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# A Survey on Feature based Image Retrieval

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***Abstract*— Content based image retrieval (CBIR) is a technique used to retrieve the image based on features like color, texture and shape from large image dataset. In early era, to search image text based image retrieval techniques were used but those were not applicable for large scale databases because of text description problems. So nowadays, the content based image retrieval is becoming a foundation of fast and exact image retrieval. To get much more knowledge about particular area of subject survey of existing techniques was important. In this paper first we review the classification of images based on visual content, then the architecture of content based image retrieval system with challenges and applications. Then discuss the various low level features color, texture, shape with techniques and neuro fuzzy technique, then user interaction techniques as relevance feedback technique, for accurate and effective image retrieval by doing the literature study.***

***Keywords*— Color Correlogram, Color Distributions, Color Histogram, Content Based Image Retrieval (CBIR), Texture, Neuro Fuzzy, HSV Color and Wavelet transform.***

## I. INTRODUCTION

Nowadays, in the field of computer vision and information retrieval major topic is an image search. Image collection is increasing rapidly as enhance in image capturing devices like image scanners, digital cameras, mobile phone camera and also with increased use of multimedia data on internet. To deal with such huge image collection effective and efficient browsing, searching and retrieval tools are needed for different areas. In early era, various image retrieval systems had developed as: text-based and content-based. All text based image retrieval systems require the text description with images in large scale data bases and manually this task is not feasible. As a result, text based image retrieval systems were not applicable for task dependent queries [1]. To overcome these problems content-based image retrieval (CBIR) was introduced in the early 1980s. Content based image retrieval (CBIR) is a technique used to retrieve the image based on features like color, texture and shape from large scale image dataset. In CBIR, images are indexed by their visual contents such as color, texture and shapes. Image retrieval process can be of two types- 1) Content based IR as low level features and 2) Semantic based IR as high level features. The tricky feature of CBIR is used to minimize the difference of content based features and semantic based features [2].

### 1.1 Image Classification:

**i) Indexed Images**

An indexed image consists of two matrix as data matrix and color map matrix. The data matrix has the equal size as the image and single number for each pixel. Color map matrix has size may be different from the image. The image matrix values do not determine the pixel colors directly. [3]

**ii) Scaled indexed images**

A scaled indexed image uses matrix values and these matrix values are linearly scaled to form lookup table indices. MATLAB image display function used to give a matrix as a scaled indexed image. [3]

**iii) Intensity Images**

It represents an image as a matrix where every element has a value based on brightness or darkness of pixel at the corresponding place be supposed to be colored. There are two ways to represent the value to represents the intensity of the pixel: assign a floating number between 0 and 1 to each pixel and the other which assigns an integer between 0 and 255. [3]

**iv) Binary Images**

In this format image can also stores as a matrix but can only paint a pixel black or white as it assigns 0 for black and 1 for white. [3]

### 1.2 Content Based Image Retrieval :

Mostly CBIR systems work in the similar manner as: Extract a feature vector of each image in the database and the set of all feature vectors is prepared as a database index. A feature vector is extracted from the query image and it is matched next to the feature vectors in the index at the time of query. Various systems differs in the features selection and in the algorithms that are used to evaluate feature vectors. [4] The block diagram of basic CBIR system is shown in Fig. 1.

 

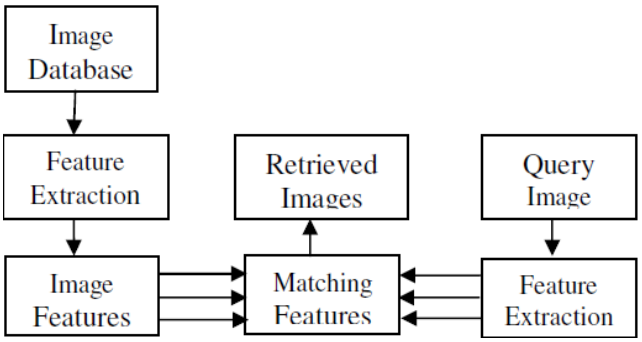


Fig.1 Block diagram of CBIR [4]

### 1.3 Challenges to CBIR systems:

Different challenges countenance in a CBIR system as:

(1) Partial query specification seems to be a challenge.
(2) To find out the approximate or accurate matching image of database to the query image.
(3) The issue associated with semantic gap as the user wants to seek semantic match, but the database can only provide similarity by data processing. [5]
(4) The expectation of users for huge amount of objects to search among. [6]

