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A REVIEW ON FEATURE BASED IMAGE SEARCHING METHODS

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Abstract: In the recent era the rapid growth in multimedia data and storage technology has led to the new techniques of mining the enormous and fast-growing volumes of data. The vital information hidden in this multimedia data cannot be extracted without powerful tools. The image searching tools plays a major role in multimedia data mining that can automatically extract semantically meaningful information. The network sites contain a tremendous amount of multimedia data such as images and videos these data is to be mined and analyzed. Multimedia mining is based on the contents of an image so searching images based on the features such as texture, shape and color is a big area for research. This paper mainly focuses on different image searching techniques and how Featured-based Image Retrieval can be helpful for Image mining.

Keywords: Image, Video Mining, Featured Based Image Retrieval, features extraction.

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INTRODUCTION

Feature-based image retrieval (FBIR) is an image search technique where images are selected from an image database by using a query image rather than the information, such as keywords, tags and descriptions associated with that image. Here, input for the search is an image, and the output is similar images from the database. The similarity between two images is measured by calculating the distance between the two images. That distance is calculated from feature vectors, and the feature vectors are constructed from the content of the image. Here, content refers to color, texture and shape of the image. The explosion in the quantity of multimedia data stored in social networks and other multimedia sites has emerged the need for powerful techniques for accessing data. Indexing and retrieval are at the core of multimedia data searching.

Multimedia mining deals with the extraction of implicit knowledge; in other words, it looks for multimedia data relationships or other patterns that are not explicitly stored in multimedia files.

Generally, multimedia database systems store and manage a large and varied collection of multimedia objects such as image, video, audio and hypertext data. Knowledge discovery from multimedia documents thus involves the analysis of non structured information [1]. To achieve it, we need tools for discovering relationships between objects or segments within multimedia document components; e.g. classifying images based on their content, extracting patterns in sound, categorizing speech and music, and recognizing and tracking objects in video streams. These resulting images are then extracted from the database. We are focusing on the image searching techniques.

FEATURE OR CONTENT BASED IMAGE SEARCHING (RETRIEVAL) :

K.K Pandey et al. [2] proposed a new matching technique to find the similar value between query color image and database color image using histogram, spatiogram andbins, their method uses RGB and HSV color space. T.N.Manjunath et al. [3] conducted survey on current state of Multimedia data mining and Knowledge discovery approaches techniques for mining multimedia data.R. Datta et al. [6] defines CBIR as : Content based image retrieval is a technology that in principle helps to organize digital pictures archives by their visual content, by this definition anything ranging from image similarity function to a robust image annotation engine falls under the purview of Content based image retrieval. Smeulders et al [8] in their paper define problem with all current approaches is the semantic gap, between low level content and higher level concepts. A. Yoshitaka et al. [10] in their paper used content based retrieval for multimedia databases. In this paper they mention CBR is not an individual entity

but relies on underlying data model, a priori knowledge of the area of interest and the scheme for representing queries. M. S. Lew et al. [7] in their paper presented a comprehensive survey of the latest CBIR techniques; they proposed prevalent research topics which have potential for improving Multimedia Retrieval by bridging the semantic gap are as: Human centered computing, New Features, New Media, Browsing and Summarization, and Evaluation & Benchmarking. S. Nandgopalan et al. [4] proposed a novel approach for generalized image retrieval based on semantic concepts like color, texture and edge histogram descriptor. S. Silakari et al. [9] Proposed framework focuses on color as feature, Color Moment and Block Truncation Coding (BTC) are used to extract features for image dataset.

IMAGE SEARCHING USING CBIR CONCEPTS:

This section mainly focuses on how low level features of image can be extracted and can be used effectively for Image mining purpose. In subsequent sections extraction techniques are discuss in details and how Indexing and Retrieval can be improved. To overcome the disadvantages inherent in a text-based retrieval system, content-based image retrieval (CBIR) was introduced in

the early 1980s. Content-based image retrieval (CBIR) is the application of computer vision to the image retrieval problem and deals with the problem of searching for digital images in large databases. CBIR generally works on the basis of querying using an example image or a part of an image. Various types of algorithm are developed and these algorithms may vary depending on the application, but result images should all share common elements with the provided example. 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. In a Generalized Image Searching System (Figure 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 intern 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 [5]. All the mathematical expressions defined in subsequent sections and their descriptions and nomenclature are taken from F. Long et al. [8].

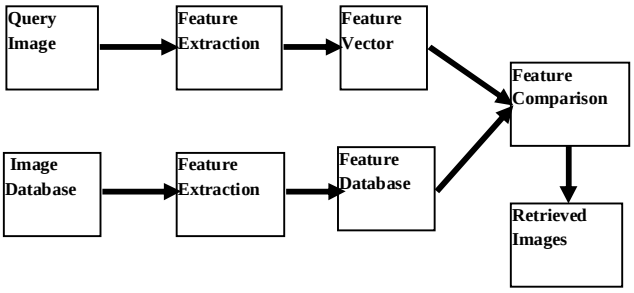

Figure 1. Generalized Image Searching System

Image Content Descriptors:

A visual content descriptor can be either global or local. A global descriptor uses the visual features of the whole image, whereas a local descriptor uses the visual features of regions or objects to describe the image content [5].

