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CONTENT BASED IMAGE RETRIEVAL ON COLOR, TEXTURE AND SHAPE FEATURES USING DWT AND MODIFIED K-MEANS

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ABSTRACT

Here we proposed algorithms for CBIR system on the basis of texture, shape,and color based feature extraction and matching of color and texture.We used the Discrete Wavelet transform for decomposition of images and clusters calculations using modified K-Means clustering.We extract texture,shape, and color and finaly measure similarity between query image and database image and reduced semnatic gap between local features and global features. Integrated approach retrive more accurate image, reduce semantic gap between local and high level features.The time taken by Modified K-Means is less as comparison to other algorithms.This is more optimized method for small as well as large database.

KEYWORDS: Content Based Image Retrieval (CBIR), Auto Color Correlogram, DWT, Modified K-Means, Gabor Wavelet, SVM, Semantic gap.

INTRODUCTION

Content-based image retrieval (CBIR) techniques, based on the low-level image content features, enable a powerful approach in retrieving images. Most of the CBIR techniques extract significant features from the images to construct image-related feature vectors and then store the feature vectors in database. So the search for target images can depend on the basis of comparison of the feature vectors between the query and the ones in database. A similarity measurement is performed to determine how similar the images in database to the query are in terms of their visual contents. The target images can be search by providing an individual example using these features with the help of process of query-by-example (QBE), by the techniques like averaging and histograms. The texture aspect can be achieved by using transforms or static vector quantization. Using gradient operators or morphological operators the shape aspect can be achieved. Image processing is any form of signal processing where the input can be a photograph or a video frame and the output may be either an image or a set of parameters related to the image. An image retrieval system is a system which allows us to browse, search and retrieve the images. For retrieving the desired query image from a huge number of databases based on the contents of the image content based Image Retrieval is used. Color, texture, shape and local features are some of the general techniques used for retrieving a particular image from the images in the database. There are two types of features like local features and global features. The other component is the relevant feedback where it helps to be more precise in searching the relevant images by taking up the feedbacks of the user.

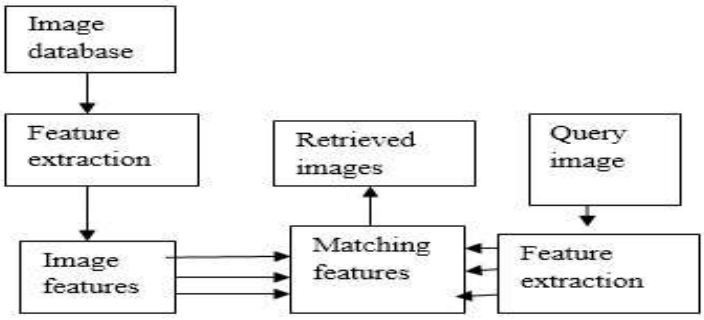

Figure: 1Block diagram of CBIR

In the past decade, more and more information has been published in computer readable formats. In the meanwhile, much of the information in older books, journals and newspapers has been digitized and made computer readable. Big archives of films, music, images, satellite pictures, books, newspapers, and magazines have been made accessible for computer users. Internet makes it possible for the human to access this huge amount of information. Color, texture and shape features have been used for describing image content. Different CBIR systems have adopted different techniques. A color histogram describes the global color distribution in an image. While the color histogram is robust to translation of object and rotation about the viewing axis, it does not include any spatial information. Different images can have same color distribution; however, large appearance changes in an image can easily change the histogram. Ching-hung Su et al.we have proposed a technique for image retrieval based on hue saturation value (HSV). Xiaojie Li et al. have utilized histogram for image retrieval.Youngeum a et al. have used HSV color space for CBIR.

In case of on-line image retrieval, the user can submit a query example to the retrieval system in search of desired images. The system represents this example with a feature vector. The similarities between the feature vectors of the query example and those of the media in the feature database are then computed and ranked.

Fields of Application

Image retrieval based on content is extremely useful in a plethora of applications such as

- **Publishing and advertising** are normally catalogued in a collection catalogue, traditionally in a card index, but nowadays in a computerized database.
- **Crime prevention** is the attempt to reduce and determine crime and criminals. to reduce crime, enforce the law, and maintain criminal justice this is applied specifically to efforts made by governments.
- **Intellectual property** (**IP**) refers to creations of the intellect for which a monopoly is assigned to designated owners by law. Intellectual property rights (IPRs) are the protections granted to the creators of IP, and include trademarks, copyright, patents, industrial design rights, and in some jurisdictions trade secrets**.**
- A typical image retrieval application example is a design engineer who needs to search his organization database for design projects similar to that required by his clients, or the police seeking to confirm the face of a suspected criminal among faces in the database of renowned criminals. In the commerce department, before trademark is finally approved for use, there is 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 images of a patient before proffering a solution.

