

IMAGE INDEXING USING INTEGRATION OF GABOR FILTER AND HSV ALGORITHM

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Abstract

Content based image retrieval (CBIR), is the most important areas of digital image processing and has become a new and fast way to retrieve images. As the image database grows faster, a better mechanism is needed to retrieve images and get better results. CBIR allows the user to provide a query image to retrieve images stored in the database according to their similarity to the query image. In this paper, content-based image retrieval is used to retrieve a query image from a large image database using two attributes such as color and texture. The color features are extracted through the Hue Saturation Value (HSV) color space and we use Gabor filters to extract texture features from random, separate regions of the image after the segmentation to increase system efficiency. This Reduces recovery time and increases image resolution.

Keywords: Content based image retrieval (CBIR), Hue Saturation Value (HSV), Gabor filters

I. INTRODUCTION

Nowadays, in communication and information image retrieval is a major topic. Image collection is increasing speedily as enhance in image capturing devices like smart phones, digital cameras, and also with increased use of multimedia data. To search and retrieve image from such large image data collection effective tools are needed for different. In early era, text based image retrieval used. All text based image retrieval systems require the text description with images in large scale data bases and manually this task is not effective. Because of this, text based image retrieval systems were not applicable for task dependent queries. To overcome these problems content-based image retrieval (CBIR) was introduced. Content based image retrieval is a powerful tool used to retrieve the image based on visual contents such as color, texture and shape from large database. To deal with image retrieving and indexing brief knowledge of image classification is required. Some of the main applications of CBIR system are biomedical imaging, Face Recognition, Geographical changes, Identification of Fingerprint, Crime Prevention, Digital Libraries, Graphic and Fashion Design, Cultural Heritage, skin detection etc.

1.1 Content Based Image Retrieval

Image-based image retrieval, a feature-extraction technique for searching images from large image databases according to user interests, has been inactive and fast in search since the 1980s. During the past years, remarkable progress has been made in research and system development. Hence, there are remaining challenging research problems still attract researchers from multiple disciplines. Previous techniques were based on the textual annotation of image but not on the visual content of images. From text descriptions, images can be organized by topical or semantic hierarchies from lookup table and to facilitate easy navigation and browsing based on standard Boolean queries.

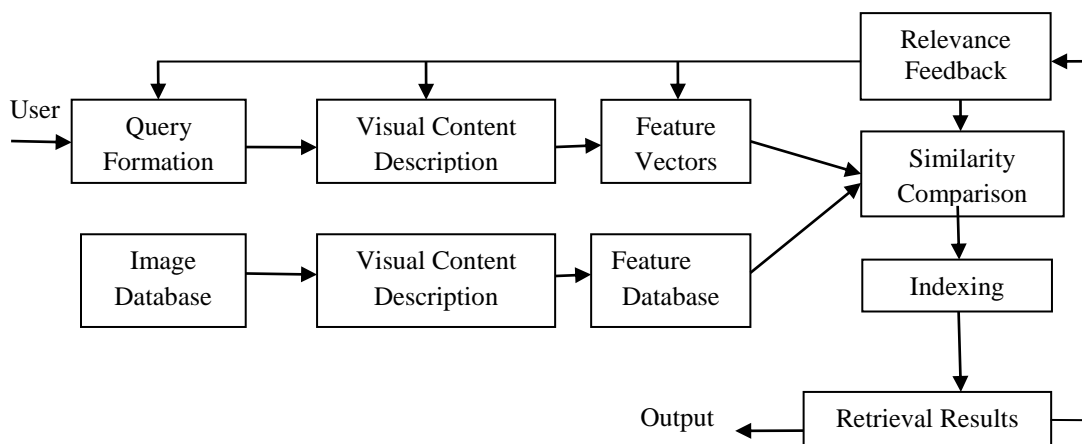


Figure1. Diagram of content based image retrieval

Content Based Image retrieval uses features extraction of an image such as color, and texture to represent and index the image. In Content Based Image retrieval systems, the visual contents of the images in the database are compared and extracted by their feature vectors. Similarity comparison is done between the given query image and images within the database. The feature vectors of the images in the database form a feature database as shown in figure 1. To retrieve images, users provide example images or sketched images to retrieve related images from large scale database. This paper is further organized by section II describes literature review. Section III discusses Image features. Section IV focus on user interaction. Section V contains results and discussion. Section VI is about conclusion.

