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COMPREHENSIVE STUDY ON CONTENT BASED IMAGE RETRIEVAL WITH THEIR FEATURES

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ABSTRACT

In current years, very huge collections of images and videos have grown swiftly. In parallel with this boom, content-based image retrieval and querying the indexed collections of images from the large database are required to access visible facts and visual information. Three of the principle additives of the visual images are texture, shape and color. Content based image retrieval from big sources has a wide scope in many application areas and software's. To accelerate retrieval and similarity computation, the database images are analyzed and the extracted regions are clustered or grouped together with their characteristic feature vectors. As a result of latest improvements in digital storage technology, it's easy and possible to create and store the large quantity of images inside the image database. These collections may additionally comprise thousands and thousands of images and terabytes of visual information like their shape, texture and color. For users to make the most from those image databases, efficient techniques and mechanisms of searching should be devised. Having a computer to do the indexing primarily based on a CBIR scheme attempts to deal with the shortcomings of human-based indexing. Since an automated process on a computer can analyze and process the images at a very quick and efficient rate that human can never do alone. In this paper, we will discuss the structure of CBIR with their feature vectors.

Keywords

Content based image retrieval (CBIR), color histogram, color, shape, texture features.

INTRODUCTION

With the current outburst of multimedia-enabled systems, the need for multimedia retrieval has increased by using leaps and bounds. Due to the complexity of multimedia contents, photograph information is a hard-albeit-exciting topic of studies, inside the domain of multimedia retrieval. Extracting treasured expertise from a huge-scale multimedia repository, commonly called “multimedia mining”, has currently stuck up as a domain of hobby amongst researchers. Typically, within the improvement of an image requisition system, semantic photo retrieval is predicated closely at the associated captions, e.g., filenames, categories, annotated key-words, and other guide descriptions [1]. Searching of images is predominantly primarily based upon associated metadata consisting of keywords, text, and so forth. The term CBIR describes the method of retrieving preferred photographs from the large collection of database on the idea of capabilities that may be robotically extracted from the photographs. The closing purpose of a CBIR machine is to avoid the usage of textual descriptions within the hunt for a photo by using the person. Unfortunately, this kind of a textual-based photograph retrieval device continually suffers from issues: high priced manual annotation and misguided and inconsistent automatic annotation. On one hand, the value related to manual annotation is prohibitive almost about a huge-scale information set. On the alternative hand, irrelevant computerized annotation yields distorted outcomes for semantic photo retrieval. As an end result, a number of effective image retrieval algorithms have been proposed to deal with such problems over the past few years. CBIR is the mainstay of contemporary picture retrieval systems. In CBIR, retrieval of photo is based totally on similarities of their contents, i.e., textures, colors, shapes etc., which are taken into consideration the decrease degree capabilities of a photo. These traditional techniques for picture retrieval are based on the computation of the similarity between the users query and pictures. In CBIR each image saved within the database, has its capabilities extracted and as compared to the capabilities of the question photograph [3]. Thus, extensively, it includes two approaches i.e. Function extraction and characteristic matching [8]. Feature extraction includes the photograph functions to a distinguishable quantity. Average RGB, shade Moments, co-occurrence, Local Color Histogram, Global Color Histogram and Geometric Moments are used to extract features from the check image. Feature matching, then again, entails matching the extracted functions to yield consequences that show off visible similarities. With the development in net and multimedia technologies, a large quantity of multimedia statistics within the form of audio, video and images has been used in many fields like medical remedy, satellite statistics, video and nevertheless pix repositories, virtual forensics and surveillance gadget. This has created an ongoing call for of structures that can keep and retrieve multimedia data in an effective way. Many multimedia records garage and retrieval systems had been advanced till now for catering these demands. The most common retrieval structures are Text Based Image Retrieval (TBIR) systems, wherein the hunt is based totally on automated or manual annotation of pix [2]. A conventional TBIR searches the database for the same text surrounding the image as given within the question string. The generally used TBIR device is Google Images [4]. The text based totally systems are speedy because the string matching is computationally less time ingesting system. However, it's far now and again difficult to express the complete visible content material of images in words and TBIR might also become in generating beside the point results. In addition annotation of images isn't always correct and consumes a variety of time. For finding the alternative way of searching and overcoming the constraints imposed by means of TBIR structures more intuitive and user friendly content based totally photo retrieval structures (CBIR) have been developed. A CBIR device uses visible contents of the photos described in the form of low level features like color, texture, shape and spatial locations to symbolize the images inside the databases. The machine retrieves similar photos whilst an instance photo or query image/sketch is presented as input to the CBIR system [5]. Querying in this manner eliminates the want of

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describing the visible content material of image in words and is near human belief of visible information. Some of the representative CBIR systems are Query by using Image Content (QBIC).