Image Retrieval Problem

In this computer age, virtually all spheres of human life including

- Commerce
- Government
- Academics
- Hospitals
- Crime Prevention
- Surveillance
- Engineering
- Architecture
- Journalism
- Fashion and graphic design, and historical research use images for efficient services. The police maintain image database of criminals, crime scenes, and stolen items. In the medical profession, X-rays and scanned image database are kept for diagnosis, monitoring, and research purposes. In publishing and advertising, journalists create image databases for various events and activities such as sports, buildings, personalities, national and international events, and product advertisements. In historical research, image databases are created for archives in areas that include arts, sociology, and medicine.

Content Based Image Retrieval

From the last couple of years search for similar images in large-scale image databases has been an active research area. Content based image retrieval is a very promising approach. In such systems, images are typically represented by approximations of their contents. A metric is defined to calculate the actual similarity between two of these points. Search for images similar to a query image ‘q’ results in finding the ‘k’ nearest neighbours of ‘q’.

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The model can be extended to support more complex queries that can consist of more than one query image and more than one feature type.

An indexing structure based on the query model is developed for fast retrieval. We presented some of the indexing structures that are commonly used in CBIR systems.

Feature Extraction

The Meaning of feature extraction is extracting compact but semantically valuable information from images. This information is used as a signature for the image. All The similar Images have similar signatures. The white color and the texture of the ground 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.

Figure 2: Example of Image Properties.

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.

Color

One of the most important features visually recognized by humans in images is color. Several color spaces, such as RGB, HSV, CIE L*a*b, and CIE L*u*v, have been developed for different purposes. Therefore, the RGB color space, a widely used system for representing color images, is not suitable for CBIR because it is a perceptually non-uniform and device-dependent system. The most frequently used technique is to convert color representations from the RGB color space to the HSV, CIE L*u*v, or CIE L*a*b color spaces with perceptual uniformity. The HSV color space is an intuitive system, which describes a specific color by its hue, saturation, and brightness values. This color system is very useful in interactive color selection and manipulation. The CIE L*u*v and CIE L*a*b color spaces are both perceptually uniform systems, which provide easy use of similarity metrics for comparing color. After selecting a color space, an effective color descriptor should be developed in order to represent the color of the global or regional areas. Several color descriptors have been developed from various representation schemes, such as color histograms, color moments, color edge, and color texture.

Color layout

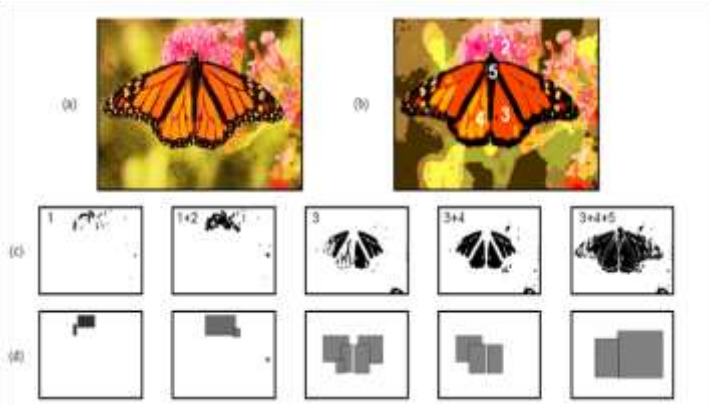

Figure 4: Color Layout

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Color Histogram

The most commonly used method to represent color feature of an image is the color histogram. The bars in a color histogram are named as bins and they represent the x-axis. A GCH takes color histogram of whole image and thus represents information regarding the whole image, without concerning color distribution of regions in the image. An example of a color histogram in the HSV color space can be seen with the image in Figure 3.3.

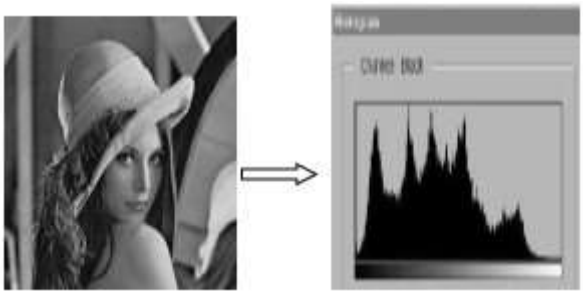

Image *corresponding Histogram*

Figure 1.5: Sample Image and Its Corresponding Histogram.

