

Survey: Content based Image Retrieval

Charulata Leuva¹

¹Department of Computer Science & Engineering

¹Narnarayan Shashtri College of Institute of Technology, Jetalpur

Abstract— In digital world there are large collection of digital images. There are several areas for retrieving images from the large set of image dataset. Professional user wants accurate result for input image. But some retrieving system does not give relevant result as per user need. Text based image retrieval system will work on metadata search and it will give irrelevant result to the user. So, User does not satisfy with text based image retrieval system. And therefore content based image retrieval system introduced for overcome this problem. In this paper introduce content based image retrieval system and feature extraction techniques. Content based image retrieval system retrieve images by colour, shape and texture feature of the images.

Key words: Image Retrieval, Text Based, CBIR, Feature Extraction, Semantic Gap

I. INTRODUCTION

A. Introduction of Image Retrieval:

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. Text-based image retrieval uses traditional database techniques to manage images [1]. Through text descriptions, images can be organized by topical or semantic hierarchies to facilitate easy navigation and browsing based on standard Boolean queries. However, since automatically generating descriptive texts for a wide

spectrum of images is not feasible, 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 [1].

In [1] typical content-based image retrieval systems (Figure 1-1), 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. In this chapter, we introduce these fundamental techniques for content-based image retrieval.

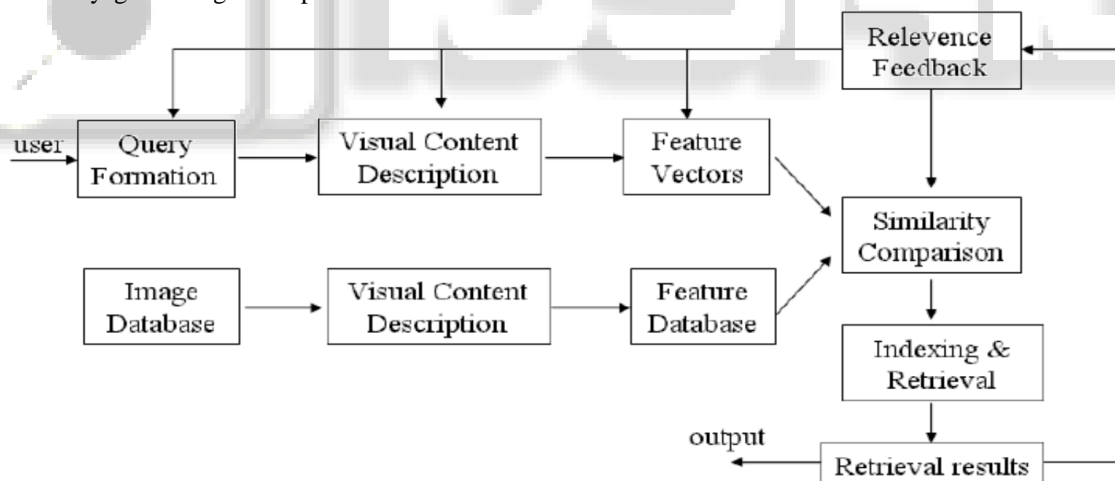


Fig. 1: Diagram for content-based image retrieval system

B. Image Retrieval Methods:

There are basically two types of image retrieval methods:

- Image Meta Search(Text Based)
- Content Based Image Retrieval

1) Image Meta Search (Text Based):

Image Meta Search is also known as Text Based Image Retrieval. It is retrieve images based on keyword, label or metadata. And it is not give relevant result as per user requirement. It is traditional retrieval method.

2) Content Based Image Retrieval:

The requirement for development of CBIR is enhanced due to tremendous growth in volume of images as well as the

widespread application in multiple fields. Texture, color, shape and spatial layout are the underlying traits to represent and index the images [2].

