

# Different Types of CBIR Applications: A Survey

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**Abstract** — Visual information in large digital databases has been grown abundantly in the recent years and content based image retrieval (CBIR) attracts the interest of image processing oriented research people. The CBIR systems proof their vital performance due to the usage of features such as color, texture and shape. The successful of the CBIR system creates the intension to apply it on many real world fields such as search engine, web and human disease analysis etc., This paper surveys a lot of applications based on the CBIR systems and this paper concentrates on the seven types of applications which are belongs with medical field, remote sense imaging, natural image organization, forensic, business and miscellaneous applications. The recent papers which are written coincide towards these applications are reviewed with the explanation about technologies used to enhance the study of CBIR based applications and methods which are adopted for CBIR in recent period. This paper is more useful for the research people who continue their research in content based image retrieval.

**Keywords** — *Query, Database, Image Retrieval, security, sensing and Texture*

## I. INTRODUCTION

The content based retrieval is a dominating research area in image processing because of its variety application possibilities in both academic and industry. The CBIR method is working based on the query image and the relevant images from database are ranked based on their similarity with query image. The CBIR applications can be implemented through cloud systems, mobile phones, peer to peer network, relational databases, social network and World Wide Web. The CBIR techniques can be applicable to variety of image types and variety of real world fields. These applications makes people's environment and life style with easy approaches which are related with image oriented applications. This paper is written as a survey of the applications developed via CBIR techniques to understand the working method and usage of CBIR in different field of applications.

## II. REAL WORLD APPLICATIONS USING CBIR

The CBIR concept can be associated with large number of real world applications and the major applications are oriented with following types.

- Medical applications
- Remote sensing image retrieval
- Natural image retrieval
- Forensic applications
- Security applications

- Business applications
- Miscellaneous applications

The figure 1 illustrates the different types of applications possible using CBIR.

### A. Medical applications

The paper [1] presents an application for retrieving 2D MRI (magnetic resonance images) slices from 3D brain volumes. This application accepts 2D MRI query image from user and it identifies the matched 3D volume according with the query slice related brain region. The matched slices are retrieved by further searched within the matched 3D volume. This CBIR system is working based on the support vector machine (SVM) method.

The paper [2] provides an application named *I-Browse* to search histological images from the medical database and it contains the facility of image retrieval by both iconic and semantic contents. It also generates textual annotations for the input images. This is a better image retrieval tool for physicians in the case of histological images.

A new CBIR method named *Customized- queries approach* (CQA) is referenced by the paper [3] to retrieve the lung images for assisting physicians. A clustering algorithm called as feature subset selection using expectations maximization clustering (FSSEM) is used to get the accurate image retrieval. It works based on the two steps and one of them is query lung image classification based on disease class labels.

The other step is the retrieval of most similar images by the feature customization (as subclass) among the disease class.

A medical image retrieval scheme is designed in paper [4] to retrieve the medical images from the *IRMA* database which is available in internet. This CBIR application is designed by the *Query independent multiview features fusion (QDMFF)* method. The QDMFF method applies linear approximation to reduce the implementation cost of multiview learning. Then a relevance feedback system is applied iteratively to find the final relevance medical images.

Pathology image databases contain microscopic images and that microscopic images are utilized by pathologist to make medical diagnoses. The pathology image retrieval is one of best applications of CBIR. The paper [5] built a methodology

for pathological image retrieval. A Client server architecture is established in associated with the physicians desktop. The user query image is used for the retrieval from pathology database by the corresponding annotations and the image contents. The feature sets are derived by color histogram, image texture, fourier coefficients and wavelet coefficients.

The paper [6] explores an application to retrieve lung images from the position emission tomography and computed tomography (PET-CT) volumes of patients. The graph based CBIR technique is adapted with this application. An offline process is used to embed each graph into a vector space in database side and the query feature graph is also embedded into the vector space. The distance between the two points in the embedded vector space decides the relevance lung images related with query lung image.