Texture

In the field of computer vision and image processing, there is no clear-cut definition of texture. However, texture can be thought of as repeated patterns of pixels over a spatial domain, of which the addition of noise to the patterns and their repetition frequencies results in textures that can appear to be random and unstructured. The different texture properties as perceived by the human eye are, for example, regularity, directionality, smoothness, and coarseness.

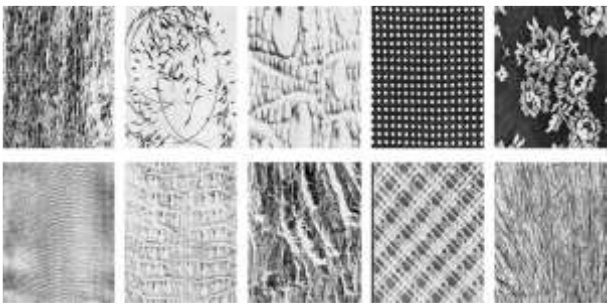

Figure 3: Examples of Texture Images.

In real world scenes, texture perception can be far more complicated. The various brightness intensities give rise to a blend of the different human perception of texture as shown in Figure 1.6. Image textures have useful applications in image processing and computer vision.

Shape

One of the common used features in CBIR systems is the shape. Shape of an object is the characteristic surface configuration as represented by the outline or contour. Shape recognition is one of the modes through which human perception of the environment is executed. It is important in CBIR because it corresponds to region of interests in images. Shape feature representations are categorized according to the techniques used. They are boundary-based and region-based [08]. Region moment representations interpret a normalized grey level image function as a probability density of a 2-D random variable. Hu[01].

Similarity Measure

The similarity between two images (represented by their feature values) is defined by a similarity measure. Selection of similarity metrics has a direct impact on the performance of content-based image retrieval. The kind of feature vectors selected determines the kind of measurement that will be used to compare their similarity [02].

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Data Clustering Techniques

A. K-Means Clustering

It is a partition method technique which finds mutual exclusive clusters of spherical shape. It generates a specific number of disjoint, flat (non-hierarchical) clusters. Statistical method can be used to cluster to assign rank values to the cluster categorical data. Next, we compute the cluster means again, using the cases that are assigned to the clusters; then, we reclassify all cases based on the new set of means. We keep repeating this step until cluster means don't change between successive steps. Finally, we calculate the means of cluster once again and assign the cases to their permanent clusters.

i. K-Means Algorithm Properties

- There are always K clusters.
- There is always at least one item in each cluster.
- The clusters are non-hierarchical and they do not overlap.

ii.K-Means Algorithm Process

- The dataset is partitioned into K clusters and the data points are randomly assigned to the clusters resulting in clusters that have roughly the same number of data points.
- For each data point:
- Calculate the distance from the data point to each cluster.
- If the data point is closest to its own cluster, leave it where it is. If the data point is not closest to its own cluster, move it into the closest cluster.

Proposed Architecture

In this thesis work we proposed algorithms on the basis of texture, shape,and color based feature extraction and matching of color and texture.I will use concept of Discrete Wavelet transform for euclidian distance and calculate clusters using modified K-Means clustering. we extract texture,shape, and color snd finaly meauser similarity between query image and database image. Integrated approach retrive more accurate image, reduce semantic gap between local and high level features.Modified K-Means takes less time of computation in comparison to other algorithms.This algorithim is more optimized for small as well as large database.

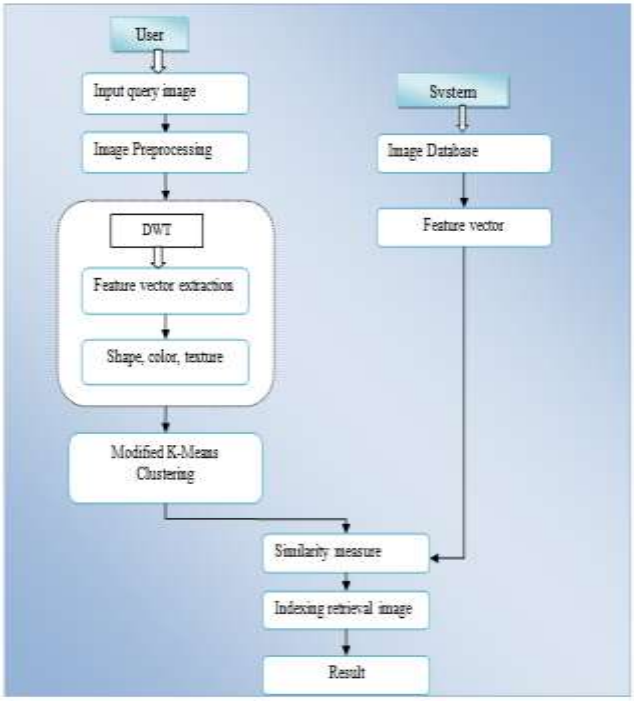

Figure 1.6: Proposed Architecture

Experimental Results and Discussion

The proposed system is designed to operate the content based image retrieval system. It has been verified with the photos of places of interest in the Wang's dataset. Our experimental results demonstrate that our CBIR system architecture not only works well for image retrieval, but also improves its precision. In our knowledge, this