### 1.4 Applications of CBIR system:

Applications of CBIR system may found in various areas such as Medicine, Automatic Face Recognition Systems, Historical Research, Identification of Fingerprint, Crime Prevention, Trademark Image Registration, Biodiversity Information Systems, Digital Libraries, Graphic and Fashion Design, Architectural and Engineering Design, Cultural Heritage, Publishing and Advertising, Remote sensing and Management of Earth Resources etc.[7]

## II. IMAGE FEATURE EXTRACTION

### 1. Color:

In image retrieval a color features are the most widely used visual feature because they are easier to extract than texture and shape information. Color feature is independent of image size and orientation, and fairly robust to background complication. Statistically, it denotes the joint probability of the intensities of the three color channels. The color indexing work of Swain and Ballard [8], which is based on color histograms, has confirmed the prospective of using color for indexing. Stricker and Orengo [9] have shown that moment based color distribution features can be matched more strongly than color histograms as histograms do not capture spatial association of color regions and thus, they have restricted selective power. The system presented in [10] incorporates mostly the algorithms introduced in [8] into a database environment. Using these algorithms reasonable results can be achieved, but it is clear that the false positives which are retrieved result from the lack of spatial information in the index. Spatial correlation of color regions and the global distribution of local spatial correlation of colors can be combined in color correlogram and color coherence vector. These techniques give better result than traditional color histograms in content-based image retrieval. However, they need very costly computation. Color moments have been successfully used in content based image retrieval systems. It has been shown [9] that characterizing one dimensional color distributions with the first three moments is more robust and runs faster than the histogram based methods.

#### a) Color Space:

Color Spaces are required for description of color based retrieval of image [11]. Vector of three dimensional spaces and color in it is part of color space, The choice of color space is made from uniformity characteristics and uniformity means to have colors points having similar distance in color space as perceived by human eye, generally RGB, HSV, LAB, LUV, YCrCb and opponent color space are used [11].

#### b) Color Histogram:

Color histogram is a widely used color representation technique for retrieving images in CBIR systems. Color histograms does not give spatial data, it is only efficient for representation of local as well as global features of colors. It computes the chromatic information and invariant of image along the view axes for translation and rotation [11]. It is a standard expression of color attribute in CBIR systems. Histograms mostly use RGB color space. When histogram is computed for large scale image dataset, it gives unsatisfactory efficiency result, to overcome this conflict joint histogram technique is given. [11]

#### c) Color Correlogram and Coherence Vector:

Spatial correlation of color regions and the global distribution of local spatial correlation of colors can be combined in color correlogram and color coherence vector. These techniques give improved result than traditional color histograms in content based image retrieval [4].

#### d) Color Distributions:

Color distributions were used for efficiently retrieving more similar images from the digital image databases, Lu et al.[19] uses the, the mean value and the standard deviation , to represent global characteristics of image, and the image bitmap is used to represent the local characteristics of mage for increasing the accuracy of the retrieval system.

 

**2. Texture:**

Texture is one of the important features of natural images and refers to inborn surface properties of an entity and their association to the surrounding background. Texture can be represented by Grey Level Co-occurrence [12**].** To get texture information of image directional features were pulled out. The six image texture properties were coarseness, regularity, directionality, contrast, line likeness and roughness. Commonly texture representation uses following methods:

1) Structural methods describe texture by identifying structural primitives and their placement rules using morphological operator and adjacency graph. They deal with the arrangement of image primitives, presence of parallel or regularly spaced objects [13].

2) Statistical methods uses statistical distribution of the image intensity [13] to characterize the texture by the popular co-occurrence matrix, Fourier power spectra, Shift invariant principal component analysis (SPCA), Tamura feature, Multi-resolution filtering technique such as Gabor and wavelet transform.

**a) Tamura Features:**

Tamura features have six characteristics which are coarseness, line-likeness, contrast, roughness, regularity and directionality [11]. Initial three characteristics proved to be noteworthy in CBIR systems such as QBIC [11]. Coarseness is defined as a texture granularity, contrast is computed from statistical methods of moment invariants such as kurtosis and variance of the entire image and directionality is computed from convolution of images [14].

**b) Gabor Filters:**

Basically Gabor filters are a set of wavelets, with each wavelet capturing energy at a particular frequency and specific orientation [4]. The scale and orientation tunable property of Gabor filter makes it especially useful for texture analysis; Gabor wavelet is widely adopted to extract texture from the images for retrieval and has been shown to be very efficient [4].