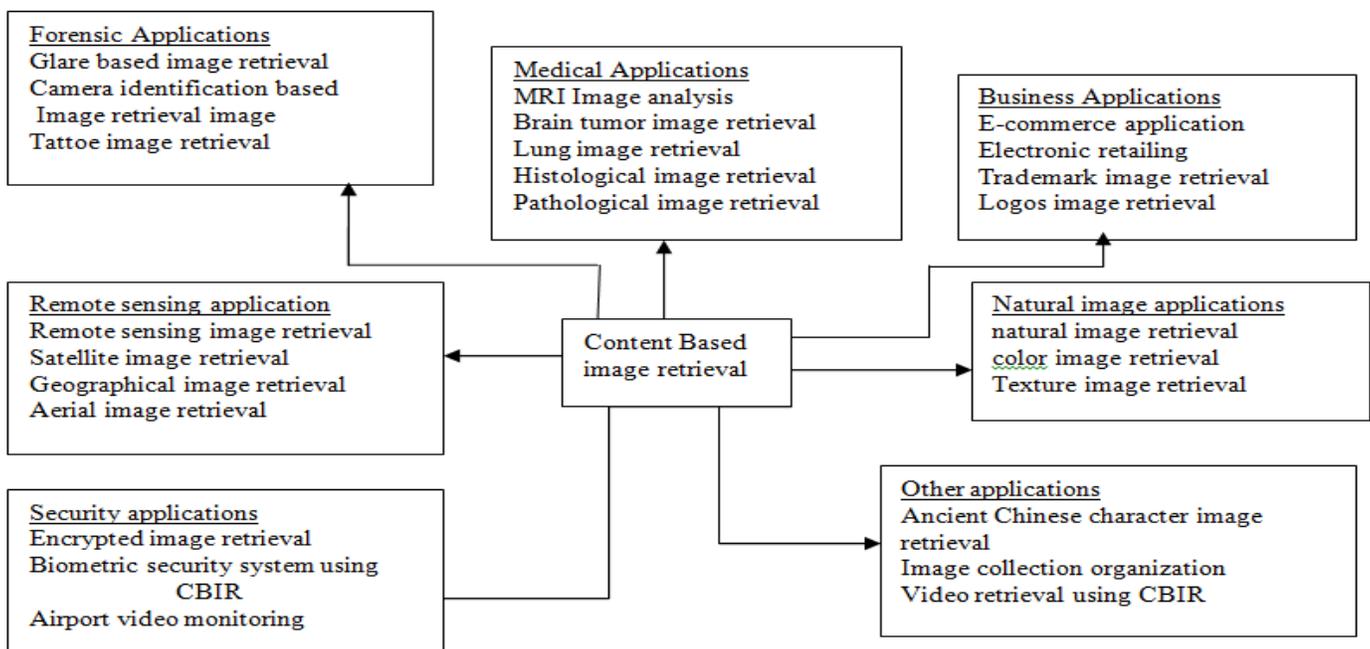


Fig.1. Block diagram of different CBIR applications

### B. Applications in remote sensing images.

Remote sensing images are very important for the territorial management. The paper [7] presented a CBIR method for remote sensing images using the structure tensor Riemannian statistical models. In this application very high resolution (VHR) remote sensor images are used as input and the property of anisotropy is modeled by Local structure tensor (LST) to achieve the image retrieval of remote sensing images.

The paper [8] yields image retrieval on remote sensing image (RSI) and this application has worked based on a grid system named RSIGrid for semantic based RSI retrieval. This CBIR method provides better recall, precision and query time for retrieval. The ontology and grid technology is applied in this

application. This RSTsGrid framework has the capacity of dynamically sharing a large volume of distributed RSIs.

Image retrieval for optical images (Satellite images) is generalized in the paper [9] which is packed with the supervised classification procedure. This supervised classification is strengthened by extraction of texture features through the learning in database. Wavelet based multivariate model is applied in this application to retrieve VHR panchromatic data. This application can be used with the searching of forest area images, vegetation area images and building area.

Change detection is the estimation of changes (in land cover) occurred in a specific interval on the same land cover space. The detection and estimation of variation of two satellite images can be found using the application which is derived

from the paper [10]. This paper deals with the change detection using relevance feedback method and target is achieved by two steps. The first step asks the user about the relevance information about the target change and the second step make updations on change detection results.

