Survey Paper on Content Based Image Retrieval

Rahul Moriwal
Department of Computer Science & Engineering
Acropolis Institute of Technology & Research, Indore (M.P.)-452001, India

Abstract— The content based image retrieval (CBIR) is the well-liked and heart favorite area of research in the field of digital image processing. The key goal of content based image retrieval (CBIR) is to excerpt the visual content of an image directly, like color, texture, or shape. There are several applications of the CBIR technique such as forensic laboratories, crime detection, image searching etc. For the purpose of feature extraction of well-matched images from the database, a universal CBIR system utilizes texture, color and shape based techniques. In this presented work, we have offered an efficient approach for the content based image retrieval, where images are decomposed using the wavelet transform, it means that the image features are converted in the matrix form and a color feature data set is prepared. In order to improve search results we have used k-means algorithm. It is shown by experimental results that, the efficiency of the proposed method is improved in contrast with the existing method.

Keywords: Image Retrieval, Clustering, Wavelet Transform, HaarWavelet Transform, Feature Extraction, K-Means Technique

I. INTRODUCTION

As processors become increasingly powerful, and memories become increasingly cheaper, the deployment of large image databases for a variety of applications have now become realizable. Databases of art works, satellite and medical imagery have been attracting more and more users in various professional fields for example, geography, medicine, architecture, advertising, design, fashion, and publishing [1]. Effectively accessing desired images from large and varied image databases is now a necessity. Due to development of multimedia technology and increasing vogue of the computer network, the conventional information retrieval systems are not able to overcome the users' current need. There are various areas in which digital images are used such as-crime prevention, commerce, finger print recognition, surveillance, hospitals, engineering, architecture, fashion, graphic design, academics, historical research, and government institutions etc. Because of this widespread demand we need to enhance in retrieval precision and minimized retrieval time. The prior methods were only dependent on text based searching instead of its visual feature. Many times just one keyword is redundantly used with more than one images, therefore it leads to erroneous outcomes. Consequently, Content Based Image Retrieval (CBIR) is evolved to defeat the restriction of text based retrieval [2]. Lately, the content-based image retrieval has grown as hot topic and the methods of content-based image retrieval are recognized as a great development work [3]. In typical content based image retrieval (CBIR) system the visual content of the images in the database are extracted and described by multidimensional future factors. Colors are widely used for image retrieval in an Image Retrieval System.

The content based image retrieval (CBIR) is one of the most popular, rising research areas of the digital image processing. Most of the available image search tools, such as Google Images and Yahoo! Image search, are based on textual annotation of images. In these tools, images are manually annotated with keywords and then retrieved using text-based search methods. The performances of these systems are not satisfactory. The goal of CBIR is to extract visual content of an image automatically, like color, texture, or shape. The CBIR technology can be used in several applications such as digital libraries, crime prevention, and photo sharing sites. Such a system has great value in apprehending suspects and identifying victims in forensics and law enforcement. A possible application is matching a forensic sketch to a gallery of mug shot images. The area of retrieve images based on the visual content of the query picture intensified recently, which demands on the quite wide methodology spectrum on the area of the image processing. "Content-based" means that the search will analyze the actual contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. Here the 'content' refers to colors and textures information that can be derived from the image itself. CBIR is desirable because most web based image search engines rely purely on metadata and this produces a lot of false detection in the results [4]. Also having humans manually enter keywords for images in a large database can be inefficient, expensive and may not capture every keyword that describes the image. There are two fundamental principles of Content Based Image Retrieval systems for the image retrieval and they are-feature extraction and matching. When we gave the image as input to the image retrieval system, then it extorts the features of image and these features were compared with the features of images which are already stored in the database. After that image retrieval system figure out the distance between input image and further images which are already stored in the database and then images are shortlisted based upon their distance. At this time we have a list of the images that have smaller distance with input image or image to be searched and these images are considered as outcome of the image retrieval system. This searching process is depends on most identical image that are already stored in the database, instead of exact match of a searched image [2]. To describe the image through small number of descriptors, feature extraction is one of the most essential steps in the image retrieval system. The fundamental visual features of the images comprise color and texture [5]. The color feature provides user an experience related to visual similarity, however the texture doesn't provide much of visual experience, yet it helps in retrieving depending upon patterns / textures [6]. Second most important feature of images is texture. Whose representation is being used for pattern recognition and computer vision.

II. LITERATURE SURVEY

Carrying out literature analysis is very major part in any research project as it obviously establishes the requirements of the work and the background improvement. It makes related queries regarding enhancements in the study previously done and permits unsolved problems to come out and thus clearly describe all boundaries concerning the development of the research plan.