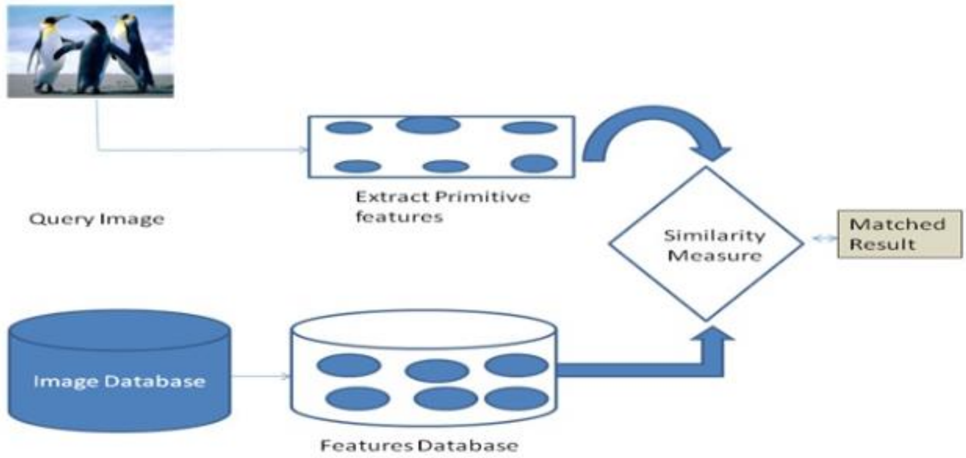

Figure 1. Architecture of CBIR

In a standard CBIR based machine (Figure 1), image based features like color, texture, shape of an image and spatial locations are shown and represented in the form of a multidimensional feature vector. The characteristic vectors of images inside the database form a feature database. The retrieval process in CBIR system is started whenever a consumer question the system using query image or provides the sketch of the image [3]. The question photograph or the query image is converted into the internal illustration of feature vector using the equal characteristic extraction process that was used for constructing the feature database. The similarity measure or the degree is hired to calculate the distance among the feature vectors of query image and those of the target images inside the characteristic database of images. Finally, the retrieval is achieved by using an indexing scheme which facilitates the efficient searching of the image database. Recently, consumer's relevance remarks or we can say the feedback is likewise included to further enhance the retrieval method so one can produce perceptually and semantically greater meaningful retrieval effects using CBIR system [4].

FIELDS OF APPLICATION

Image retrieval is primarily based on content of the material and is extraordinarily useful in many applications or the spheres of our lives together with publishing and marketing, ancient studies, fashion and photo layout, architectural and engineering design, crime prevention, medical diagnosis, geographical information and remote sensing structures, etc. [5]. A usual image retrieval software system is a design engineer who wishes to go looking his company database for layout initiatives similar to that required by way of his clients, or the police in search of to confirm the face of a suspected crook among faces within the database of renowned criminals. In the trade department, earlier than trademark is ultimately authorized to be used, there may be need to find out if such or similar ones ever existed. In hospitals, some ailments require the medical practitioner to search and review similar X-rays or scanned photographs of a patient before proffering a solution. The maximum vital utility, however, is the Web, as large fraction of it is committed to pix, and attempting to find a specific photograph is certainly a daunting assignment. Numerous commercial and experimental CBIR structures are now available, and many net search engines at the moment are geared up with CBIR centers, as for example Alta Vista, Yahoo and Google [6].

COLOUR FEATURES

Color is one of the major features used in CBIR systems. This popularity is attributed to the ease in implementation and the distinguishing differences between colors. It is a robust feature to changes such as the scene layout or viewing angle. Color can be represented with different models such as HSI, YIQ, CMY and RGB. The RGB model is the most widely known one and can be visualized as a cube. One corner of the cube is the origin L (0, 0, and 0) and each of the three primary colors Red, Green and Blue are assigned an edge to represent the axis from the origin. Any other individual color obtained after combining the red, green and blue components in certain proportions then lie in this coordinate space. The origin represents black as it is the point of lowest red, green and blue values. Understandably, the opposite corner with the highest red, green and blue values represents white. The 3D coordinate space is similar to the way our three sets of retinal cones work in our human visual system [7]. The RGB model is nonetheless limited in representing the full human perception which includes details such as the brightness and purity of a color. Those are however implicit in the coordinate space and the nonlinear transformation from RGB to HSI is used to capture those additional properties.