Geographical images are commonly acquired by the satellites or aircrafts. The implementation of CBIR on the geographical image database can be used to organize the geographical images of a specified area and this application is much needed for military applications. The paper [11] contributes an application to make searches geographic images from satellite imagery. The power in performance is due to the *bag-of-words* (BOW) approach and the *vector of locally aggregated descriptors* (VLAD).

Enteromorpha Prolifera is a green alga intensively in a specific area on the sea surface in the floating state. The flood of the enteromorpha prolifera contains large quantity of nutritious ingredients in the sea water. The large area occupation of the alga makes unwanted disturbances in the natural sea oriented human life. This disaster can be prevented by detecting this alga and so it is very crucial one for safety of human life. The paper [12] presents a scheme for the detection of this alga. This task is achieved by the RGB to NTSC color space conversion and the k-means segmentation algorithm.

### C. CBIR application on natural images

Natural images are acquired when the time of natural modes of operation (e.g. busy streets, meadows, living rooms). The author Guo-Dong *et al* [13] says about the application of natural image retrieval and using two types of similarity measures to hike the performance of image retrieval. The combined form of similarity measure is named as constrained similarity measure (CSM) and it works based on Euclidean distance and support vector machine. The positive and negative possibilities are utilized to decide the boundary of similarity measures.

The author Guanghai liu [14] expresses an application for natural image retrieval based on visual attention. This application provides better results for flowers, butterflies, race cars and animals. The features such color, orientation, saliency cue and spatial information are encoded by saliency textures to obtain the CBIR results on natural images.

An application supported to natural color images is developed by the author Shiv Ram Dubey *et al* [15] to improve the search accuracy in image retrieval. This application is developed based on *local neighborhood based robust color occurrence descriptor* (LCOD) to derive the information from the local structure of the image. The quantity of color information is reduced to less quantity and these reduced

shades are utilized to compute the descriptor. A binary pattern is generated for each pixel of image. This application reacts well for animal images, mountain images and marine images.

The paper [16] releases an application of image retrieval for natural images and fuzzy logic is handled to classify the natural images. The neural network concept is added to find the relevance image set. This application can be well attached with the retrieval of landscape images, flower images and art images.

The author Jamil Ahmad *et al* [17] focuses on developing an application for content based image retrieval on natural color images by using the salient structures histogram. This application retrieves natural images from a large size database. The sparse matrix model is fixed with the salient image structures related with color and edge data to get accurate and fast image retrieval. The images such as bus, animal and birds are retrieved with betterness by this application.

The applications developed by [18] intelligently retrieve natural images such as elephants, food, buildings, roses, and bus and seashore scenes with better accuracy. This method uses four orthogonal transforms such as cosine, walsh, kekke and Hartley to obtain the powerful retrieval of natural images. This method can be well used with web based image search.

### D. CBIR applications on forensic

The main part of human life habit is connected with digital images and these images are growing vulnerable to digital forgery. The photo editing software's are the main factor for this issue. The traditional method available for examining and authentication of each image in a large database is practically not possible. If an automatic system is developed to detect or trace a special characteristic in digital images of database, then the valuable time of forensic people can be saved much. The paper [19] presents an application for this purpose and it finds glare property in the image. This method retrieves the glared images from a large database using Benford's law. This application can be much useful for forensic people to search photos with specified light source.

Forensic people need an application to search the specified images taken by a specified type of camera which are used among internet web pages to maintain lawful actions against child pornography and others. The paper [20] develops an application for these criteria by an image retrieval system to retrieve images based on compressed camera identification.

Forensic department people need the identification of tattoo images from human bodies to detect the culprits who may contains tattoo images in their body parts. The traditional ways are not suitable for this usage, so there is a need of

applications to search the tattoo images. The Anil K. Jain *et al.* [21] described an idea for this type of forensic requirement by the concept of tattoo image matching and retrieval. This retrieval is achieved by the Tattoo-ID based matching system. The image features are derived using *Scale invariant feature transform* (SIFT).

