A SURVEY ON CONTENT BASED IMAGE RETRIEVAL SYSTEM USING COLOR AND TEXTURE

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Abstract
In the past few decades, many technological advances have come into existence for image retrieval. Due to recent advances in science & technology, people are being motivated to communicate by sharing images, video, graphics etc. It results in the storage of large amounts of digital images and day by day this number is going high. The domains of digital images fall in diverse areas such as medical diagnosis, fashion industry, education, entertainment etc. Users are facing difficulties in accessing large amount of images from the database as the current commercial database systems are designed for text data and not well suited for digital images. Therefore efficient image searching and retrieval are important. In this context so many research have been done in CBIR. CBIR extract low-level features such as color, texture for comparing images. This survey covers various methods used for extracting low level features. In addition to these, the performance measures are also introduces.

Keywords: Content Based Image Retrieval, Feature extraction, Color, Texture, Performance Measure

1. Introduction
An image retrieval system is a computer system for browsing, searching and retrieving images from a large database of digital images [1]. Image retrieval has been an area of interest for researchers during the past few decades. Image retrieval is a specialized data search for exploring images from large database. In the early years Text Based Image Retrieval system was popular, but now-a-days Content Based Image Retrieval has become much admired research area for researchers. Figure 1 shows the typical content-based image retrieval systems. In this figure the visual contents of the images in the database are extracted and described by multi-dimensional feature vectors. The feature vectors of the images in the database form a feature database. To retrieve images, users provide the retrieval system with example images or sketched figures. The system then changes these examples into its internal representation of feature vectors. The similarities /distances between the feature vectors of the query example or sketch and those
of the images in the database are then calculated and retrieval is performed with the aid of an indexing scheme. The indexing scheme provides an efficient way to search for the image database. Recent retrieval systems have incorporated users' relevance feedback to modify the retrieval process in order to generate perceptually and semantically more meaningful retrieval results. [2]

Figure 1: Block diagram for content-based image retrieval system

2. Feature Extraction using Low-Level features
Feature extraction is the basis of Content Based Image Retrieval. These features are the characteristics of image content. Content Based Image Retrieval uses visual features such as color, texture, shape, spatial relationship etc. to represent and index image.

2.1 Color Feature
Color is the most frequently used visual feature for Content Based Image retrieval. To extract color feature from images, various methods are available. Some of these methods are given below:

2.1.1 Color Histogram
A color histogram is a widely used method among color feature extraction. It represents the proportion of particular colors in an image. Color histogram has HSV color space and RGB color space. These color space are used to compute color histogram. This color histogram is computed using HSV color space and RGB color space. This computed color histogram of each image is stored in the database. At the time of searching user can either specify the proportion of each color of his interest or can specify referencing image which is used to calculate color histogram. The system then retrieve those images whose color histogram match most closely to the user query.

2.1.2 Color correlogram
Color correlogram is the feature of color information. It has the advantage that it includes the spatial correlation of colors which can be used to describe the global distribution of local spatial correlation of colors and it is simple to calculate. [1].

2.1.3 Color Moments
Color moments are used to differentiate images based on their features of color. These moments provide a measurement for color similarity between images. These similarity values can be compared to the values of images indexed in a database for image retrieval. The color histogram, color moments and color set only contain the color information of each pixel in an image where as Color moments are the measures that can be used differentiate images based on their features of color. [1].

2.2 Texture
Texture is another important feature of image. It refers to uniform visual patterns within the image. It contains important information about the structural arrangement of the surface, such as; clouds, leaves, bricks, fabric, etc. It also describes the relationship of the surface to the surrounding environment.
short, it is a feature that describes the distinctive physical composition of a surface. [3] To extract texture feature from images, various methods are available. Some of these methods are given below:

2.2.1 Tamura Features
The Tamura Features include coarseness, contrast, directionality, likeliness, regularity and roughness in accordance with psychological studies on the human perception of texture. [4]

2.2.2 Wavelet Transform
The wavelet transform transforms the image into a multiscale representation with both spatial and frequency characteristics. It calculates the frequency. This allows for effective multi-scale image analysis with lower computational cost. Wavelet is popular tool in image processing and computer vision. Many applications, such as compression, detection, recognition, image retrieval have been investigated. Wavelet transform has features of space-frequency localization and multi resolutions. [1].

2.2.3 Gabor Filter
Gabor filters transform is a good multi-resolution approach that represents the texture of an image in an effective way using multiple orientations and scales. This approach has a spatial property that is similar to mammalian perceptual vision, thereby providing researchers a good opportunity to use it in image processing. Gabor filters are found to perform better than wavelet transform and other multi-resolution approaches in representing textures and retrieving images due to its multiple orientation approach. We use the Gabor filter approach to extract global texture features from the whole image, and to extract texture features from image regions[5].

