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ANNOTATION OF CONTENT BASED IMAGE RETRIEVAL

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Abstract
Content-based image retrieval, a technique which uses visual contents to search images from large scale image databases according to users' interests, has been an active and fast advancing research area since the 1990s. During the past decade, remarkable progress has been made in both theoretical research and system development. Images were first annotated with text and then searched using a text-based approach from traditional database management systems. Text-based image retrieval uses traditional database techniques to manage images. Through text descriptions, images can be organized by topical or semantic hierarchies to facilitate easy navigation and browsing based on standard Boolean queries. Most text-based image retrieval systems require manual annotation of images. Obviously, annotating images manually is a cumbersome and expensive task for large image databases, and is often subjective, context-sensitive and incomplete. As a result, it is difficult for the traditional text-based methods to support a variety of task-dependent queries. Content-based image retrieval (CBIR) systems utilize low level query image feature as identifying similarity between a query image and the image database. Image contents are plays significant role for image retrieval. In this paper, we discuss some of the key contributions in the current decade related to image retrieval and image annotation.

Keywords: Content-Based Image Retrieval, Text-Based Image Retrieval, Image Database, Annotation, Query Image.

Introduction
Multimedia contents are growing explosively and the need for multimedia retrieval is occurring more and more frequently in our daily life. The last decade has witnessed great interest in research on content-based image retrieval. Content-based image retrieval has been an active research area in recent years. There has been an experimental increase in the amount of non-text based data being generated from various sources. Early work on image retrieval can be traced back to the late 1970s. In 1979, a conference on Database Techniques for Pictorial Applications was held in Florence. Early techniques were not generally based on visual features but on the textual annotation of images. In other words, images were first annotated with text and then searched using a text-based approach from traditional database management systems. As a result of advances in the Internet and new digital image sensor technologies, the volume of digital images produced by scientific, educational, medical, industrial, and other applications available to users increased dramatically.

The difficulties faced by text-based retrieval became more and more severe. Content-based image retrieval uses the visual contents of an image such as *color*, *shape*, *texture*, and *spatial layout* to represent and index the image. Content based image retrieval in early days because of very large image collections the manual annotation approach was more difficult. In order to overcome these difficulties Content Based Image Retrieval (CBIR) was introduced. Content-based image retrieval (CBIR) is the application of computer vision to the image Retrieval problem. In this approach instead of being manually annotated by textual keywords, images would be indexed using their own visual contents .The visual contents may be colour, texture and shape. This approach is said to be a general framework of image retrieval .There are three fundamental bases for Content Based Image Retrieval which are visual feature extraction, multidimensional indexing and retrieval system design. The colour aspect can be achieved by the techniques like averaging and histograms. The texture aspect can be achieved by using transforms or vector quantization .The shape aspect can be achieved by using gradient operators or morphological operators.

I. Content-Based Image Retrieval
In typical content-based image retrieval systems, 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.

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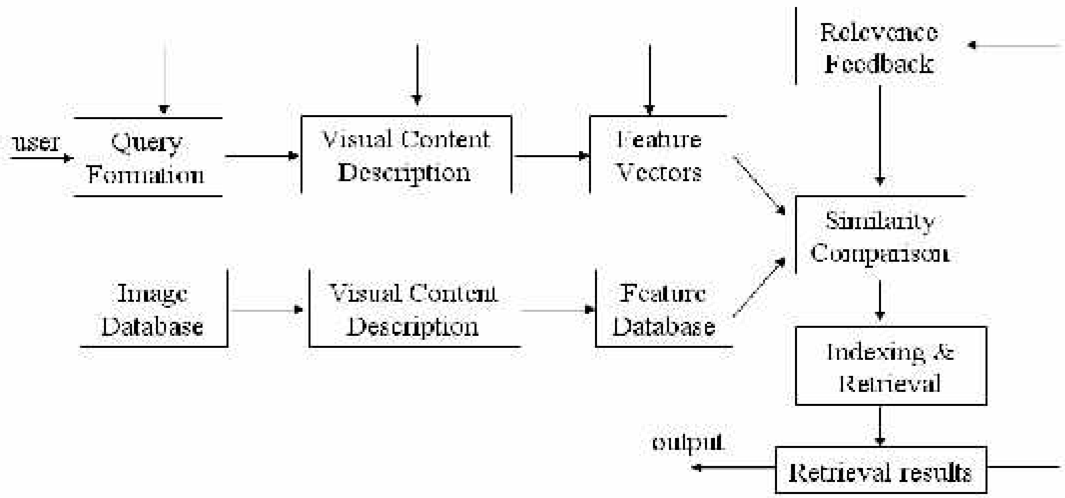