The tattoo image retrieval is achieved by another application which is presented in the paper [22] to assist the forensic department people for their crime detective operations. In this paper the author Joonsoo Kim develops a tattoo image retrieval scheme by the user. The selected ROI is searched in database using *scale invariant feature transformation* (SIFT) and *Local self similarity* (LSS) methods. This method achieves good performance

### **E. CBIR Applications on Security Issues**

Physician or a diagnosis aid system can search medical images into a distance server using a query image and that server retrieves that relevance images and share that health records with the physician or diagnosis aid system. In this case security issues raised to maintain the confidentiality and data privacy. Due to this reason, there is a need of CBIR systems with security which should support retrieval of encrypted images. The paper [23] develops a method to support this type of applications using homomorphic encrypted images. The wavelet based image features are used in this method and the encrypted images can be retrieved by physicians using client server architecture with secured way.

The author Hang Cheng [24] provides a CBIR method to support the encrypted image retrieval application. This method uses encrypted jpeg images for secured retrieval of medical images. The AC coefficients of markov process are used to maintain security. In client side, the encrypted images (returned by the server) are decrypted to original image using encryption key. Biometric security systems have been attracting researchers because of its unique power in security systems. Biometric security systems are deals with human's unique physical or behavioral characteristics to help the identification system. To tune the speed of identification into fast mode, the CBIR systems can help to the development of biometric security system. The paper [25] prescribes a method to image retrieval for biometric security system by using three features such as color, texture and shape. This method not only fastens the biometric system speed and it reaches better accuracy level in image retrieval.

The increase of airports and latest monitor equipments hike the quantity of monitoring data (or images) too large to handling. To improve this airport video monitoring system, the CBIR methods can able to help to improve the security level. The airport security can be further accelerated by the

CBIR method which is described in the paper [26] using Distributed indexing Schema D-MVP.

### **F. CBIR applications in E-Commerce**

E-purchase is the current trend in the world rather than traditional shop purchases because of convenience of internet. When the time of E-purchasing, the users meet a problem on selection of needed items to purchase. The CBIR systems can assist the user's choices in clothing and help them for the better selection of clothing during e-purchase. The paper [27] concentrates on this type of E-Commerce based application using the feature sets such as colors, shapes and textures.

The paper [28] designs a CBIR Method to assist the users while their E-Purchasing for the improvement of E-Commerce facilities. This method enriches the search and retrieval of product information using CBIR in the application of clothing electronic retailing. This method concentrates on men's shirt retailing via computer based sales using the feature sets such as color and texture. As a result of this application the sales of an E-Commerce website is increased abundantly.

Many business organizations maintain their trademarks for their business protection because trademark is a form of intellectual property rights. The protection of trademark symbols is an unavoidable concept for business organizations. The CBIR systems provide solution for the protection of trademarks by finding the duplicate trademark images using their own feature sets. The paper [29] supports for this type of business application by search similar symbols from a trademark symbol bank. Watershed transform is adopted with this method for extraction of features and a tree structure is utilized to index images.

In E-Commerce based marketing, the logos and trademarks catch its high position, because of its uniqueness and high value. To maintain the business, the organizations need to search and confirm about the non-duplication of their logos and trademarks. An application is proposed by the paper [30] for the retrieval of color logos and trademarks to support business activities. This target is achieved using the dominant color and spatial similarity.

### **G. CBIR applications on miscellaneous activities**

The researches about the ancient chinese characters assist human to better understanding the chinese culture. These chinese characters look like neat, but there exists some differences between various versions of the characters. To study these characters, the CBIR systems can be utilized because CBIR systems can retrieve similar characters from the chinese character bank. The paper [31] designs a method for ancient chinese character image retrieval using the

effective neighboring clustering method, and coarse periphery features and edge directional line element features.

The number of image collections in web is continuous to grow every year and a key problem of how to organize this

large quantity images? is also arise from every human. The image collection formation can be used to provide catalogs for navigation and summarization. The paper [32] addresses