3. Related Work
Rao et al. [6] proposed CTDCIRS (color-texture and dominant color based image retrieval system), they integrated three features like Motif co occurrence matrix (MCM) and difference between pixels of scan pattern (DBPSP) which describes the texture features and dynamic dominant color (DDC) to extract color feature. Ja-Hwung Su, Wei-Jyun Huang, Philip S. Yu, Vincent S. Tseng (2011) [7] have proposed a novel method, Navigation-Pattern-Based Relevance Feedback (NPRF), to achieve the high efficiency and effectiveness of CBIR. In terms of effectiveness, the proposed search algorithm NPRF Search makes use of the discovered navigation patterns and three kinds of query refinement strategies, Query Point Movement (QPM), Query Reweighting (QR), and Query Expansion (QEX), to converge the search space toward the user’s intention effectively. By using NPRF method, high quality of image retrieval on RF was achieved in a small number of feedbacks. The experimental data came from the collection of the Corel image database and the web images. The evaluation parameters used were precision and coverage. The experimental results revealed that the proposed approach NPRF is very effective in terms of precision and coverage. Within a very short term of relevance feedback, the navigation patterns can assist the users in obtaining the global optimal results.

ManimalaSingha and K.Hemachandran [8] presented a novel approach for Content Based Image Retrieval by combining the color and texture features called Wavelet-Based Color Histogram Image Retrieval (WBCHIR). Similarity between the images is ascertained by means of a distance function. The experimental result shows that the proposed method outperforms the other retrieval methods in terms of Average Precision. Moreover, the computational steps are effectively reduced with the use of Wavelet transformation. According to Kiranyaz et al. (2012) [9] the color feature of an image can be a powerful feature for the purpose of CBIR, if extracted in a perceptually oriented way and kept semantically intact. Dr.A.Kannan [10] has presented two diagnostic techniques Compute Tomography (CT) scan and Magnetic Resonance Imaging (MRI) are being implemented in medical field to diagnose any abnormal changes in tissues and organs for the early recovery of the patients. The condition of brain tumor of a patient is analyzed using Hybrid K-Nearest Neighbor Support Vector Machine (HKNNSVM) and Nearest Neighbor (NN) algorithms. The medical field plays a vital role in every country and day to day improvements are being conducted at regular intervals to save the life of the patients from very crucial diseases. Hence, the aim of CBIR system is to retrieve either homogenous or heterogeneous tumor conditioned MR images from the database based on the user’s need. The NN method is used to retrieve heterogeneous MR images from the database, whereas HKNNSVM algorithm is used to retrieve hom-
ogenous MR images from the database. K. Haridas, Dr. Antony Selvadoss Thanamani [11] have represented CBIR is a method of capturing relevant images from a large storage space. They experiments various methods like RGB Color Histogram, Tamura Texture and Gabor Feature. These methods are tested based on three parameters like Precision value, Recall value and Accuracy rate. After experiments, the results show that Gabor Feature Method is more efficient in comparison of other methods. The Gabor Feature contains 81.7% accuracy in CBIR system. Sumiti Bansal, Er. Rishamjot Kaur [12] has presented CBIR as a most important research area. Image retrieval is a technique of finding out most important features of image. Main task of CBIR is to get perfect and fast result. To get better results, relevance feedback techniques were conducted into CBIR such that more precise results can be obtained by taking user’s feedback. They present a review on CBIR using various techniques such as support vector machine (SVM) that should combine all relevance or irrelevance features such as color, texture, shape and size. SVM is used in real world problem like voice recognition, tone recognition, text categories, image classification, object detection, handwritten digital recognition and data classification.

Kommineni Jenni, Satria Mandala, Mohd Shahrizal Sunar [13] has extracted an image based on a query, from a database containing a large amount of images. They present a method for content based image retrieval based on support vector machine classifier. In this method the feature extraction was based on the color string coding and string comparison. Using database classification we can improve the performance of the content based image retrieval than compared with normal CBIR i.e. without database classification. Finally, this database classification and color string coding feature selection gives the better results. Savita Gandhani, Nandini Singhal [14] have proposed that in image processing, computer vision and pattern recognition, the image retrieval is a most popular research area. They have compared different color, texture and shape feature extraction methods that are mostly used in image understanding studies. These comparison shows that there is a performance variability between the various feature extraction methods. Ammar Huneiti, Maisa Daoud [15] have described that CBIR is becoming a necessity for many applications such as medical imaging, Geographic Information Systems (GIS), space search and many others. They proposed a CBIR method by extracting both color and texture feature vectors using the Discrete Wavelet Transform (DWT) and the Self Organizing Map (SOM) artificial neural networks.

4. Performance Measure
The performance of CBIR system can be measured using two measurements namely Precision and Recall [1].

**Precision:** Precision is the fraction of retrieved images that are relevant to the input image

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\text{Precision} = \frac{\text{Total no.of Retrieval Relevant image}}{\text{Total no.of Retrieval image}}
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**Recall:** Recall is the fraction of the images that are relevant to the query that are successfully retrieved.

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\text{Recall} = \frac{\text{Total no.of Retrieval Relevant image}}{\text{Total no.of Relevant image}}
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5. Conclusion
Many companies are facing problems in retrieving relevant images from a large database. CBIR provides solution to these problems. This paper provides various methods like color histogram, color correlogram, color Moments to retrieve images using color and methods like Tamura Features, Wavelet Transform, Gabor Filter to retrieve images using texture feature. Finally the paper provides the techniques to compute the value of Precision and Recall.

References
[2] Dr. Fuhui Long, Dr. Hongjiang Zhang and Prof. David Dagan Feng, "Fundamental Of Content Based Image-Retrieval"


