the previously recovered techniques are employed on the traditional system and their performance improvement is performed.

This section provides the understanding about study of the work and the next section involve the study of different image retrieval techniques.

Year	Ref. No.	Dataset used	Methodology	Findings	Approach Used
2009	[12]	Image from Google and yahoo	One class classification- 1) Crawl images from Google and Yahoo. 2) Form a single class called target class containing irrelevant images. 3) Use kernel whitening and SVDD for detecting the relevant (outlier to target class) images. 4) Relevance feedback is used to improve performance.	1) Useful even with lack of clean data and contaminated unrelated data. 2) Useful in non-popular or non-typical category classification.	1) Kernel whitening 2) Support vector Data description 3) Relevance feedback
Mar 2010	[13]	Synthetic database	Active re-ranking- 1) Collect labeling information from user to obtain specified semantic space. 2) Localize the visual characteristics of the user intentions in space.	1) Use both ambiguity and representativeness. 2) Reduce user labelling efforts	1) Structural in formation based sample selection. 2) Local global discriminative dimension reduction algorithm (LGD).
April 2011	[14]	Bing query logs	Click data based re-ranking- 1) Identify previously clicked images for the same query. 2) GPR is then trained to predict normalized clicks on each image. 3) Combining original and	1) No need of user intervention. 2) Query independent method 3) Reduce label noise problem 4) Promote likely to be clicked images along	1) Gaussian process Regression(GPR) 2) Click boosting as tie breaker.

			predicted click count re-rank images.	with previously clicked images.	
Nov 2011	[15]	Flickr images with tags, NUS-WIDE	<p>Bag Based re-ranking-</p> <ol style="list-style-type: none"> 1) Partition images into clusters using textual and visual features 2) Uses multi instance(GMI) framework 3) Treats each cluster as Bag and images as instances 	<ol style="list-style-type: none"> 1) MI learning Problem 2) Weak bag Annotation 3) Average precision for images 	<ol style="list-style-type: none"> 1) MI-SVM, GMI-SVM 2) K-means Algorithm for Clustering
Jun 2012	[16]	MSRA-MM	<p>Circular re-ranking method- Retrieved images are modelled as graphs in different feature spaces followed by-</p> <ol style="list-style-type: none"> 1) Random walks: Re-ranking the images by treating each feature space independently. 2) Mutual reinforcement: Pair wise exchanging modality spaces. 3) Circular Re-ranking: iteratively updating the image ranks by circular mutual reinforcement. 	<ol style="list-style-type: none"> 1) Addresses the issue of multi-modality Interaction in visual search by mutual reinforcement. 2) In this way, the performance of the weak Modality is also benefited by learning from strong modalities. 	<ol style="list-style-type: none"> 1) Recurrent pattern mining- <ul style="list-style-type: none"> - Self - Crowd - Example based 2) Deriving fusion weights- <ul style="list-style-type: none"> - MAD - Query class-dependent Fusion
Nov 2013	[17]	MSRA-MM	<p>Topical graph method[- Given a textual query-</p> <ol style="list-style-type: none"> 1) Initial Re-ranking list obtained by current search engine 2) Sub-graph extracted from latent graph 3) Finally optimal re-ranked list obtained 	<ol style="list-style-type: none"> 1) Offline part: Uses image collection to learn a latent space graph. 2) Matrix factorization: Get global and local features 3) Online part: For sub-graph extraction. 	<ol style="list-style-type: none"> 1) Re-ranking with multi-latent topical graph 2) Uses latent semantic analysis and construct multi latent graph
April 2015	[18]	Text input with image tags	<p>There are two major modules.</p> <ol style="list-style-type: none"> 1) Training module. 2) Testing. 	<ol style="list-style-type: none"> 1) In image retrieval we can retrieve image with the help of text input with image. 2) In this way performance of image retrieve increased by this technique. 	<ol style="list-style-type: none"> 1) Grid color moment. 2) Canny Edge Detection. 3) LBPC (local binary patter)

Table 1: Study of Different Image Retrieval Technique

VI. CONCLUSION

Internet is a source of information and data, where different kinds and formats of data are available for use. Internet users can search the specific kind of data from web using the web search engines. The extraction from the data from a given source of data is known as the information retrieval. In this presented work the image retrieval systems are key area of research. During investigation various kinds of image search systems are found some of them are working on the basis of text associated with the images and some of them are works on the basis of image contents. The content based image retrieval systems are much accurate than the text based search systems. But due to annotation concepts that technique can be more appropriate then content based search.

