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Performance Enhancement of Content Based Image Retrieval System Using Contrast Limited Adaptive Histogram Equalization

[1]Bhaswati Das, [2]Deepak Sharma
[1](M.tech student, ECE,M.M Engineering College, Mullana , Ambala, Haryana, India)
[2(]Assitant Professor ECE Deptt. M.M Engineering College, Mullana ,Ambala, Haryana, India)

ABSTRACT - *The retrieval performance of content-based image retrieval (CBIR) systems still leaves much to be desired, especially when the system is serving as an interface to an image collection covering many different topics. The problem of missing semantical information about the images leads to great numbers of false matches because of misleading similarities in the visual primitives that are retrieved. In this paper we used the feature extraction to improve the efficiency of the content based image retrieval system. Our Experimental results shows there is an improvement in proposed system.We used CLAHE(Contrast Limited Adaptive Histogram Equalization)for better results. At the end we had analysed the performance of CBIR system using CLAHE and without using CLAHE by calculating precision and recall.*
KEYWORDS: *CBIR(Content Based Image Retrieval, CLAHE(Contrast Limited Adaptive Histogram Equalization), Discrete Wavelet Transform(DWT), feature extraction, precision/recall.*

I. INTRODUCTION

This paper gives an overview of the currently available literature on content based image retrieval. It evaluates after a few years of developments the need for image retrieval and presents concrete scenarios for promising future research directions. This section gives an introduction to content based image retrieval systems (CBIRSs) and the technologies used in them. Image retrieval has been an extremely active research area over the last 10 years, but the review articles on access methods in image databases appeared already in the early 80s [1]. The following articles from various years explain the state of the art of the corresponding years and contain references to a large number of systems and descriptions of the technologies implemented. Enser [2] gives an extensive description of image archives, various indexing methods and common searching tasks, using mostly text based searches on annotated images. The overview of the research domain in 1997 is given and in the past, present and future of image retrieval is highlighted. An almost exhaustive overview of published systems is given and an evaluation of a subset of the systems is attempted [6]. Unfortunately, the evaluation is very limited and only for very few systems. The most complete overview of technologies to date is given by Smeulders [7]. This article describes common problems such as the semantic gap or the sensory gap and gives links to a large number of articles describing the various techniques used in the domain.

II. BLOCK DIAGRAM OF CBIR

Basic idea behind CBIR is that, when building an image database, feature vectors from images (the features can be color, shape, texture, region or spatial features, features in some compressed domain, etc.) are to be extracted and then store the vectors in another database for future use. When given a query image its feature vectors are computed. If the distance between feature vectors of the query image and image in the database is small enough, the corresponding image in the database is to be considered as a match to the query. The search is usually based on similarity rather than on exact match and the retrieval results are then ranked accordingly to a similarity index. The block diagram of basic CBIR system is as shown in Figure.1.

A. Image

An image (from Latin: *imago*) is an artifact that depicts or records visual perception, for example a two dimensional picture, that has a similar appearance to some subject usually a physical object or a person, thus providing a depiction of it.

B. Database index and storage

A collection of image data, typically associated with the activities of one or more related organizations .Focuses on the organization of images and its metadata in an efficient manner. Sometimes delves more thoroughly into an image's content query by an image's characteristic rather than just keywords/tag. It efficiently store images in database.

