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Study on Query Based Clustering Technique for Content Based Image Retrieval

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Abstract*— Content-based image retrieval (CBIR) is a new but widely adopted method for finding images from vast and annotated image databases. As the network and development of multimedia technologies are becoming more popular, users are not satisfied with the traditional information retrieval techniques. So nowadays the content based image retrieval (CBIR) are becoming a source of exact and fast retrieval. In recent years, a variety of techniques have been developed to improve the performance of CBIR. An image retrieval system that takes the input query image and retrieves the similar images according to the spatial coordinates and which uses the k means clustering algorithm for its segmentation. Most existing Content Based Image Retrieval based on the images of color, text documents, informative charts, and shape.

***Keywords*—** Content Based Image Retrieval, Clustering Techniques, Color, Texture, and Shape.

I. INTRODUCTION

Content-Based Image Retrieval (CBIR) is defined as a process that searches and retrieves images from a large database on the basis of automatically-derived features such as color, texture and shape. The techniques, tools and algorithms that are used in CBIR, originate from many fields. Such as statistics, pattern recognition, signal processing, and computer vision. It is a field of research that is attracting professionals from different industries like crime prevention, medicine, architecture, fashion and publishing. **Content-based image retrieval** (**CBIR**), also known as **query by image content** (**QBIC**) and **content-based visual information retrieval** (**CBVIR**) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large database. "Content-based" means that the search analyses the contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. The term "content" in this context might refer to colors, shapes, textures, or any other information that can be derived from the image itself. CBIR is desirable because most web-based image search engines rely purely on metadata and this produces a lot of garbage in the results. Also having humans manually enter keywords for images in a large database can be inefficient, expensive and may not capture every keyword that describes the image. Thus a system that can filter images based on their content would provide better indexing and return more accurate results.[1][2][3]

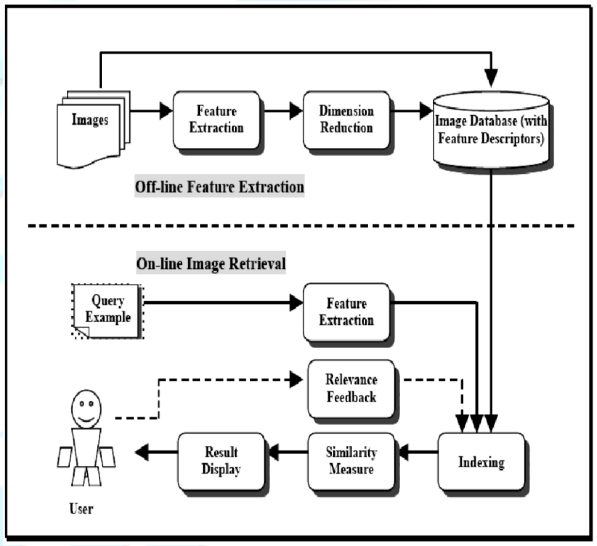

Figure 1: A Conceptual Framework for Content-Based Image Retrieval.

II. THE RETRIEVAL OF CONTENT BASED IMAGE

A. Color-based retrieval

Out of the many feature extraction techniques, color is considered as the most dominant and distinguishing visual feature. Generally, it adopts histograms to describe it. A color histogram describes the global color distribution in an image and is more frequently used technique for content-based image retrieval (Wang and Qin, 2009) because of its efficiency and effectiveness. Color histograms method has the advantages of speediness, low demand of memory space

and not sensitive with the image's change of the size and rotation, it wins extensive attention consequently.[4]

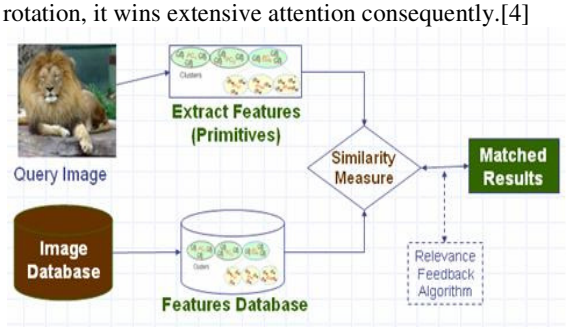

Figure 2: Color Based Retrieval.