REFERENCE

- [1] Mayuri D. joshi revati M. Deshmukh, kalashree N.Hemke, Ashwini Bhake and Rakhi Wajgi: Image retrieval and re-ranking technique, vol.5, No.2, April 2014
- [2] Kranthi Kumar.K, T.Venu Gopal, M. Rama Krishna: Relevance feedback for Content based image retrieval based on Multitexton Histogram And Microstructure Descriptor, vol 04, Special Issue 01; 2013
- [3] Aman Chadha, Sushmit Malik, Ravdeep johar: Comparative Study and Optimization of Feature-Extraction Techniques for Content based Image Retrieval, vol. 52-No.20, August 2012

- [4] Nidhi Singhai: Content Based Image Retrieval Systems, Vol 4-No.2, July 2010
- [5] A New and Effective Image Retrieval Method Based On Combined Features, P Liu, K Jia, Z Wang, Z Lv, IEEE International Conference on Image and Graphics, August 2007, Vol 1, Pages: 786-790
- [6] Using Phase and Magnitude Information of the Complex directional Filter Bank for Texture Image Retrieval, S. Oraintara, T. T. Nguyen, IEEE International Conference on Image Processing, Oct. 2007, Vol. 4, Pages 61-64
- [7] Flickner, M., Sawhney, H., Niblack, W., Ashley, J., Huang, Q., Dom, B., Gorkani, M., Hafner, J., Lee, D., Petkovic, D., Steele, D. and Yanker, P., "Query by image and image content: The QBIC system", IEEE International Journal of Computer Vision, 1995, Vol 28(9), Pages: 23-32
- [8] Low-Level Color and Texture Feature Extraction for Content-Based Image Retrieval, Michele Saad, Final Project Report, EE 381K: Multi-Dimensional Digital Signal Processing, May 2008, Pages: 20-28.
- [9] [Whatis.techtarget.com/definition/wavelet](http://whatis.techtarget.com/definition/wavelet)
- [10] https://en.wikipedia.org/wiki/Discrete_Fourier_transform
- [11] https://en.wikipedia.org/wiki/Fractal_compression
- [12] Yang Hu, Nenghai Yu, Zhiwei Li, Mingjing Li. "Image Search Result Clustering And Re-ranking via PARTIAL GROUPING". IEEE transaction ,1-4244-1017-7/07, 2007.
- [13] Xinmei Tian, Dacheng Tao, Member, IEEE, Xian-Sheng Hua, Member, IEEE, and Xiuqing Wu." Active Re-ranking for Web Image Search". IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 19, NO. 3, MARCH 2010.
- [14] Vidit Jain, Manik Varma." Learning to Re-Rank: Query-Dependent Image Re-Ranking Using Click Data". ACM 978-1-4503-0632-4, April 2011.
- [15] Ting Yao, Chong-Wah Ngo, Member, IEEE, and Tao Mei, Senior Member, IEEE." Circular Re-ranking for Visual Search" .IEEE Transaction on image processing, vol. 22, no. 4, April 2013.
- [16] Linjun Yang, Member, IEEE, and Alan Hanjalic, Senior Member, IEEE." Prototype-Based Image Search Re-ranking".IEEE TRANSACTIONS ON MULTIMEDIA, VOL. 14, NO. 3, JUNE 2012
- [17] Meng Wang, Member, IEEE, Hao Li, Dacheng Tao, Senior Member, IEEE, Ke Lu, and Xindong Wu,Fellow, IEEE." Multimodal Graph TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 11, NOVEMBER 2012
- [18] Junge Shen, Tao Mei, Qi Tian, Xinbo Gao." Image Search Re-ranking with Multi-latent Topical Graph". IEEE transaction 978-1-4673-5762-3, Nov 2013.