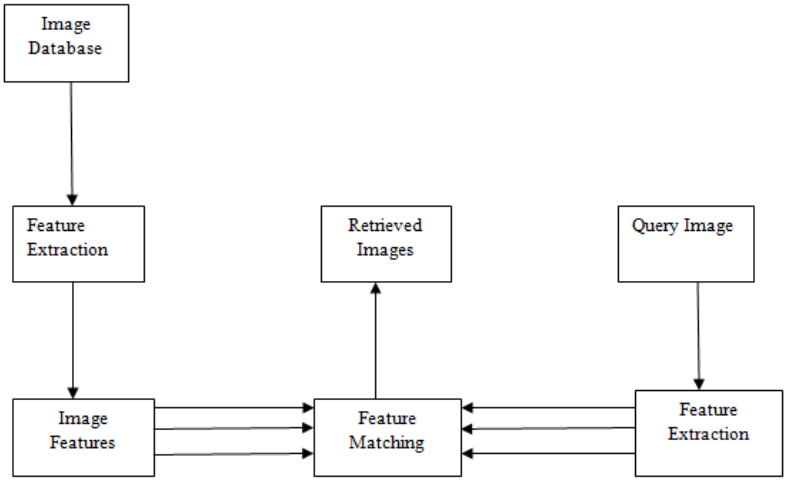

Figure 1.Block diagram of Content based image retrieval

C. Query image and Query result

Query image is something which is used to retrieve image from the database that satisfy the criteria of similarity to the user's query image. An image retrieval system is a computer system for browsing, searching and retrieving images from a large database of digital images.

D. Contrast Limited Adaptive Histogram equalization (CLAHE)

Adaptive histogram equalization (AHE) is a computer image processing technique used to improve contrast in images. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast of an image and bringing out more detail. However, AHE has a tendency to over amplify noise in relatively homogeneous regions of an image

III. PROPOSED WORK

At first a query image is read and the then images from the database is read. Then we have used CLAHE(Contrast Limited Adaptive Histogram in the images. After that we have extracted the features by using Discrete Wavelength Transform (DWT). After the feature extraction, all extracted feature will be form in feature vector. The query image then compared with images database by calculating the Euclidean distance. Ranking all relevant images and sorting them in ascending order based on Euclidean distance and displayed resultant images with highest rank. The system then ranking the images and display the top relevant images to user. The CBIR system performance measurement is based on the Precision and Recall. The experimental result are conducted using Matlab7.0. For this experiment we used image database from practical lab.

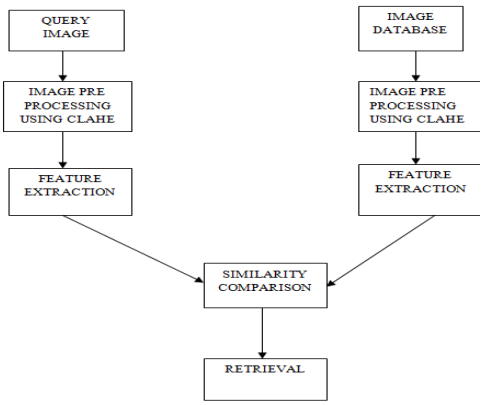

Figure 2.Implementation of CBIR

An image retrieval system is a computer system for browsing, searching and retrieving images from a large database of digital images. 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. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (e.g. the same measurement in both feet and meters) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. The transform of a signal is just another form of representing the signal. It does not change the information content present in the signal. The Wavelet Transform provides a time-frequency representation of the signal. It was developed to overcome the short coming of the Short Time Fourier Transform (STFT), which can also be used to analyze non-stationary signals. While STFT gives a constant resolution at all frequencies, the Wavelet Transform uses multi-resolution technique by which different frequencies are analyzed with different resolutions. A wave is an oscillating function of time or space and is periodic. In contrast, wavelets are localized waves. They have their energy concentrated in time or space and are suited to analysis of transient signals.