**c) Wavelet Transform:**

In recent time Wavelets have become important. Its significant features are compression and locality of query images. [20]

**d) Contour let Transform:**

It has two different and repeated breakdown stages. First multi scale disintegration applies Laplacian pyramid method to transform the image into one coarse version [11]. Second a directional stage uses iteratively two dimensional filtering and critical down sampling to partition each LP into flexible number of frequency wedge-shaped sub-bands thus capturing geometric structures and directional information in real-world images [11].

3) In spectral approach, Fourier transform used for texture description of an image and then groups the transformed data in a way that it gives some set of measurements. [13]

**3. Shape:**

Shape features of image object have widespread application in CBIR systems. Shape may be defined as the surface pattern of an object as an outline or contour. It allows an object to be distinguished from its surroundings by its outline. Shape can be represented based on two categories:

- **a)** Boundary-based - Only outer boundary of the shape used for shape representation. This is done by relating the considered region using its external properties as the pixels along the object boundary [15].
- **b)** Region-based - Entire shape region with its internal characteristics are used to describe shape i.e. the pixels contained in that region.[15]

The most successful representatives for these two categories are Fourier descriptor and moment invariants.

**Fourier descriptor:**

The fourier descriptor is use the fourier transformed boundary as the shape feature for image retrieval.. To take into account the digitization noise in the image domain, Rui et al. proposed a modified Fourier descriptor which is both invariant to geometric transformations and strong to noise [13].

**Moment invariants:**

The main aim is to use region-based moments which are invariant to transformations, as the shape feature. Many improved versions emerged in this method, [13] Based on the discrete version of Green's theorem, Yang and Albregtsen proposed a fast method of computing moments in binary images. Some facts that motivated the most useful invariants were found by extensive experience and trial-and-error, Kapur et al. developed algorithms to systematically search and generate for a given geometry's invariants [13].

**4. Neuro Fuzzy:**

Neuro fuzzy content based image retrieval system works as, the query to retrieve the images from database is prepared in terms of natural language then Fuzzy logic is used to define the query. [16]

## III. USER INTERACTION

User interaction in CBIR system consists of a query formation which is discussed briefly below. [11]

**a) Query through Example:**

User gives sample image in query to assist the system for the retrieval process. CBIR system extracts the features from example image, and then database is searched for the most similar feature image. In query via example it is not

 

mandatory for the user to give description of image in any form. [11]

**b) Query through Sketch:**

User sketches the query image in a graphic user interface tool with image characteristics or features as color, texture, shape to retrieve the image in this method. Drawn outlines of object image have to be normalized for reducing the negative details of the query object before comparing it to database images [11].

**c) Query via Group Example:**

Query via group example permits the user to give group images as a sample query to the system. The system will then search for exact or approximate images relevant to sample group query image. By using group by query example we can give the target images features more accurately with different image example in group. [11]

**d) Category Browsing:**

Category browsing searches the image in database with the category specified for query. [17]

**e) Relevance Feedback:**

In relevance feedback systems, a searching interface animatedly changes the weights of content based visual features in the query image based on the user feedback of relevant retrieved images [18]. Similarity matching between the query image and the target images is main task of CBIR and Relevance feedback integrates users' evaluation of the retrieval results as it is interactive process. [3] Unfortunately, the gap between high-level concepts and low-level features, as well as the subjective perception for the visual content by the human being, result a significant mismatch between the retrieval results judged manually and by the computers, so to improve the retrieval precision, human contacts are usually involved. In general, the relevance feedback scheme includes an interactive scoring system to estimate the past retrieval results to improve the subsequent content retrieval [3]. There are various relevance feedback algorithms categorized on the basis of statistical analysis, kernel based approach techniques and entropy based techniques for relevance feedback [11].

## IV. CONCLUSION

This paper gives review of traditional retrieval systems with their problems. Various image formats as part of CBIR systems, then outline of general Content Based Image Retrieval System with its architecture given. Major challenges as well as applications of CBIR were studied. In this survey paper discussion on techniques of an image retrieval based on low level features and neuro fuzzy for efficient and accurate image retrieval are provided by literature study. Different user interaction techniques are also included for proficient understating of techniques for interaction with system to an end user. So this paper gives summarization of the different features of images with their functionality for content based image retrieval systems.

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