MATERIALS AND METHODOLOGY

The database is created in 10 different categories and each group contains 100 images. All images are resized to a size of 384X256 pixels. The various collections of images are buildings, beaches, Africans, buses, dinosaurs, elephants, roses, horses, mountains and food. Initially features all the images read by the database program. Later the database is given a query image. Depending on similar color and texture, similar images are retrieved.

II. LITERATURE REVIEW

Blaser proposed Database Technologies for Image Applications provided content-based image retrieval, a technique that uses visual content to search for images from large-size image databases according to users' wishes. Research has been developed rapidly since the 1990s. During the past years, excellent progress has been made in theoretical research and system development. However, there remain many different types of challenging research problems that continue to attract researchers from multiple disciplines using new research methods [Blaser-1979].

Ns changhas proposed, A relational database system for images providing advances in image processing, database management, and information retrieval has resulted in content-based multimedia retrieval to emerge as an important research area. Traditionally, content-based multimedia retrieval was supported by augmenting multimedia objects with textual annotations. Information retrieval techniques on textual descriptions were then used to support content-based retrieval. There are numerous limitations of this approach. First, this approach is not efficient because object needs to be manually annotated with keywords and/or textual descriptions making it impractical for large database. Second, due to the subjectivity of the human annotator, the annotations may not be consistent which negatively affects retrieval effectiveness. Furthermore, it may be infeasible to describe visual content (e.g., shape of an object) using simply words. To overcome the above problems, over the past few years' content-based retrieval over visual features has emerged as a promising research direction [Ns Chang-1979].

E. Cawkill proposed Picture Research Projects in the British Library: Image, Word and Retrieval a combination of three features color, texture, and edge histogram descriptor. There is a chance to add new features in for better retrieval efficiency. Using different research methods, accuracy will be improved. This is possible through User Interface (UI) in the form of relevance feedback. The image properties analyzed in this work are using computer vision algorithms and image processing. For color the histogram of images are computed, for texture co-occurrence matrix based energy and standard deviation. For retrieval of images, a novel idea is developed based on greedy strategy to reduce the computational complexity [E. Cawkill-1993]. M.K. Mandal et.al proposed Quick Wavelet Graphics Techniques for Image Indexing a new fusion approach using non local and local features. Generally Color Histogram (CH) is used as global feature and Block Bit Plane (BBP) as a local feature. For similarity measurement for query image and target image, distance d1 is used for CH features and BBPs are compared bit by bit using Hamming distance. Finally the overall similarity is computed as a weighted combination of global and local features [Mandal, S. Panchanathan, T. Abu Al-Nasr-1999].

III. IMAGE FEATURES

1. Color:

Color features are the most widely used in image retrieval and indexing color features are easier to extract features of object than texture and shape information. Color feature robust to background and is not depends on image size and orientation, and it denotes the combined probability of the intensities of the three color channels. Color distribution features can be matched more strongly than color histograms as histograms do not capture spatial association and they have restricted selective power .color features. color regions of spatial correlation and the global distribution of local spatial correlation of colors can be combined in color correlogram and color coherence vector. These techniques give better efficiency than traditional color histograms. However, they need very costly computation. Color moments have been efficiently used in content based image retrieval systems. It has been clear that characterizing one dimensional color distributions with the three moments is more powerful and runs faster than the histogram based methods.

a) Color Space:

Color Space is used for description of image retrieval based on color. Vector of three dimensional spaces and color in it and it is a part of color space, the choice of color space is made from characteristics of uniformity and uniformity means to having similar distance between color points in color space as perceived by human eye, generally RGB, HSV, YCrCb and opponent color space are used.