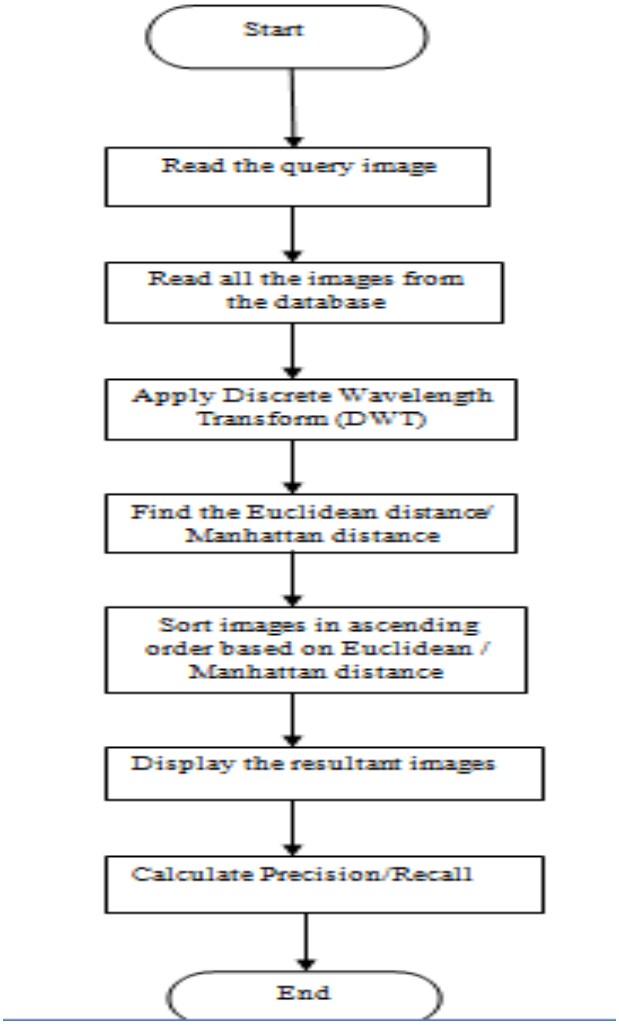

Figure 3 Flow chart of image retrieval without using CLAHE

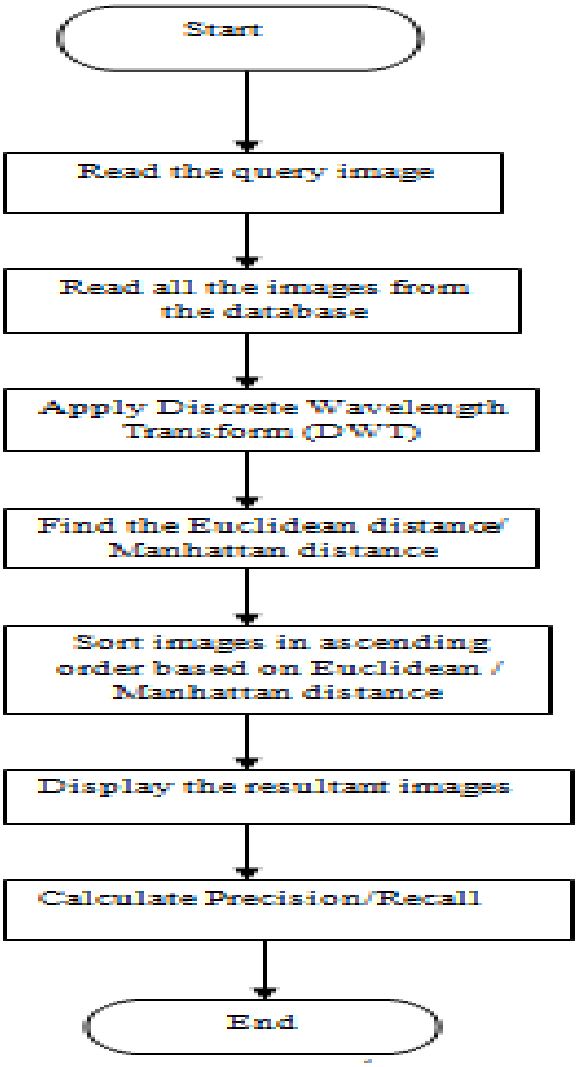

Figure 4 Flow chart of image retrieval using CLAHE

IV. RESULT AND DISCUSSION

The CBIR system performance measurement is based on the Precision and Recall. The experimental result are conducted using Matlab7.0. For this experiment image database is used from practical lab.Precision is defined as the number of relevant images retrieved by a search devise by the total number of images retrieved by the search.Recall is defined as the number of relevant images retrieved by search divided by total number of existing relevant image.The precision and recall is calculated by the following formula:

Precision = Total no of images retrieved
No of relevant images retrieved

Recall = Total no of images retrieved
Total no of relevant images in database

In this paper, similarity comparison technique is used for the better performance of the CBIR system and the better similarity in the query image and the images which are retrieved. The technique is as follows:

- Euclidean Distance: $d(q,p) = \sqrt{\sum_{i=1}^{n}(qi - pi)^2}$ where $p = (p1,p2,\dots,pn)$ and $q = (q1,q2,\dots,qn)$.