A. Ivan Lee, Paisarn Muneesawang and Ling Guan [12]:

Ivan Lee, et.al. (1996) have present the analysis of the CBIR system with the human controlled and the machine controlled relevance feedback, over different network topologies including centralized, clustered, and distributed content search. In their experiment for the interactive relevance feedback using RBF, they observe a higher retrieval precision by introducing the semi-supervision to the non-linear Gaussian-shaped RBF relevance feedback.Relevance feedback suffers from few vital problems - User interaction for providing feedback is time consuming and it is a tiring process.

B. E.L. van den Broek, L.G. Vuurpijl, P. Kisters and J.C.M. Von Schmid Nijmegen [7]:

E.L. van den Broek et al have proposed a CBIR system with Color Selection scheme which provides facilities for query-by-color, which is depends on 11 color categories, utilized for color scheme by everyone. Here images are extracted via low frequency DCT coefficients which are changed from YUV color space. Thus ultimately system proposed by authors provides improved retrieval performance to help people choose from the dominant features of query images. This methodology will ultimately improve effective retrieval based on people preferences on the queried image. In Region of Interest Image Indexing System [9], a person can search images from database through the use of region of interest (ROI) also this will provide you results based on region preferences while searching through database.But the technique is only sufficient for performing effective retrieval by introducing users' opinions on the query images; this is the main drawback of this technique.

C. Wei-Ying Ma and B. S. Manjunath [13]:

Wei-Ying Ma et al have proposed a model for image retrieval system which was evolved at the University of California at Santa Barbara. For feature extraction this system utilizes a hybrid methodology which integrates texture, color, and shape details from an image using indexing technique. The most significant characteristic of the NETRA is to utilize segmented local regions for indexing of images inside the database. So that, global and local both types of characteristics are utilized.The retrieval performance of NETRA is based on low-level feature similarity of images and it was soon realized that the performanceof NETRA was limited due to the semanticgap as they were unable to infer the interest of the user.To overcome this, most content-based image retrieval systemstypically utilize mouse-clicks and other traditional forms ofinput to identify the regions or objects of interest.

D. John M. Zachary, Jr. and Sitharama S. Iyengar [14]:

John M. Zachary et al have presented the issues from the perspective of real-world system formation. It also discusses some of the major feature extraction methods utilized in existing CBIR systems, and review numerous CBIR system implementations.

E. Rong Zhao and William I. Grosky [15]:

Rong Zhao and William I. Grosky (2002) view that bridging the semantic gap between the low-level features and the high-level semantics is within the interface between the user and the system. In this paper authors utilized latent semantic analysis which finds differentimage features co-occur with similar annotation keywords, and consequently lead toimproved techniques of semantic image retrieval, but it is observed that latent semantic analysis not correctly and efficiently finds the image features. Other research direction is towards improving aspects of CBIR systems by finding the latent correlation between low-level visual features and high-level semantics and integrating them into a unified vector space model.

F. Peter Stanchev, David Green Jr., and Boyan Dimitrov [16]:

Peter Stanchev, et. al. proposed that several visual descriptors exist for representing the physical content of images, for instance color histograms, textures, shapes, regions, etc. Depending on the specific characteristics of a data set, some features can be more effective than others when performing similarity search. For instance, descriptors based on color representation might be effective with a data set containing mainly black and white images. Techniques based on statistical analysis of the data set and queries are useful. Even if it is not possible, in general, to overcome the semantic gap in image retrieval by feature similarity, it is stillpossible to increase the retrieval effectiveness by a proper choice of the image features, among those in theMPEG-7 standard, depending on the characteristics of the various image data sets (obviously, the morehomogeneous the data set is, better results can be obtained).

G. Ryszard S. Chora´s [11]:

Ryszard S. Chora´s (2007) contributes their work for the identification of the problems existing in CBIR and Biometrics systems describing image content and image feature extraction. They have described a possible approach to mapping image content onto low-level features. Their paper investigated the use of a number of different color, texture and shape features for image retrieval in CBIR and Biometrics systems.

H. Gaurav Jaiswal and Amit Kaul [17]:

Gaurav Jaiswal and Amit Kaulconcluded that content based image retrieval is not a replacement of, but rather a complementary component to text based image retrieval. Only the integration of the two can result in satisfactory retrieval performance. In this paper they reviewed the main components of a content based image retrieval system, including image feature representation, indexing, and system design, while highlighting the past and current technical achievement.