Red-Green-Blue (RGB) Color Space

The color representation RGB used in image retrieval. In this representation, the values of the red, green, and blue color channels are stored in particular manner. They can range from 0 to 255, with 0 being not present and 255 being maximum value. A channel, alpha also provides a measure of transparency for the image pixel.

The distance between two pixels is measured as:

$$\frac{(255 - |\Delta Red|) \cdot (255 - |\Delta Green|) \cdot (255 - |\Delta Blue|)}{255^3}$$

Where ΔRed is the red channel difference value, $\Delta Green$ is the green channel difference value, and $\Delta Blue$ is the blue channel difference value between the two pixels being compared. This distance matrix has an output in the range. When used to compare pixels, a cut-off, generally between 0.6 and 0.8, and is used to describe whether the two pixels are similar to each other. Because distance measurement depends on the difference between pixel color values, the area of the similarity to the value of a particular image segment is the same pixel value location is compared to the RGB color space.

Hue-Saturation-Value (HSV) Color Space

Hue-Saturation-Value (HSV) color space is alternative of RGB. Instead of looking at each value of red, green and blue individually, a HSV creates a different continuum of colors, in terms of the different hues each color possesses. The hues are then differentiated with the amount of saturation they have, that is, in terms of how little white they have mixed in, as well as on the magnitude of the hue. In the value range, large numbers denotes bright colorations, and low numbers denotes dim colorations.

The gradient, saturation and value calculation can be done as detailed below. From the figure below, h stands for hue, v stands for value, and s stands for saturation. The RGB colors are also represented with r for red, g for green, and b for blue. The remainders of the variables are temporary computation results.

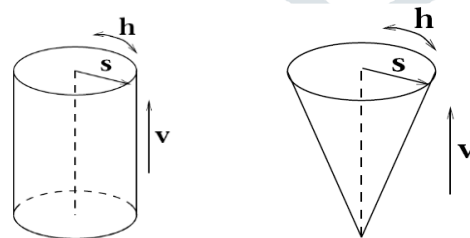


Figure 3.2 Two HSV color space representation

The cylindrical representation is a good approximation, but the conical representation results in better performance.

$$v = \max(r, g, b)$$

$$s = \frac{v - \min(r, g, b)}{v}$$

Here, \max denotes a function returning the maximum (255) value among its arguments, and \min denotes a function returning the minimum (0) value among its arguments.

$$h = \begin{cases} \text{if } r = \max(r, g, b) \text{ and } g = \min(r, g, b) \text{ then } 5 + b\text{point} \\ \text{if } r = \max(r, g, b) \text{ and } b = \min(r, g, b) \text{ then } 1 + g\text{point} \\ \text{if } g = \max(r, g, b) \text{ and } b = \min(r, g, b) \text{ then } 1 + r\text{point} \\ \text{if } g = \max(r, g, b) \text{ and } r = \min(r, g, b) \text{ then } 3 - b\text{point} \\ \text{if } b = \max(r, g, b) \text{ and } r = \min(r, g, b) \text{ then } 3 + g\text{point} \\ \text{if } b = \max(r, g, b) \text{ and } g = \min(r, g, b) \text{ then } 5 - r\text{point} \end{cases}$$

where

$$r\text{point} = \frac{v - r}{v - \min(r, g, b)}$$

$$g\text{point} = \frac{v - g}{v - \min(r, g, b)} \text{ and}$$

$$b\text{point} = \frac{v - b}{v - \min(r, g, b)}$$

The value computation, maps to the range of values which r, g, and b can take.