B. The retrieval based on texture feature

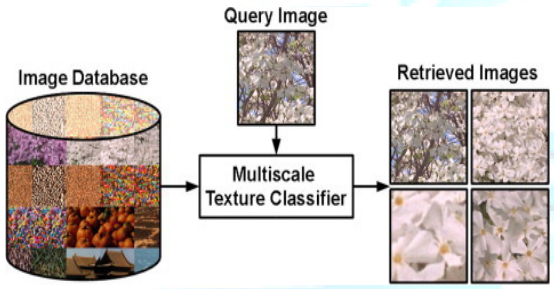

Figure 3: Texture Based Retrieval.

The identification of specific textures in an image is achieved primarily by modeling texture as a two-dimensional gray level variation. Textures are characterized by differences in brightness with high frequencies in the image spectrum. They are useful in distinguishing between areas of images with similar color (such as sky and sea, or water, grass). A variety of methods has been used for measuring texture similarity; the best- established depend on comparing values of what are well-known as second-order statistics estimated from query and stored images. Essentially, these estimate the relative brightness of picked pairs of pixels from each image. [5]

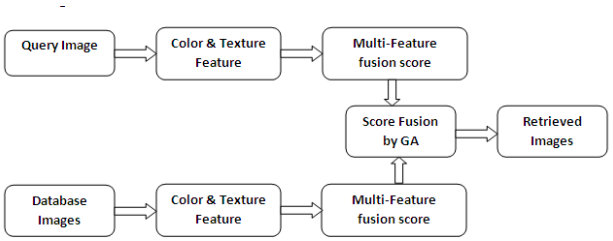

Figure 4: Retrieval Based On Texture Feature.

C. The retrieval based on shape feature

Shape information are extracted using histogram of edge detection. Techniques for shape feature extraction are elementary descriptor, Fourier descriptor, template matching, quantized descriptors, canny edge detection etc. Shape features are less developed than their color and texture counterparts because of the inherent complexity of representing shapes. In particular, image regions occupied by an object have to be found in order to describe its shape, and a number of known segmentation techniques combine the detection of low-level color and texture features with region-growing or split-and-merge processes. But generally it is hardly possible to precisely segment an image into meaningful regions using low-level features due to the variety of possible projections of a 3D object into 2D shapes, the complexity of each individual object shape, the presence of shadows, occlusions, non-uniform illumination, varying surface reflectivity, and so on.[6]

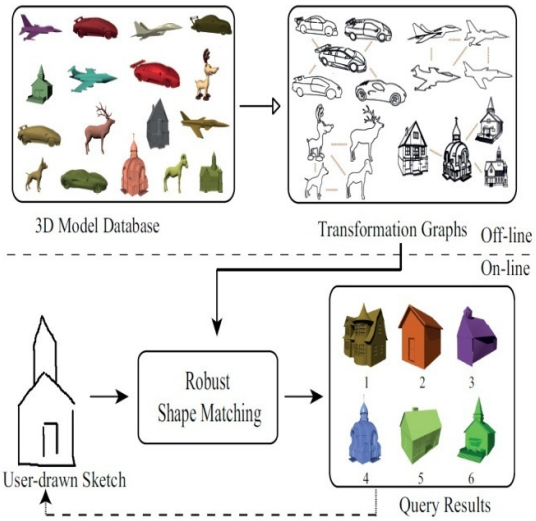

Figure 5: Retrieval Based On Shape Feature.

III. CBIR TECHNIQUES

1. Query Technique

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. The underlying search algorithms may vary depending on the application, but result

images should all share common elements with the provided example.

Options for providing example images to the system include:

- A pre-existing image may be supplied by the user or chosen from a random set.
- The user draws a rough approximation of the image they are looking for, for example with blobs of color or general shapes.

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

2. Semantic Retrieval

The ideal CBIR system from a user perspective would involve what is referred to as *semantic* retrieval, where the user makes a request like "find pictures of Abraham Lincoln". This type of open-ended task is very difficult for computers to perform - pictures of Chihuahuas and Great Danes look very different, and Lincoln may not always be facing the camera or in the same pose. Current CBIR systems therefore generally make use of lower-level features like texture, color, and shape, although some systems take advantage of very common higher-level features like faces. Not every CBIR system is generic. Some systems are designed for a specific domain, e.g. shape matching can be used for finding parts inside a CAD-CAM database.

3. Other Query Methods

Other query methods include browsing for example images, navigating customized/hierarchical categories, querying by image region (rather than the entire image), querying by multiple example images, querying by visual sketch, querying by direct specification of image features, and multimodal queries (e.g. combining touch, voice, etc.)