II. FEATURE EXTRACTION

A. Extraction of Color:

In image retrieval, the color is commonly used feature. Varieties of color spaces are available and different colors are defined on selected color space. To make image recognition possible by human, important feature is color. It is a property that relies on light reflection to eyes and the information processing in the brain. For color features RGB

color histogram is used & to determine texture features statistical texture measures & wavelet transform is used [2]. Current research is attempting to segment color proportion by region and by spatial relationship among several color regions. Examining images based on the colors they contain is one of the most widely used techniques because it does not depend on image size or orientation [3].

B. Texture Extraction:

In CBIR, one of the salient common attribute is texture. In image classification texture provides important information as in many images of real world. Systems comprises spectral features achieved by using Gabor filtering, wavelet transform texture features commonly used by system of retrieving images [9].

Texture is a difficult concept to represent. The identification of specific textures in an image is achieved primarily by modeling texture as a two-dimensional gray level variation [3].

C. Shape Extraction:

For rectangular shaped images Gabor filter and wavelet transform are basically designed. In CBIR system arbitrary-shapes regions exists In Tiled approach, the matching is done in corresponding manner and query image tiles are compared against tiles of target image. Matching of query image is allowed to any target image tile. Based on the textured image, an algorithm was proposed which modeled the textural information by a set of features possessing a perceptual intelligence to be used for image retrieval [9].

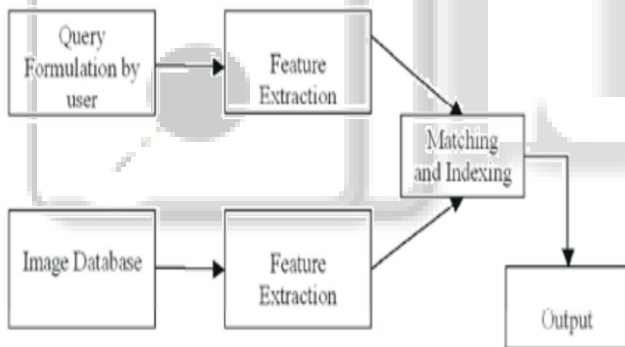


Fig. 2.1: Flow chart of Content based image retrieval

In fig 2.1 present the how to retrieve the image for content based using the various query formulate by the user as well as apply the different extraction on image which is came from database.

Shape feature can be divided into 2 categories [10]:

- Boundary based: Outer boundary of object is calculated.
- Region based: Entire region i.e. area covered by object.

1) Mean:

This feature is related to the *brightness of an image*. As I previously wrote image is a collection of row and column i.e. pixel values. By these pixel values calculate the image histogram i.e. graphical representation of an image. For calculating mean divide the histogram into levels, this process called quantization.

Formulas for calculating mean [10]

$$\mu_j = \frac{1}{N} \sum_{i=1}^N x_{ji}$$

It represents *contrast of each level of image*. It is calculated by using mean values of image and pixel values of each level and variance is the square of standard deviation.

$$\sigma_j = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_{ji} - \mu_j)^2}$$

III. CBIR TECHNIQUES

In nowadays Many CBIR systems have been proposed, but still now the many problem of retrieving images on the basis of their pixel content remains largely unsolved.

Basically four types of techniques are used for Content based image retrieval;

A. Query Techniques:

Different implementations of CBIR make use of different types of user queries. Query by example is a query technique that involves providing the CBIR system with an example image that it will then base its search upon.

This query technique removes the difficulties that can arise when trying to describe images with words.

B. Semantic Retrieval:

Semantic retrieval starts with a user making a request like "find pictures of Abraham Lincoln". This type of open-ended task is very difficult for computers to perform - Lincoln may not always be facing the camera or in the same pose. Many CBIR systems therefore generally make use of lower-level features like texture, color, and shape. These features are either used in combination with interfaces that allow easier input of the criteria or with databases that have already been trained to match features

C. Relevance Feedback (Human Interaction):

Combining CBIR search techniques available with the wide range of potential users and their intent can be a difficult task. An aspect of making CBIR successful relies entirely on the ability to understand the user intent.