Images are retrieved in two ways. It is retrieved first without using Contrast Limited Adaptive Histogram Equalization (CLAHE) and then using CLAHE. Contrast Limited AHE (CLAHE) differs from ordinary adaptive histogram equalization in its contrast limiting. This feature can also be applied to global histogram equalization, giving rise to contrast limited histogram equalization (CLHE), which is rarely used in practice. In the case of CLAHE, the contrast limiting procedure has to be applied for each neighbourhood from which a

transformation function is derived. CLAHE was developed to prevent the over amplification of noise that adaptive histogram equalization can give rise to.

3.1 Images retrieved without using CLAHE.

Figure 5 Query image

At first query image is read and then ten relevant images from the databases is read.After reading the ten relevant images from the large database ,the features from the image is extracted. Discrete Wavelength Transform(DWT) is used for feature extraction.For similarity comparison the query image and the images from the databases is compared using Euclidean distance.In Figure 4.1 it is seen that that the query image is read and in Figure 4.2 it is seen that ten relevant images is retrieved from the database with respect to query image on the basis of Euclidean distance.

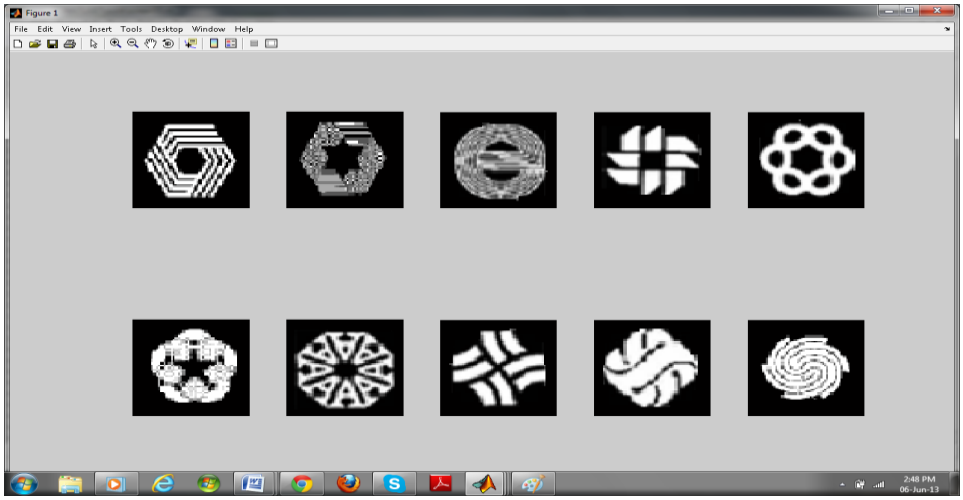

Figure 6 Ten relevant images

3.2 Images retrieved using CLAHE

For better performance of CBIR system, Contrast Limited Adaptive Histogram Equalization (CLAHE) is used. CLAHE helps in preventing the over amplification of noise.

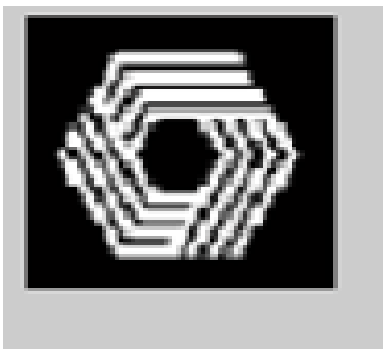

Figure 7 Query image

Then again the similar procedure is applied in retrieving images as in case of images retrieved without using CLAHE.After applying CLAHE,feature is extracted using DWT and then similarity comparison of the query image and images in the database is done using Euclidean distance.After determining Euclidean distance of the query image with the other images in the database,the image which has least Euclidean distance is considered to be the best image.So it is seen in Figure 4..3,a query image is read and in Figure 4.4 it is clearly showed that ten relevant images are retieved on the basis of Euclidean distance.