Comparing the color content of images is an obvious, and consequently popular, choice for performing image retrieval duties. Color acts as a robust descriptor that can often simplify the tasks of object identification and extraction from a given image [8]. For example, in Figure 2 it is much easier to locate image pixels of the flower from the rest of the image when using the color image as opposed to the grayscale version. Due to the very nature of color representation, the color data itself provides multiple measurements at any given pixel location in an image. Because of the inherent properties of color, the last two decades have produced a number of interesting methods by which color image retrieval can be performed. A selection of these methods will be discussed following a review of the fundamentals of color and its methods of representation.

Figure 2. A color and grayscale version of an image illustrating the advantages of color

TEXTURE-BASED CBIR

Another famous method to CBIR entails the use of texture in order to index database photos. Texture inside the realm of photograph processing gives data approximately the nearby spatial arrangement of colors or intensities in a given photograph [10]. Images that have similar texture houses need to therefore have the same spatial arrangements of colors or intensities, but not necessarily the equal colors. Because of this, the use texture-based image indexing and retrieval techniques is quite unique than those used strictly for color. In the field of laptop imaginative and prescient and photograph processing, there is no uncomplicated definition of texture. This is because to be had texture definitions are based totally on texture evaluation methods and the capabilities extracted from the photograph. However, texture can be concept of as repeated styles of pixels over a spatial area, of which the addition of noise to the styles and their repetition frequencies results in textures which can appear like random and unstructured [9]. Texture houses are the visible patterns in a photo that have properties of homogeneity that do not result from the presence of most effective a single color or Intensity. The unique texture homes as perceived by means of the human eye are, as an instance, regularity, directionality, smoothness, and coarseness, see Figure 3.

FEATURE EXTRACTION FROM IMAGES

The extraction of the texture and color content of the images take place both during the database population phase and querying phase. Depending on the user's intention, the texture feature extraction can be performed in three different

ways:

Fully Automatic Texture Feature Extraction: The system is capable of determining a rectangular region on the image representing the texture characteristics of the image. Since this region is relatively smaller than the whole image and it is a good representation, dealing with the automatically segmented region provides two things: the feature extraction time decreases, and the query processing phase is accelerated.

Semi-Automatic Texture Feature Extraction: In most of the applications, the users are not interested in the texture of the whole image but a specific region-of-interest. Since the user is provided drawing facilities on the loaded image, the region-of-interest is determined simply by dragging and dropping the mouse on the image. Similar to the fully automatic case, processing the region-of-interests fastens the system.

Texture Feature Extraction of Whole Image: The texture feature extraction for the whole image is the default case, and is meaningful when the whole image is of interest.