**Table I : Comparative survey of CBIR applications and methods**

S. No	CBIR Applications	Areas	Methods
1	Medical applications	MRI Image analysis [1]	SVM [1]
		Brain tumor image retrieval [1]	SVM [1]
		Lungs image retrieval [3], [6]	CQA and FSSEM [3]
		Histological image retrieval [2], [4]	QDMFF [2], I-Browse [4]
		Pathological image retrieval [5]	Graph based CBIR
2	Remote sensing image retrieval	Remote sensing image retrieval [7], [8]	structure tensor Riemannian statistical model[7], RSIsGrid [8]
		Satellite image retrieval [9]	Wavelet based multivariate model[9]
		Geographical image retrieval [10], [11]	Chance detection using RF[10], VLAD [11]
		Aerial image retrieval [12]	K-means segmentation in NTSC color space
3	Natural image retrieval	Natural image retrieval [13], [14]	CSM[13] saliency textons [14]
		Color image retrieval [15],[16],[17]	LCOD [15], Fuzzy logic [16], Salient structure histogram [17]
		Texture image retrieval[18]	Four orthogonal transforms [18]
4	Forensic applications	Glare based image retrieval [19]	Using Benford's law [19]
		Camera identification based image retrieval image [20]	compressed camera identification [20]
		Tattoo image retrieval [21], [22]	SIFT [21], SIFT and LSS [22]
5	Security applications	Encrypted image retrieval [23], [24]	Wavelet based feature[23] AC coefficients of markov process [24]
		Biometric security system using CBIR [25]	color, texture and shape [25]
		Airport video monitoring [26]	Distributed indexing schema [26]
6	Business applications	E-commerce application [27]	color, texture and shape [27]
		Electronic retailing [28]	color and texture [28]
		Trademark image retrieval [29]	watershed transform [29]
		Logos image retrieval [30]	color and spatial similarity [30]
7	Miscellaneous applications	Ancient Chinese character image retrieval[31]	Neighboring clustering method, coarse periphery features and edge directional line element feature [31]
		Image collection organization [32]	Vector Space Model (VSM) [32]
		Video retrieval using CBIR [33],[34]	CLD, Edge histogram descriptor and co-occurrence matrix [33] Query and Annotation-based image retrieval (ABIR) [34]

the key problem of organizing image collections and their spectacular applications. The CBIR application of paper [32] concentrates on both low level image content and high level semantics to produce better image organization depending on the user's taste.

The CBIR applications can be useful to improve the tourism of a country. The Paper [33] projected a new idea with handheld devices and CBIR to improve the tourism. The tourism oriented images are stored in a server, and the CBIR is running on the server. When the tourist found an interesting subject in his tour, he can photograph that image of subject using his handheld device and can query the relevance images

using the query image which he has taken. The CBIR technique retrieves the relevance images from server and send back results the hand held devices of user. The tourist can study the important related matters about his interesting subject. The *color layout description* (CLD), *Edge histogram descriptor* and *co-occurrence matrix* techniques are used to achieve this tourism application.

Video retrieval is the crucial application in multimedia requirements. It can be useful for video search and browsing in the web. The paper [34] exploits an application for video retrieval using CBIR concept. The database videos are separated into frames and the query image is used to retrieve the relevant videos. Color features, shape features and texture features are used for this achievement.

### III. DISCUSSION

This paper divides the CBIR applications into seven separations and reviews the latest papers associated with them to understand each and every CBIR applications. The table 1 expresses some meaningful discussions on CBIR applications. Also it shows the comparative survey of categories in each application and the methods adopted by each category and give the papers referred. Mean retrieval time for paper [1] is around 19 seconds. CQA yields 73.18 percent effective retrieval precision in paper [2]. Mean average precision 52.43 for paper [6]. For paper [8], the average precisions are 72.6% and 59.6% for the ontology-based and the keyword-based retrieval, respectively and the computational time for paper [9] is around minutes. Equal error rate is 94% for paper [10] and precision rate is 54% and 77.20 for paper [14] and [17] respectively. SCD running time is of 0.06 seconds for paper [33]. For some papers the precision rate is not reported.

### IV. CONCLUSION

The real world needs CBIR idea in many fields such as medical image retrieval, natural image retrieval and remote sense image retrieval etc. This paper presents some latest application developed based on CBIR to assist the fields such as image retrieval in medical, natural and remote sense images. This paper also illustrates the latest papers which are handled the applications with related to business, security, forensic and miscellaneous fields. The papers listed in this review-of-CBIR-application provide data about how CBIR can be utilized for the above mentioned seven types of applications? This paper concludes that CBIR can be used too many real world application with the benefit to users. The readers who read this paper can easily understand and study the different type of applications using CBIR. Paper [8] and paper [17] gives better average precisions rate as 73% and 77% respectively.

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