CBIR systems can also make use of relevance feedback, where the user progressively refines the search results by marking images in the results as "relevant", "not relevant", or "neutral" to the search query, then repeating the search with the new information.[7][8]

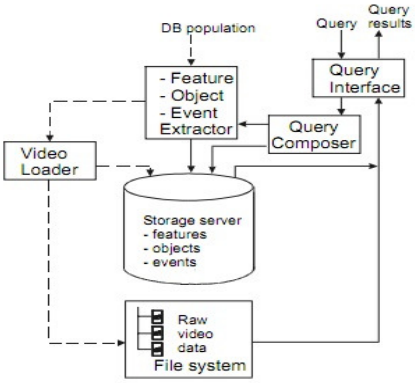

Figure 6: Retrieval with other CBIR Technique.

4. Content comparison using image distance measures

The most common method for comparing two images in content-based image retrieval (typically an example image and an image from the database) is using an image distance measure. An image distance measure compares the similarity of two images in various dimensions such as color, texture, shape, and others. For example a distance of 0 signifies an exact match with the query, with respect to the dimensions that were considered. As one may intuitively gather, a value greater than 0 indicates various degrees of similarities between the images. Search results then can be sorted based on their distance to the queried image. A long list of distance measures can be found in.

5. Color

Computing distance measures based on color similarity is achieved by computing a color histogram for each image that identifies the proportion of pixels within an image holding specific values (that humans express as colors). 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. Color searches will usually involve comparing color histogram, though this is not the only technique in practice.

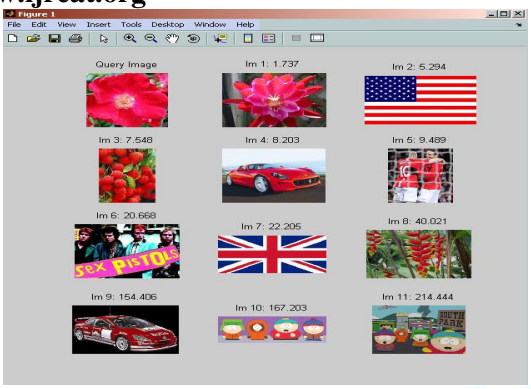

Figure 7: Color Image Retrieval in CBIR.

6. Texture

Texture measures look for visual patterns in images and how they are spatially defined. Textures are represented by Texel's which are then placed into a number of sets, depending on how many textures are detected in the image. These sets not only define the texture, but also where in the image the texture is located.

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. The relative brightness of pairs of pixels is computed such that degree of contrast, regularity, coarseness and directionality may be estimated. However, the problem is in identifying patterns of co-pixel variation and associating them with particular classes of textures such as *silky*, or *rough*.

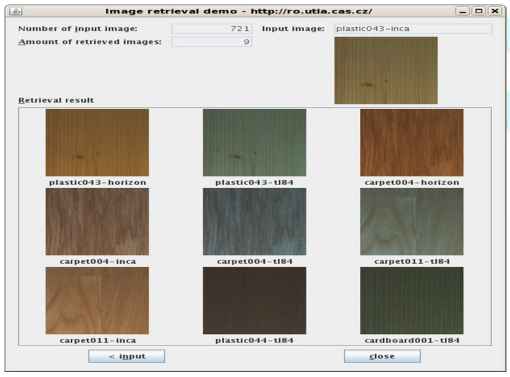

Figure 8: Texture Image Retrieval in CBIR.

7. Shape

Shape does not refer to the shape of an image but to the shape of a particular region that is being sought out. Shapes will often be determined first applying segmentation or edge detection to an image. Other methods like use shape filters to identify given shapes of an image. In some case accurate shape detection will require human intervention because methods like segmentation are very difficult to completely automate. [9]

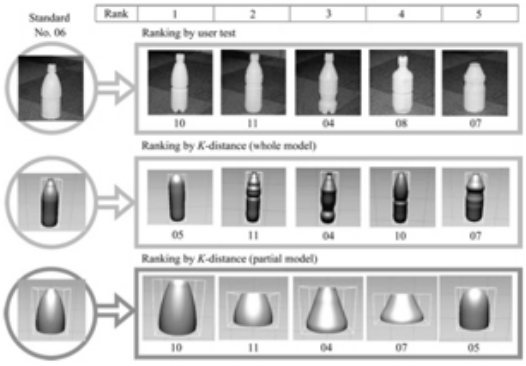

Figure 9: Shape Image Retrieval in CBIR.