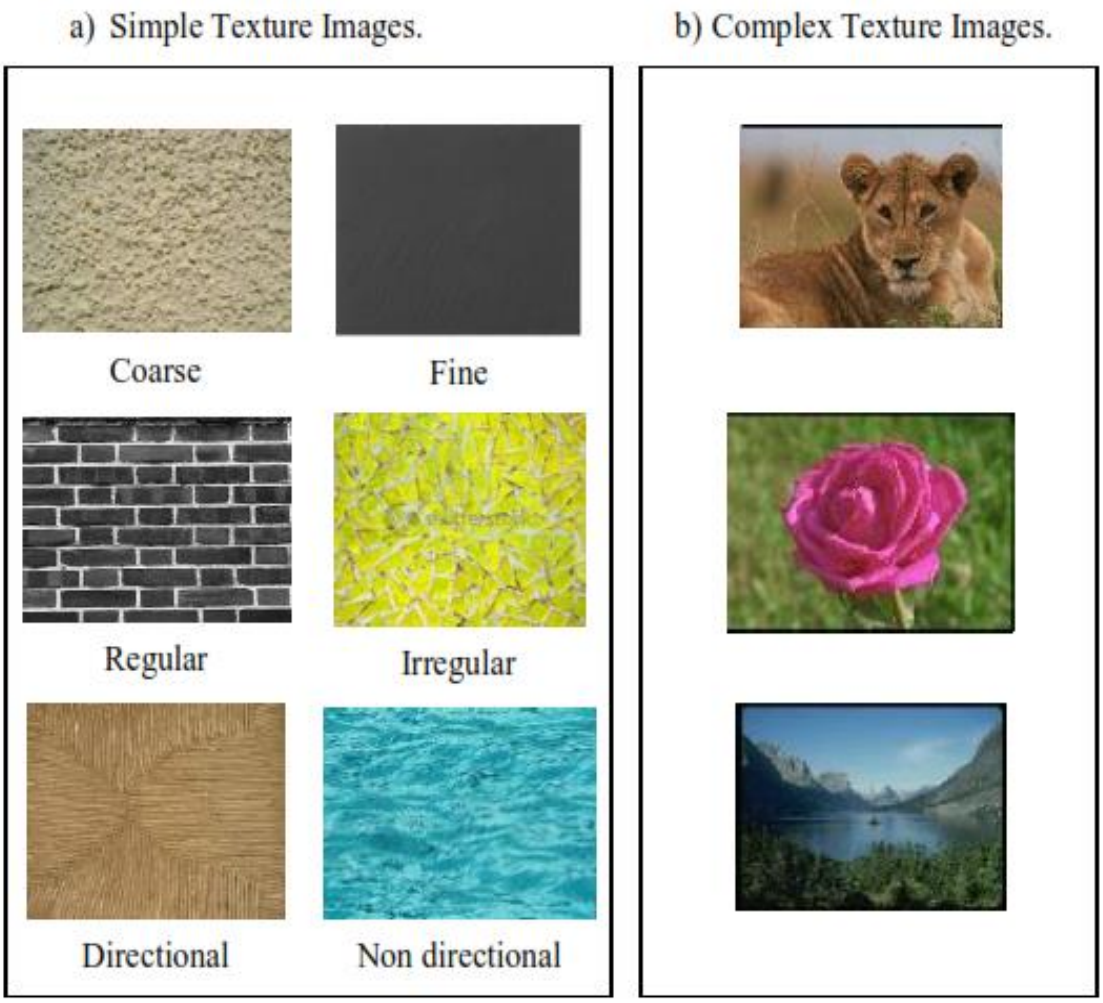

Figure 3. Examples of simple and complex texture images

SHAPE FEATURES

Shape feature provides the most important semantic information about an image. Shape features are usually described using part or region of an image. The accuracy of shape features largely depends upon the segmentation scheme used to divide an image into meaningful objects [13]. However, fast and robust segmentation is difficult to achieve. This limits the shape features only to those retrieval applications where objects or region of images are readily available. The shape descriptors are categorized into two classes: boundary based descriptor and region based descriptor. Some boundary based representative shape description techniques are chain codes, polygonal approximations, Fourier descriptor and finite element model [15]. On the other hand state of the art region based descriptors are statistical moment and area. A good shape feature should be invariant to translation, rotation and scaling.

SPATIAL INFORMATION

The performance of an image retrieval system can be improved by considering spatial locations of different objects in the image. The spatial location of objects and their relationship can provide useful discriminating information in image retrieval applications [15]. For instance, parts of blue sky and ocean may have similar color histograms, but their spatial locations in images are different. The spatial location matching can be implemented by matching the images based on fixed location similarity. In this approach a similar object lying in different regions of an image cannot be detected [16]. For instance; image having tiger in the left part may not get similarity with images having tiger in the right part of images. To overcome this problem systems compare all region of image with the query object or region. This may result in the increase of response time of the system. The most commonly used techniques for finding spatial location similarity includes 2D strings, spatial quad-tree and symbolic images.

SIMILARITY MEASURE

The degree of similarity between query and target images is calculated based on the value of similarity measure. The images are ranked according to their similarity value and presented as output of CBIR system. Often, the choice of similarity measure affects the performance of retrieval system. Many similarity measures have been developed over the years based on the quantitative estimates of the distribution of features in the image. Some of the most commonly used similarity measures employed in CBIR are Euclidean distance , Minkowski- form distance, Histogram intersection distance, Quadratic- form distance, Mahalanobis distance and Kullback Leibler (KL) divergence distance.

CONCLUSIONS

Content based image retrieval is a challenging method of capturing relevant images from a large storage space. Although this area has been explored for decades, no technique has achieved the accuracy of human visual perception in distinguishing images. Whatever the size and content of the image database is, a human being can easily recognize images of same category. From the very beginning of CBIR research, similarity computation between images used either region based or global based features. Global features extracted from an image are useful in presenting textured images that have no certain specific region of interest with respect to the user. Region based features are more effective to describe images that have distinct regions. Retrieval systems based on region features are computationally expensive because of the need of segmentation process in the beginning of a querying process and the need to consider every image region in similarity computation. In this paper, we presented an architecture of content based image retrieval with its various applications.

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