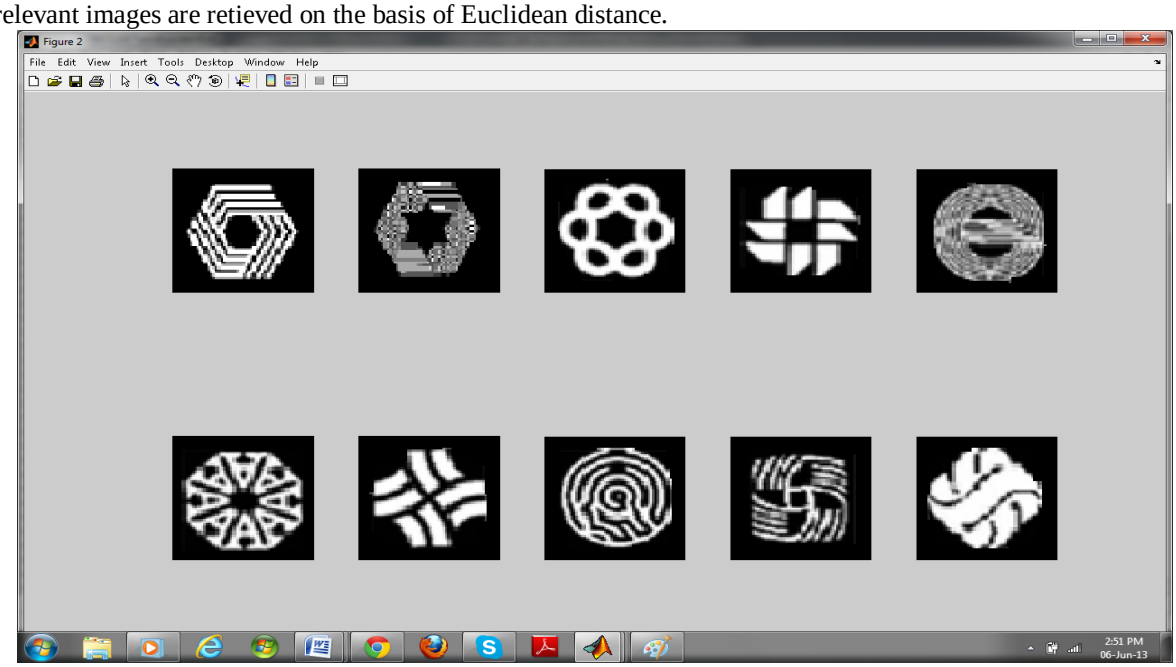

Figure 8 Ten relevant image.

It is seen that in Table 4.1 ,the Euclidean distances of some images is compared between the retrieved images without using CLAHE and then using CLAHE.

Table 1 Comparison between Euclidean distance of retrieved images using CLAHE and without using CLAHE

METHOD	**1st IMAGE**	**2nd IMAGE**	**3rd IMAGE**	**4th IMAGE**	**5th IMAGE**	**6th IMAGE**	**7th IMAGE**	**8th IMAGE**	**9th IMAGE**
Without using CLAHE	0	5.4350	6.1876	6.8184	6.8567	6.9514	6.9593	7.2008	7.5123
With using CLAHE	0	4.8434	5.5245	6.0002	6.1289	6.2159	6.2332	6.3492	6.6161