Color

Color property is one of the most widely used visual features in content-based image retrieval (CBIR) systems. Researches in this field fall in three main subareas: (a) definition of adequate color space for a given target application, (b) proposal of appropriate extraction algorithms, and (c) study/evaluation of similarity measures.

Color Histogram

It is the most commonly used descriptor in image retrieval. The color histogram is easy to compute and effective in characterizing both the global and the local distribution of colors in an image. The color histogram extraction algorithm involves three steps: partition of the color space into cells, association of each cell to a histogram bin, and counting of the number of image pixels of each cell and storing this count in the corresponding histogram bin. This descriptor is invariant to translation and rotation. The similarity between two color histograms can be performed by computing the L1, L2, or weighted Euclidean distances.

Texture

Texture is the property of an image, characterized by the existence of basic primitives whose spatial distribution creates some visual patterns Generally, texture representation methods are classified into two main categories: structural and statistical. Structural methods, including morphological operator and adjacency graph. Statistical methods, including Tamura feature, shift-invariant principal component analysis (SPCA), and multi-resolution filtering techniques such as Gabor and wavelet transform, define texture by the statistical distribution of the image intensity [5].

Shape

Content-based image retrieval systems use shape features for finding the relationship between the images. Most frequently used methods for shape description can be boundary-based (rectilinear shapes, polygonal approximation, finite element models and Fourier-based shape descriptors) or region-based (statistical moments).

SIMILARITY AND INDEXING SCHEMES

Feature-based image retrieval (FBIR) system usually calculates visual similarities between a query image and images in a database. In recent years many similarity measures have been developed for image retrieval based on empirical estimates of the distribution of features. Different similarity/distance measures will affect retrieval performances of an image retrieval system significantly. Here we will discuss some of the commonly used methods. Similarity Measures Mahalanobis Distance Mahalanobis distance is a distance measure introduced by P. C. Mahalanobis in 1936 [11]. It is based on correlations between variables by which different patterns can be identified and analyzed. It gauges *similarity* of an unknown sample set to a known one.

$$D(I,J) = \sqrt{(F_I - F_J)^T C^{-1} (F_I - F_J)}$$

We denote *D (I, J)* as the distance measure between the query image I and the image J in the database; and fi(I) as the number of pixels in bin i of I . If feature dimensions are independent then Mahalanobis distance can be simplified as, in that case only a variance of each feature component ci, is needed: $D(I,J) = \sum_{i=1}^{N} (F_I - F_J)^2 / c_i$

Minkowski-Form Distance

Minkowski-form distance is the most widely used method for image retrieval. If each dimension of image feature vector is independent of any other and is of equal importance, the Minkowski-form distance Lp is appropriate for calculating the distance between two images [11]. This distance is defined as:

$$D(I,J) = (\sum_i |f_i(I) - f_i(J)|^p)^{1/p}$$

When *p*=1, 2, and ∞, *D* (*I*, *J*) is the *L1*, *L2* (also called Euclidean distance), and *L*∞ distance respectively. The intersection of the two histograms of I and J is defined as:

$$S(I,J) = \frac{\sum_{i=1}^{N} min(f_i(I), f_i(J))}{\sum_{i=1}^{N} f_i(J)}$$

Indexing

Effective indexing is an important issue in feature-based image retrieval. Because the feature vectors of images tend to have high dimensionality and are not well suited to traditional indexing structures, dimension reduction is usually used before setting up an efficient indexing scheme. One of the techniques commonly used for dimension reduction is principal component analysis (PCA). In addition to PCA, many researchers have used Karhunen-Loeve (KL) transform to reduce the dimensions of the feature space. After dimension reduction, the multi-dimensional data are indexed. A number of approaches have been proposed for this purpose, including R-tree (particularly, R*-tree), linear quad-trees, K-d-B tree and grid files [5].

USER INTERACTION

User interfaces in image retrieval systems typically consist of a query formulation part and a result presentation part. Specifying what kind of images a user wishes to retrieve from the database can be done in many ways. Commonly used query formations are: category browsing, query by concept, query by sketch, and query by example.

EVALUATION

To evaluate the performance of the retrieval system, two measurements, namely, recall and precision, are used. For a query q, the data set of images in the database that are relevant to the query q is denoted as R(q), and the retrieval result of the query q is denoted as Q(q). The precision of the retrieval is defined as the fraction of the retrieved images that are indeed relevant for the query:

$$precision = \frac{|Q(q) \cap R(q)|}{|Q(q)|}$$

The recall is the fraction of relevant images that is returned by the query:

$$recall = \frac{|Q(q) \cap R(q)|}{|R(q)|}$$

CONCLUSION

The growth in the availability of the images over the internet demands the powerful tool for extracting or retrieval of the required images. So this paper has discussed the various methods for retrieval and the different methods for similarity comparison of query and image present in database.

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