Figure 1-1. General model content-based image retrieval system

CBIR extracts low-level features which is Inbuilt in the images to present the contents of images. Each image has features such as categories into three main classes: color texture and shape features. This has resulted in a growing interest, and great active research, into the extraction of relevant information from non text-based database. One of the most common data in multimedia systems is image. Therefore, the capability of managing images, allocating their quick and efficient indexing and retrieval are repeatedly followed in multimedia database management systems. There are three fundamental bases for content-based image retrieval, i.e. visual feature extraction, multidimensional indexing, and retrieval system design. Each image has three contents such as: color, texture and shape features. Color and texture both plays important image visual features used in Content-Based Image Retrieval to improve results. Color histogram and texture features have potential to retrieve similar images on the basis of their properties. As the feature extracted from a query is low level, it is extremely difficult for user to provide an appropriate example in based query. Content-based image retrieval (CBIR) systems have attracted significant research and commercial interest. Color is most common feature of an image such as used in Content-Based Image Retrieval. These features are able to identify objects and retrieve similar images on the basis of their contents. These methods do work very efficient in object recognition and Web searching .An efficient query reformulation is necessary for finding the relevant images from the database.

II. Feature Extraction

Feature (content) extraction is the basis of content-based image retrieval. In sense, features may include both visual features (color, texture, shape) and text-based features (key words,
Annotations).

Color

One of the most straightforward visual features of an image is the color because human eye is sensitive to colors. Color features are the basic characteristic of the content of images. Using color features, human can recognize most images and objects included in the image. Several methods for retrieving images on the basis of color similarity have been proposed, but most are variations on the same basic idea. Each image added to the database is analyzed to compute its feature. Color space represents the color in the form of intensity value. We can specify, visualize and create the color by using color space method. There are different color feature extraction methods.

Color Feature Extraction Methods

1. Histogram Intersection Method

Histogram Intersection (HI) considers global color features. The duos of color histograms X and Y with k bins for each, HI is defined as, In Histogram Intersection method, the number of bins makes impact on performance. The large no of bins represent the image in very complex manner it increases the computational complexity.

2. Zernike Chromaticity Distribution Moments:

It is derived from chromaticity space. This method gives fixed length and computation effective representation of an image which contains the color content of an image but, their size is invariant under rotation and flipping.

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c. Color Histogram

Color histogram represents the image from different perspective. The image in which color bins of frequency distribution are represented by color histogram and it counts the pixels which are similar and store it. Color histogram analyzes every statistical color frequency in an image. The change occurred in the translation, rotation and angle of view these problems are solved by color histogram and also it focuses on individual parts of an image. The computation of local color histogram is easy and it is resistant to minor variations in the image so for indexing and retrieval of image database it is very important.

Texture

Texture is one of the crucial primitives in human vision and texture features have been used to identify contents of images. Examples are identifying crop fields and mountains from aerial image domain. Moreover, texture can be used to describe contents of images, such as clouds, bricks, hair, etc. Both identifying and describing characteristics of texture are accelerated when texture is integrated with color, hence the details of the important features of image objects for human vision can be provided. One crucial distinction between color and texture features is that color is a point, or pixel, property, whereas texture is a local-neighborhood property. The main motivation for using texture is the identifying and describing characteristics of texture feature. Since the power of texture increases when combined with color, the content-based retrieval system provides techniques for querying with respect to texture and color in an integrated manner. There are three main approaches to the task of texture feature extraction: spectral approach, structural (or syntactic) approach and statistical approach. Conventional texture features used for CBIR are statistic texture features using gray-level co-occurrence matrix (GLCM), edge histogram descriptor (EHD), which is one of the MPEG-7 texture descriptors, and wavelet moments. There are different methods of texture feature extraction.