In this HSV 64 bins are used for each color channel. Totally we obtain 192 features for each image. These 192 features are used for retrieving the image by computing feature vectors.

b) Color Histogram:

Color histogram is used as color representation technique for image retrieving. Color histograms is not giving spatial data, it is only effective for local as well as global features of colors. It calculates the local and global image information and invariant of image along the view axes for translation and rotation. It is an efficient expression of color attribute in CBIR systems. Histograms mostly use RGB color space. When histogram is computed for large scale image database, it gives average efficient result; to overcome this joint histogram technique is given.

c) Color Distributions:

Color distributions were used for efficiently retrieving most of the similar images from the large image databases, Luet al uses the, the mean value and the standard deviation , to represent global characteristics of image, and specially the image bitmap is used to represent the local characteristics of image for increasing accuracy of the image retrieval.

1. Texture:

Texture refers to property of natural and artificial surfaces, including clouds, trees, bricks, hair, fabric and their surrounding background. Texture properties contain important information about the structural arrangement of surfaces and their relationship to the background. Common texture properties are coarseness, regularity, directionality, contrast, line likeness and roughness. Because of its importance of pattern recognition of texture pattern recognition, there are rich research results from the past years. Now more and more research achievements are being added to it. The natural world having texture: the surface of any object is textured in particular scale. A wealth of textures is observed on both artificial and natural objects like wood, plants, materials and skin. In a general sense, the word texture refers to surface characteristics of the object and appearance of an object based on the size, shape, density, rough, arrangement, and proportion of its elementary parts. The texture is usually described as soft or coarse, soft or hard, smooth coarse, matte or glossy, and so on. Different tools for extract the features of texture are Gabor filter, standard wavelet, Haar wavelet etc.



Figure 3.1 Texture Images

a) Gabor Filters:

Basically Gabor filters are group of wavelets and related to Gabor wavelet, with each wavelet capturing energy at a particular dilations and specific rotation. The scale and orientation property of Gabor filter useful for texture analysis. Gabor filter is one of the most important techniques for retrieving the image.

b) Standard Wavelet Transform:

A wavelet is an important tool in image processing like oscillation with amplitude that starts at zero then increases, and decreases back to zero. Wavelets are purposefully crafted to have particular properties and useful for signal processing. The waves can be combined using a "shift, multiply and sum" technique called convolution, with parts of an unknown signal to extract information from the unknown signal. These features compression and locality of query image.

There a new segmentation method for images consisting of texture regions using local spectral histograms. By analyzing the algorithm into three stages, we can derive probabilistic models and extract the matrimonial features with fragmentation through the iterative update. These lead to more accurate area boundaries, which are more centered through the resettlement phase. Comparisons with other methods show that our method gives a more accurate segmentation. It is provided as a result of a 95% partition using a density filter or also uses a different partition filter. Accuracy of existing methods is given below in table by analyzing different research papers. Some of these are intensity filers, two gradient, three gradient intensity filters, standard wavelet and Gabor wavelets.

Table 3.1: Texture Segmentation Accuracy by using different combination of the Eight Filters.

Filter(s)	Accuracy (%)	
	Without Localization	With Localization
Intensity filter	95.2	99.2
Two gradient filters	82.4	97.8
Intensity + two gradient filters	94.4	98.9
Two LOG filters	91.4	98
Three Gabor filters	88.9	99.3
Two LOG + three Gabor Filters	93.2	98.7
Intensity + two LOG filters	94.3	99.2
Two gradient + three Gabor filters	90.9	98.7

IV. USER INTERACTION

In retrieving content-based images, user interaction with the retrieval system is difficult. Flexible configuration and query modification can only be obtained by engaging the user in the loopback procedure. User interfaces in image retrieval systems typically consist of the Query Forming part and the View Results part. Different types of query images are following.

1) Query via Example

Query by example allows the user to give sample image as query to retrieve the image from large database. Query by example can be classified into query by external image example, if the query image is not present in the dataset, and query by internal image example, if otherwise. For query by internal image, all relationships between images in database can be pre-computed. The advantage of query by example is that the user is not required to provide an external description of the target, which is computed by the system. It is suitable for most of the applications where the target is an image of the same object or different of objects under different viewing conditions. Most current systems provide this form of querying.