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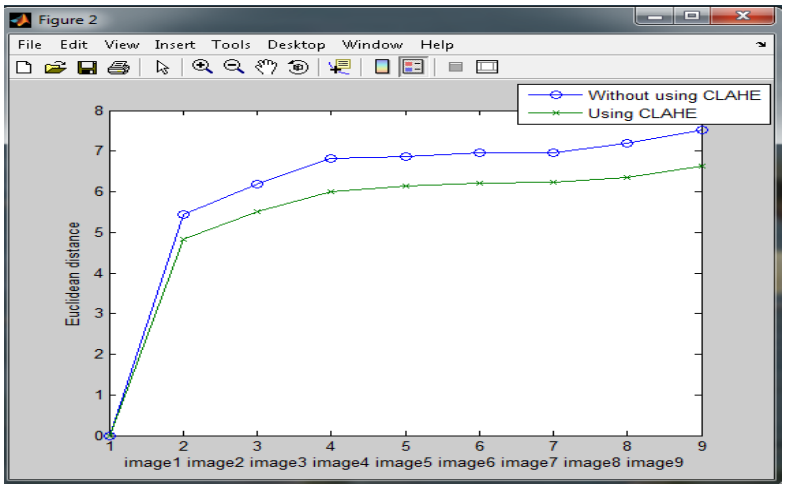

Figure 9 Comparison between Euclidean distance of retrieved images using CLAHE and without CLAHE

In Figure 9,it is seen that two line graphs are plotted with different points of Euclidean distance first without using CLAHE and then using CLAHE. Now precision and recall of all the images is calculated one by one to find the accuracy of the images. Images in the database is categorized and then precision and recall is calculated one by one in each category for better performance in the accuracy of the images.

Method	Average precision	Average recall
Content Based Image Retrieval without using CLAHE	0.35	0.44
Content Based Image Retrieval using CLAHE	0.40	0.47

Table 2. Performance analysis of CBIR system using CLAHE and without using CLAHE by calculating average precision and average recall.

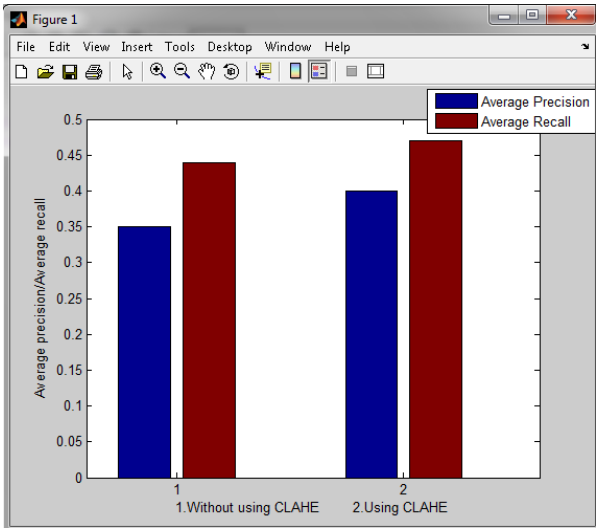

Figure 10. Performance analysis of CBIR system using CLAHE and without using CLAHE by calculating average precision and average recall.

Thus it is seen in Table 2 the average precision and average recall is calculated and then it is compared first without CLAHE and then using CLAHE and in Figure 10, a bar graph is plotted for the performance analysis of CBIR system using CLAHE and without using CLAHE by calculating average precision and average recall.

V. CONCLUSION

This paper described the outlines of an approach that aims at improving the performance of CBIR systems and successfully implemented a method which improves the performance of CBIR system by using CLAHE and the performance is enhanced in terms of accuracy by improving precision and recall. Two techniques are used for similarity comparison, Euclidean distance and Manhattan distance. This is done for looking the comparison of the images retrieved first by Euclidean distance and then again by Manhattan distance. After determining Euclidean and Manhattan distance of the query image with the other images in the database,the image which has least Euclidean and Manhattan distance is considered to be the best image. The Euclidean distances and Manhattan distances of the images is compared first between the retrieved images without using CLAHE and then using CLAHE. The performance of CBIR system is analysed using CLAHE and without using CLAHE by calculating precision and recall.Both precision and recall are increased in case of images retrieved by applying CLAHE in both the similarity comparison techniques, i.e Euclidean distance and Manhattan distance. Thus it is proved that after applying CLAHE the performance of the CBIR system increases on the basis of precision/recall.