I. Chih-Chin Lai and Ying-Chuan Chen [18]:

Chin-Chin Lai et al have tried decrease the gap among the retrieval outcomes and the users' anticipation by demonstrating an interactive genetic algorithm (IGA). Here, authors have utilized the attributes of color like the standard deviation, mean value, and image bitmap. The features of texture for example entropy depend upon the gray level co-occurrence matrix and the edge histogram which are utilized by the authors. In thispaper authors have proposed IGA which is very difficult and very complex for identification of images, further moreentropy feature is used as texture feature in which data distributions leads to lacks of the constraints.

J. Sagar Soman, Mitali Ghorpade, Vrushali Sonone and Satish Chavan [19]:

Sagar Soman et al have utilized Content Based Image Retrieval (CBIR) technique on color and texture of images. Here, author demonstrates two different methods for feature extraction. General CBIR system utilizes color, texture and shape as the base criterion for feature extraction technique to get better search results if we query images from databases. In proposed CBIR system, author proposes use of color and texture for feature extraction. In order to retrieve texture features they are applying block wise Discrete Cosine Transforms (DCT) on complete image and to extract color feature they have utilized moments of colors (Deviation, Mean and Skewness) on the set of queried images from database. For obtaining better results in image retrieval they were comparing feature vectors of the query image with the feature vectors of the images in database. They were computed the separate and combined vectors by utilizing color and texture features and in comparison they showed that combined feature vector outcomes were comparatively better. In this paper authors utilized Discrete Cosine Transforms (DCT) (to retrieve a texture feature) which is very complex method and not generate better image features and also its application area is limited to the image compression. This technique utilizes the combination of features so it required more memory to store the image features.

K. Swapnalini Pattanaik and Prof. D. G. Bhalke [20]:

Pattanaik, Bhalke (2012) has worked to prove that Content Based Image Retrieval has overcome all the limitation of Text Based Image Retrieval by considering the contents or features of image. A query image can be retrieved efficiently from a large database. A Database consists of different types of images has implemented on the system. Different Features such as histogram, color mean, Color structure descriptor texture is taken into consideration for extracting similar images from the database. From the experimental result it is seen that combined features can give better performance than the single feature. So selection of feature is one of the important issues in the image retrieval. The system is said to be efficient if semantic gap is minimum. The proposed technique utilized combination of features so it required more space to store the image features, this is the main drawback of this image. The result can be improved in future by introducing feedback and user ‟s choice in the system.

L. Pooja Verma and Manish Mahajan [9]:

Pooja Verma and Manish Mahajan(2012)have used canny and sobel edge detection algorithm for extracting the shape features for the images. After extracting the shape feature, the classified images are indexed and labeled for making easy for applying retrieval algorithm in order to retrieve the relevant images from the database. In their work, retrieval of the images from the huge image database as required by the user can get perfectly by using canny edge detection technique according to results. In this paper authors just compare the results based on the shape feature of image which is extracted with the help of canny and sobel edge detection algorithm, but the results have not shown any improvement as compared to results produced when consider color feature of an image.

M. Swapnalini Pattanaik and D.G. Bhalke [21]:

Swapnalini Pattanaik and D.G. Bhalke have demonstrated the basic idea of proficient retrieval of images with the help of most common features of Mpeg-7 (Multimedia Content Description Interface- 7). To present a set of standard techniques for demonstrating multimedia content is the foremost goal of Mpeg-7 and it also permitted fast and efficient content identification with supporting a great amount of applications. Here, color structure descriptor is utilized for color and edge histogram descriptor is utilized for texture by the authors. We can also increase the performance of CBIR system by utilizing these two features. Here, authors utilized MPEG-7 descriptors to achieve better results but the implementation of these descriptors is very complex and time consuming.

N. Devyani Soni and K. J. Mathai [2]:

Devyani Soni and K. J. Mathai have presented a technique for image retrieval dependent upon text, color space methodologies by means of color correlogram and color histogram. Color space methods utilized global color histogram and local color histogram and those are putted on both color spaces- RGB color space and HSV color space, and then they were compared. The color correlogram is the second order statistical method to compute spatial correlation. In this work, firstly the image will be investigated according to annotated text and then the color features will be taken out with the help of color histogram and color correlogram. In this paper color correlogram achieves the good retrieval performance among many others, such as color histograms, color coherence vector, but it comes along with many infeasibility problems such as its massive memory requirement and computational complexity.

III. CONCLUSION

The content based image retrieval (CBIR) is one of the most popular, rising research areas of the digital image processing. Most of the available image search tools, such as Google Images and Yahoo! Image search, are based on textual annotation of images. In this paper, we have provided the meaning of content based retrieval as well as all the work that is till now processed by all the researchers. Problems which we are identified in the existing image retrieval systems are as follows-

1) How to retrieve the search image accurately.

2) How we can manage a large database of images.
3) How we can make the searching process efficient.

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