

Image Retrieval by using visual features and study of various Image Retrieval systems

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Abstract

Images have rich contents such as color, shape, texture etc. By using these contents it is possible to interactively find any kind of image from large collection of image database. We highlight various ideas from researchers about various methods in interactive search. We discuss visual features of an image like color, shape and texture. We also discuss several content based image retrieval systems (CBIR). This paper, explore Content Based Image Retrieval (CBIR) technique and various research applications of CBIR.

Keywords: *CBIR, Color feature, Texture feature, Shape feature.*

1. Introduction

The content-based image retrieval system retrieves the images stored from the database. It compares the features of the query image against the images in the database collection of images. The CBIR system first extracts and stores the features of the query image then it go through all images in the database and extract the features of each image. The results are the images that are most similar to the query image[1]. Today, in many areas like government, academia and hospitals digital images are being created. But only way of searching these images was using keyword indexing or by simply browsing.. Early work on image retrieval can be traced back to the late 1970s. Content-based image retrieval is 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[2].The rapid growth of the Internet and fast advancement in color imaging technologies have made digital color images more and more readily available[3].

Image retrieval can be grouped into two main types: Text Based Image Retrieval and Content Based

Image Retrieval. In the early years Text Based Image Retrieval was popular, but now a day Content Based Image Retrieval has been a topic of research. Text Based Image retrieval is the traditional image retrieval system. In traditional retrieval systems features are added by adding text strings describing the content of an image. Commercial image catalogues use manual annotation and rely on text retrieval techniques for searching particular images. But the problem with manual annotation is that it is very time consuming and user of Text Based Image retrieval must describe an image using nearly the same keyword that were used by the annotator in order to retrieve the image.

In a content Based Image Retrieval (CBIR) system, features are extracted automatically and there is no manual intervention[4].

An image can be represented as a set of visual features like color, shape and texture features. In this paper, we discuss the visual features of an image and some of the image retrieval systems.

2. Image Features

Image feature is a visual property of an image. Every image has certain visual content like color, shape and texture.

In this section, we discuss some of the visual features of an image in brief.

2.1 Color

Several methods are available for retrieving images on the basis of Color. A color histogram shows the proportion of pixels of each color within the image. While searching any image, the user can either specify the desired

proportion of each color, or submit an example or query image from which a color histogram is calculated. The matching process retrieves those images whose color histograms match with those of the query image [5].

The color is one of the most widely used visual features in image retrieval. Most of the images are in the red, green, blue (RGB) color space. Other spaces such as hue, saturation, value (HSV) and LUV spaces are much better with respect to human perception and are more frequently used. Color features are often easily obtained directly from the intensity of the pixel, e.g. color histogram over the whole image or over a segmented region is often used [6][7].

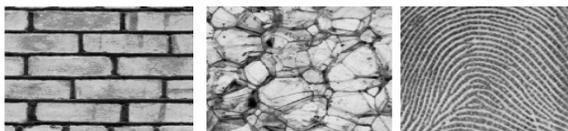
2.2 Shape

Shape is an outline of an object. It may be defined as the characteristics surface configuration of an object. Shape based image retrieval is the measuring of similarity between shapes represented by their features. It is one of the primitive features for image content description.

There are many techniques of shape description and recognition. These techniques can be broadly categorized into two types, boundary based and region based. Boundary based methods use only the contour or the border of the shape of object and ignore its interior. Hence, these methods are also called external methods of shape extraction. Recognition of a shape by its boundary is the process of comparing and identifying shapes by analyzing the shapes boundaries but the local structural organization is always hard to describe[8][9][10].

2.3 Texture

Texture contains important information about the structural arrangement of the surface, such as; clouds, leaves, bricks, fabric, etc.



a) Bricks

b)Rock

c) Fingure Print

Fig. 1-Examples of Texture

Texture measures have an even larger variety than color measures. Some of the most common measures for capturing the texture of images are wavelets and Gabor filters. These texture measures try to capture the characteristics of the image or image parts with respect to changes in certain directions and the scale of the images. This is most useful for region or images with homogeneous texture [6].

Texture is a key component of human visual perception. This makes it an essential feature to consider when querying image databases. One can easily identify texture but, it is more difficult to define. Unlike color, texture occurs over a region rather than at a point. It is normally defined purely by grey levels and as such is orthogonal to color. Texture has qualities such as periodicity and scale; it can be described in terms of direction, coarseness, contrast and so on [11].

3. Image Retrieval Systems

Here we have some existing Content Based Image Retrieval systems. Some of these systems are developed for commercial use and some as part of research activities.

3.1 Query by Image Content (QBIC)

QBIC stands for Query By Image Content and was the first commercial application developed by IBM for content-based image retrieval. QBIC supports the queries based on color, texture and sketches. The query is based on one reference image and one feature at a time. Available features include average color, color histogram, color layout, texture, and shape. The visual queries can also be combined with textual keyword predicates.

3.2 VisualSEEK

This is a content-based image and video query system developed at the Image and Advanced Television Lab of Columbia University. It integrates feature-based image indexing by color with region-based spatial query methods. This enables queries with multiple color regions in the sketch image. Queries may be conducted by sketching a layout of color regions, by providing the URL of a seed image, or by using instances of prior matches.

3.3 Virage

The Virage Image Engine is a commercial Content Based Image Retrieval System developed at Virage Technologies. It supports queries based on color, texture, shape, and structure of the image. These features can be combined in a query, and the user can adjust the weights associated with each feature. Virage is intended as a portable framework for different CBIR applications, and the architecture of the system is designed to support “plug-in” modules for specific needs.

3.4 NETRA

NETRA is prototype image retrieval system that is currently being developed at the University of California, Santa Barbara. NETRA uses color, texture, shape, and spatial location information of segmented

image regions to search and retrieve similar regions from the database [12].

3.5 MARS

Multimedia Analysis and Retrieval System (MARS) is an interdisciplinary research effort involving multiple research communities at the University of Illinois. The main focus of MARS is to develop methods to organize various features into adaptive retrieval architecture, instead of finding the “best” representations for any particular image request [13].

3.6 Photobook

Photobook is a set of Interactive tools for searching images developed at the MIT Media Lab[14].

4. Applications of Content Based Image Retrieval System

Some of the applications of Image Retrieval are described below:

4.1 Intellectual Property

While Trademark image registration, new Trademark image is compared with the existing Trademark images to avoid conflict.

4.2 Crime Prevention

Face recognition systems are used by Police departments.

4.3 Medical Diagnosis

Medical professionals use images in the form of X-rays, ultrasound etc. for diagnosis and monitoring purpose

4.4 Remote Sensing

Geographical information systems, weather forecast, monitoring of satellite images[15].

4.5 Security

Finger print scanning is used for security purpose. Insert acknowledgment, if any. Sponsor and financial support acknowledgments are also placed here.

5. Conclusion

This paper is the study of Content Based Image Retrieval and various existing CBIR systems. Still there is a lot of space for research in CBIR technology.

After reviewing various research papers, we found that the image retrieval system can be developed by extracting various image features like color, shape and texture. These extracted features are then compared with the database image features to search the image. We say that Image Retrieval using visual features is still a developing technology.

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