2) Query through Sketch:

Query by sketch allows user to sketch query image with a graphic interface tool provided either by the retrieval system or by some other software. Queries may be drawn by several objects with certain properties like color, texture, shape, sizes and locations. In most cases, a coarse sketch is enough, as the query can be refined based on retrieval results.

3) Query through Group Example:

Query by group example allows user to select multiple images as sample query.. The system will then detect the images that best match the features of the group of examples. In this way, a target can be defined more precisely by specifying the related feature variations and removing unrelated variations in the query image.

4) Category Browsing:

Category browsing is to search the image in database according to the category specified of the image.

V. RESULT AND DISCUSSION



Fig 5.1: Sample Database

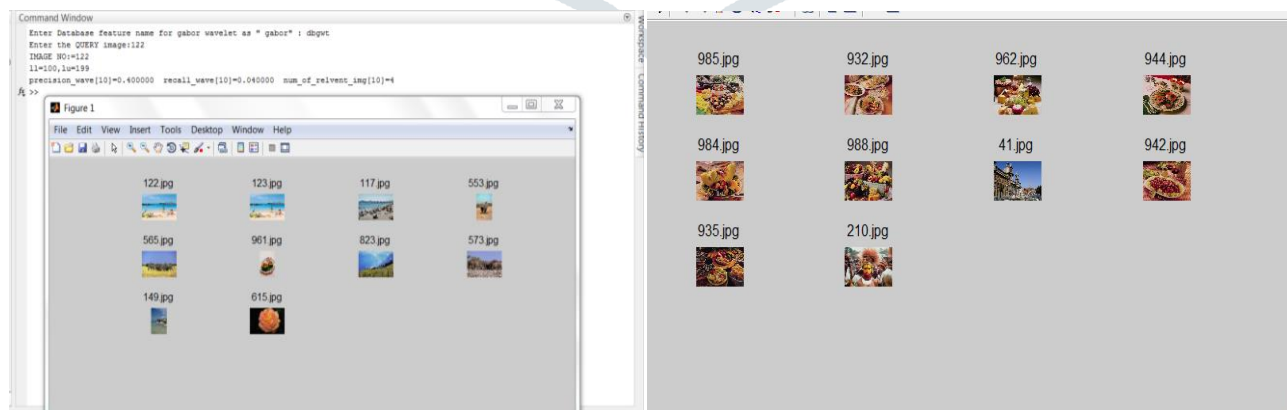


Fig 5.2: Retrieve results

The fig5.1 is a simple database and it contains different categories of images. Fig 5.2 describes the retrieved results from the sample database. When the query image is given from the images of beach, the related images using the color and texture of query image are retrieved. The obtained results in fig 5.2 are related to the images of beach and food given in database.

VI. CONCLUSION

In this report, current technical achievements in visual feature extraction, CBIR using Genetic Algorithm, and system design are presented. In CBIR, images are indexed by their visual content, such as color and texture. The fundamental difference between content-based and text-based retrieval is that the human interaction. In text-based retrieval human plays a crucial role of annotation of images while in content based retrieval, different low level features are extracted using computer vision techniques.

In existing method for content based image retrieval using color, texture and shape features. For color features, color histograms of each color band have been extracted. Here two types of color spaces were implemented and compared in terms of average precision and average recall. Color-based retrievals in HSV color space gives better performance than in RGB color space. For texture features mean, standard deviation, and energy have been extracted from every decomposed sub band of image. Wavelet and Gabor transforms decompose the sub band of image and Canon edge detection is used to detect variation in intensity of image and it gives better performance. We found some drawbacks to extract features for relevant image retrieval from large scale database, in future we will try to overcome from existing methods by using new method. From the above methods we found that K-mean clustering, Hidden Markov model, discrete wavelet frames decomposition and a mean shift algorithm, Haar wavelet and Intensity filter methods give better accuracy to retrieval.

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