IV. APPLICATION

There is a growing interest in CBIR because of the limitations inherent in metadata-based systems, as well as the large range of possible uses for efficient image retrieval. Textual information about images can be easily searched using existing technology, but this requires humans to manually describe each image in the database. This is impractical for very large databases or for images that are generated automatically, e.g. those from surveillance cameras. It is also possible to miss images that use different synonyms in their descriptions. Systems based on categorizing images in semantic classes like "cat" as a subclass of "animal" avoid this problem but still face the same scaling issues.
Potential uses for CBIR include:

- Architectural and engineering design
- Art Collections
- Crime prevention
- Geographical information and remote sensing systems
- Intellectual property
- Medical diagnosis
- Military
- Photograph archives
- Retail catalogs

Content based image retrieval for general-purpose image databases is a highly challenging problem because of the

large size of the database, the difficulty of understanding images, both by people and computers, the difficulty of formulating a query, and the issue of evaluating results properly. A number of general-purpose image search engines have been developed.

Existing general-purpose CBIR systems roughly fall into three categories depending on the approach to extract signatures: histogram, color layout, and region-based search. There are also systems that combine retrieval results from individual algorithms by a weighted sum matching metric.

After extracting signatures, the next step is to determine a comparison rule, including a querying scheme and the definition of a similarity measure between images. For most image retrieval systems, a query is specified by an image to be matched. We refer to this as global search since similarity is based on the overall properties of images. By contrast, there are also "partial search" querying systems that retrieve results based on a particular region in an image.[10][11]

V. PROBLEM DEFINITION

Remarkable observations in the review of related works are as follows:
In recant year there is work for content based image retrieval to improve it efficiency, performance. Now I have to do query based clustering technique for content based image retrieval by using this on the basis of images we can find similar and dissimilar images and data.

The existing CBIR systems use either global features, or region based features to represent the content of an image. Each type of these features can be significant in representing images with certain semantics. For example, global features are useful for retrieving textured images that have no specific regions in accordance to the user, such as natural scenes used as backgrounds. Thus, utilizing an integration of both types of features can improve the performance of the retrieval system.[12]

VI. RELATED WORK

In recant year there is work for content based image retrieval to improve it efficiency, performance. Now I have to do query based clustering technique for content based image retrieval by using this on the basis of images we can find similar and dissimilar images and data.

The search for similar images in large-scale image databases has been an active research area in the last couple of years. A very promising approach is content based image retrieval (CBIR). In such systems, images are typically represented by approximations of their contents. This so-called feature extraction aims at extracting information that is semantically meaningful but needs a small amount of storage.[13]

VII. FEATURE EXTRACTION

Feature extraction is a means of extracting compact but semantically valuable information from images. This information is used as a signature for the image. Similar images should have similar signatures.

The information gained by feature extraction is used to measure the similarity between two images. Images are represented by points in the high dimensional feature space. Each extent of the feature corresponds to one dimension in the feature space. A metric is defined to calculate the actual similarity between two of these points.[14][15]

Figure 10: Example of Image Properties

The white color and the texture of the building are characteristic properties. In a similar way, the sky can be described by its blue color. Furthermore, we can take the size of the objects in the image into account.

Representation of images needs to consider which features are most useful for representing the contents of images and which approaches can effectively code the attributes of the images. Feature extraction of the image in the database is typically conducted off-line so computation complexity is not a significant issue. This section introduces three features: texture, shape, and color, which are used most often to extract the features of an image. [16]

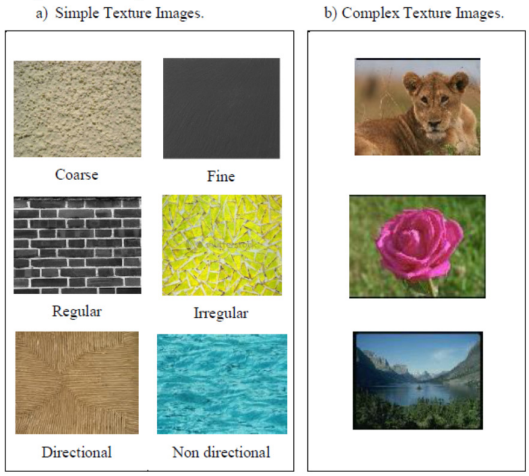

Figure 11: Examples of Simple and Complex Texture Images.

VIII. CONCLUSIONS

The purpose of this survey is to provide an overview of the functionality of content based image retrieval systems. The term "content-based image retrieval" seems to have originated in 1992 when it was used by T. Kato to describe experiments into automatic retrieval of images from a database, based on the colors and shapes present. Combining advantages of query based clustering technique for content based image retrieval to find similar and dissimilar image group and data.

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