1. The Grey Level Co-occurrence Matrix:

The Grey Level Co-occurrence Matrix Is Statistical approach. Texture features are calculated from the statistical distribution. This method is a technique of extracting subsequent order statistical texture features. The elements of matrix represent the relative frequency. This method describes texture by creating statistics of the dispersal of intensity values as well as location and orientation of similar valued pixel.

Formula to calculate grey level co-occurrence for single pixel-

$$M_{co} = \sum_{x=1}^{K}\sum_{y=1}^{K}\begin{cases} 1, \text{if } I(x,y) = i \text{ and } I(x+d_x, y+d_y) = j \\ 0, & \text{Otherwise} \end{cases}$$

2. Edge Detection:

Edge detection method determines the texture complexity by using the edge pixels in specified region, the edgeless per unit area.

$$F_{edgeness} = \frac{|\{p \mid Mag(p) > T\}|}{N}$$

Where, N= region with N pixels.
Mag(p)= gradient magnitude.
Dir (p) =gradient direction.

3. Laws Texture Energy Measures:

For detecting various types of textures it uses local masks. To compute the energy of texture it uses convolution masks of 5×5 which is represented by a nine element vector for each pixel.

Shape

Shape is an important visual feature and it is one of the basic features used to describe image content. However, shape representation and description is a difficult task. This is because when a 3-D real world object is projected onto a 2-D image plane, one dimension of object information is lost. As a result, the shape extracted from the image only partially represents the projected object. To make the problem even more complex, shape is often corrupted with noise, defects, arbitrary distortion and occlusion. Further it is not known what is important in shape. Current approaches have both positive and negative attributes; computer graphics or mathematics use effective shape representation which is unusable in shape recognition and vice versa. In spite of this, it is possible to find features common to most shape description approaches Usually, Shape features can be extracted from an image by using two kinds of methods: contour and regions. Contour based methods are normally used to extract the boundary features of an object shape. Such methods completely ignore the important features inside the boundaries. Region-based image retrieval methods firstly apply segmentation to divide an image into different regions/segments, by setting threshold values according to the desirable results. Whereas the boundary of an image can be obtained by applying any edge detection method to an image. Shape matching is a well-explored research area with many shape representation and similarity measurement techniques found in the literature. Shape representation methods include Fourier descriptors, polygonal approximation, invariant moments, B-splines, deformable templates, and curvature scale space (CSS). Most of these techniques were developed for whole shape matching, i.e., closed planar curve matching. Fourier descriptor has proven to be more efficient and robust than is the CSS in a review of shape representation and description techniques. Fourier descriptor was not suitable for partial shape matching. The two objects cannot have exact same shape but by using various algorithms we can recognize similar shape easily. The main problem to recognize shape that the setting location the object shows different shape from different location, so it is measure problem to recognize the actual shape of the object.

Shape Feature Extraction Methods

1. Binary Image Algorithm

Binary image algorithm convert image into two color format i.e. black and white color format, then trace exterior boundary region of image and by applying shape factor shape of the image is recognized. Shape is calculated by shape factor (i.e)

$$\text{SHAPE FACTOR} = \frac{Area}{(Diameter)^2}$$

shape recognition algorithm when input is given as an image then load that image, contrast of the image is enhanced and image is converted into black and white format i.e. the image is converted into binary format. All boundary regions are traced and determine all shapes by applying shape factor then label all images and separate each shape from each other.

2. Horizontal and Vertical Segmentation

In an horizontal segmentation image is divided into horizontal segments and trace the coordinate points and determine the shape of object due to that sitting location problem of object cannot be occurred same as in an vertical segmentation image is divided into vertical segments and trace the coordinate axis points of the image according to the coordinate axis shape of the object accurately recognized. Chain code method calculate the boundary of binary image, Area of an object represents the number of pixels resides within closed boundary of binary image and Horizontal and Vertical Distances are represented by calculating the distance between boundary lines.

Conclusion and Future Works

In this paper annotate the content based image retrieval and explored the low level features of color ,space and texture extraction methods in CBIR . One of the features of this study is the use of a publicly available benchmark that further studies can use.

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