D. Machine Learning:

Machine learning and application of iterative techniques are becoming more common in CBIR. This technique is suitable for complex semantics but difficult to implement. This technique uses two types of machine learning tools that are supervised or unsupervised, associated low-level features with query concepts.

IV. SEMANTIC GAP REDUCTION TECHNIQUES

Those retrieval systems which are based on low-level features do not match human perception, and considered insufficient and unpredictable. This is known as semantic gap [8].

These techniques are explained below:

A. Object Ontology:

Object Ontology uses semantics of an image to define it. This technique, define different levels for assigning low-level image features. Each level defines the region attribute that is well known to humans and considered as the intermediate level descriptor for an image [5].

B. Machine Learning:

This method predicts the value of production on the basis of inputs that user provide. In supervised machine intelligence, number of images is collected and on basis of entry measure a binary classifier is trained to detect semantic category label. Another method is neural network according to which the user selects 11 categories (concepts): brick, cloud, fur, grass, ice, road, rock, sand, skin, trees and water. Then a lot of input is introduced into the neural network classifiers to establish the link between low level features of an image and its high-level semantics [5].

C. Relevance Feedback:

Relevance feedback methods work online and based on intentions of user. Relevance feedback technique is not feasible in some domain but this technique involves user's communication. Relevance feedback mechanism works when the user enters the query in the form of an image,

picture or text. The system provides the initial results of user retrieval and make image as "relevant" and "irrelevant."

D. Semantic Templates:

Semantic Template is a set of general characteristics that are calculated from the number of images stored in the database. It traces a link between the characteristics of high and low-level features. It usually defined as a function of a concept representative calculated from a group of sample images.

E. Web Image Retrieval:

This system has some technical difference from image retrieval in other application. Some additional information on the Web is available to ease semantic-based image retrieval. For example, the URL of image file often has a clear hierarchical structure including some information about the image such as image category.

1) Comparison between various Semantic Reduction Gap Techniques:

Comparison between various Semantic Reduction Gap Techniques		
Techniques	Advantages	Disadvantages
Object Ontology	Easy to design, suitable to application with simple semantic	No proper system available for texture naming
Machine Learning	Suitable for complex semantics	Low speed of learning.
Relevance Feedback	Effective in boosting image retrieval accuracy	Requires five or more iterations to achieve high performance
Semantic Templates	Maximum Recall Ratio	In depth understanding requires
Web Image Retrieval	Provides additional information on web	Results are not so much accurate

Table 3.1: Comparison between various Semantic Reduction Gap Techniques

REFERENCES

[1] Dr. Fuhui Long, D. H. FUNDAMENTALS OF CONTENT-BASED IMAGE RETRIEVAL.
 [2] Mehwish Rehman, M. I. (2012). Content Based Image Retrieval: Survey. World Applied Sciences Journal , 404-412
 [3] SUJATHA, S. S. (Aug 2013). Survey Paper On Various Methods In Content Based Information Retrieval. Impact: International Journal of Research in Engineering & Technology (IMPACT: IJRET) ISSN 2321-8843, Vol. 1 (Issue 3), 109-120.
 [4] al, N. L. (2012). A Review of Image Classification Techniques in Content Based Image Retrieval. International Journal of Computer Science and Information Technologies , 5182 – 5184
 [5] D.Jeyabharathi, D. S. (2013). Performance Analysis of Feature Extraction and Classification Techniques in CBIR. International Conference on Circuits, Power and Computing Technologies, 978-1-4673-4922-2.
 [6] Nancy Goyal, N. S. (July 2014). A Review on Different Content Based Image Retrieval Techniques Using High Level Semantic Features. International Journal of Innovative Research in Computer and Communication Engineering, Vol. 2 (Issue 7).
 [7] Nidhi Singhai, P. S. (July 2010). A Survey On: Content Based Image Retrieval Systems. Applications, 0975 – 8887.