REFERENCES

[1] S.-K. Chang, T. Kunii, Pictorial database applications, IEEE Computer 14 (11) (1981)13{21}.
[2] P. G. B. Enser, Pictorial information retrieval, *Journal of Documentation 51 (2)*(1995) 126{170}.
[3] A. Gupta, R. Jain, Visual information retrieval,Communications of the ACM 40 (5)(1997) 70{79}.
[4] Y. Rui, T. S. Huang, S.-F. Chang, Image retrieval:Past, present and future, in: M. Liao (Ed.), Proceedings of the International Symposium on Multimedia Information Processing,Taipei, Taiwan, 1997.
[5] J. P. Eakins, M. E. Graham, content based image retrieval, Tech. Rep. JTAP{039, JISC Technology Application Program, Newcastle upon Tyne (2000).
[6] C. C. Venters, M. Cooper, content based image retrieval, Tech. Rep. JTAP 054, JISC Technology Application Program (2000).

[7] A. W. M. Smeulders, M. Worring, S. Santini,A. Gupta, R. Jain, Content based image retrieval at the end of the early years,IEEE Transactions on Pattern Analysis and Machine Intelligence 2.

[8] Savvas A. Chatzichristofis, Yiannis S. Boutalis,"Im g(Rummager): An Interactive Content Based Image Retrieval System.," Second International Workshop on Similarity Search and Applications,pp. 151-153,2009.

[9] Michael Lama, Tim Disneyb, Mailan Phamc, Daniela Raicud, Jacob Furstd, Ruchaneewan Susomboond, "Content-Based Image Retrieval for Pulmonary Computed Tomography Nodule Images," National Science Foundation,pp. 155-167,2008.

[10] Nidhi Singha,Kanchan Singhb, Ashok K. Sinha, "A Novel Approach for Content Based Image Retrieval," Procedia Technology 4,Elsevier publications,pp. 245-250,2012.

[11] Zhenhua Zhang, Wenhui Li, "An Improving Technique of Color Histogram in Segmentation-based Image Retrieval," Fifth International Conference on Information Assurance and Security,pp. 381-384,2009.

[12] Miguel Angel Veganzones,Manuel Graña, "A Spectral/Spatial CBIR System for Hyperspectral Images,"IEEE journal of selected topics in applied earth observations and remote sensing, vol. 5, no. 2,pp. 488-500,April,2012.

[13] Lining Zhang, Lipo Wang,Weisi Lin, "Generalized Biased Discriminant Analysis for Content-Based Image Retrieval," IEEE transactions on systems, man, and cybernetics—part b: cybernetics, vol. 42, no. 1,pp. 282-290,Feb,2012.

[14] Gerald Schaefer, " Content-based retrieval from image databases: colour, compression, and browsing,"IEEE Trans,Image Process ,vol.29,pp. 5-10,2010.

[15] Jennifer G. Dy, Carla E. Brodley, Avi Kak, Lynn S. Broderick, Alex M. Aisen," Unsupervised Feature Selection Applied to Content-Based Retrieval of Lung Images" IEEE transactions on pattern analysis and machine intelligence, vol. 25, no. 3,pp. 373-378, March, 2003.

[16] Zhong Su, Hongjiang Zhang, Stan Li, and Shaoping Ma, "Relevance feedback in Content-based Image Retrieval: Bayesian framework, feature subspaces,and progressive learning" IEEE transactions on image processing, vol. 12, no. 8, pp. 924-937,Aug, 2003.

[17] Raghu Krishnapuram, Swarup Medasani, Sung-Hwan Jung, Young-Sik Choi," Content-Based Image Retrieval Based on a Fuzzy Approach" IEEE transactions on knowledge and data engineering, vol. 16, no. 10, pp. 1185-1199,Oct ,2004.

[18] Dionysius P. Huijsmans and Nicu Sebe," How to Complete Performance Graphs in Content-Based Image Retrieval: Add Generality and Normalize Scope", IEEE transactions on pattern analysis and machine intelligence, vol. 27, no. 2, pp. 245-251,Feb, 2005.