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proposed system first combines segmentation and grid module, feature extraction module, modified K-means clustering module to build the CBIR system. Furthermore, the concept of modified k means module which recognizes the side of every grids of image is first contributed in this thesis. Applying the concept of features based dwt into the content based image retrieval system also contributes in our system architecture. The experimental results confirm that the proposed CBIR system architecture attains better solution for image retrieval. Our model represents the first time in which combine new modules and techniques proposed in the thesis have been integrated with CBIR system.

Figure 1.7.1: GUI for proposed work

Figure 1.7.2: Load dataset

Figure 1.7.3: Input query image

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Figure 1.7.4: Processing on input image

Figure 1.7.5: Query Image Retrieval using Modified K means and DWT

RESULT AND DISCUSSION

Comparison between K-Mean and Modified approach algorithm with large Number of Records and its Execution Time in milliseconds is shown on the table 1.8.1.And comparison of Retrieved Precision value by different methods is shown on the table 1.8.2. These results clearly show that the performance of the proposed method is better than the other methods.in this paper we used 1000 image database along with Wang database image. Some sample of database images shown in figure 1.8.2 shown below.

Number of Records	**Execution Time using K-Mean Algorithms(In minutes)**	**Execution Time using Modified K-Mean Algorithms (In minutes)**
700	1	0.899
800	2.66	1.9001
900	3.5	2.83
1000	5	4.11

Table 1.8.1: Comparison between K-Mean and Modified K-Mean Algorithm

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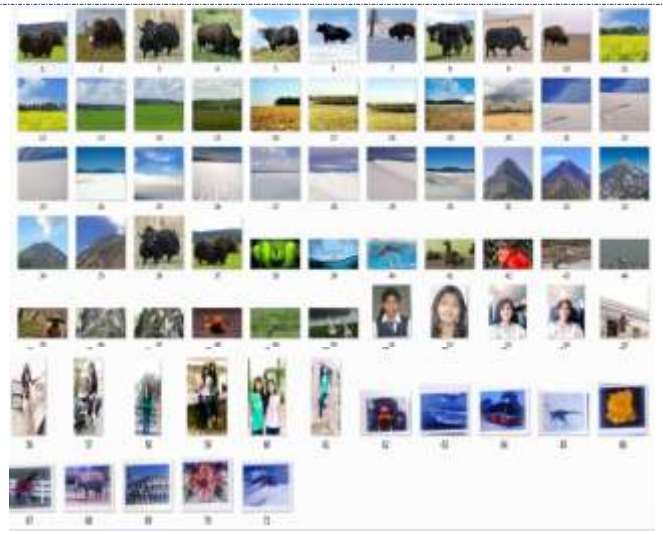

Figure: 1.8.2. Sample of some Image Database

classes	Category	WBCH[46]	CH[46]	Proposed
1	African People	0.65	0.72	0.84
2	Beach	0.62	0.53	0.88
3	Building	0.71	0.61	0.89
4	Buses	0.92	0.93	0.93
5	Dinosaurs	0.97	0.95	0.96
6	Elephants	0.86	0.84	0.89
7	Flowers	0.76	0.66	0.88
8	Horses	0.87	0.89	0.91
9	Mountains	0.49	0.47	0.86
10	Food	0.77	0.82	0.89
	Average Precision	0.762	0.742	0.893

Table 1.8.3: Retrieved Precision value by different methods.

CONCLUSION

The proposed system is designed to operate the content based image retrieval system. It has been verified with the photos of places of interest in the Wang's dataset. Our experimental results demonstrate that our CBIR system architecture not only works well for image retrieval, but also improves its precision. In our knowledge, this proposed system first combines segmentation and grid module, feature extraction module, modified K-means clustering module to build the CBIR system. Furthermore, the concept of modified k means module which recognizes the side of every grids of image is first contributed in this thesis. Applying the concept of features based DWT into the content based image retrieval system also contributes in our system architecture. The experimental results confirm that the proposed CBIR system architecture attains better solution for image retrieval. Our model represents the first time in which combine new modules and techniques proposed in the thesis have been integrated with CBIR system.

This paper proposes a modified version of the well-known *k*-means clustering algorithm. The modified algorithm maintains all important characteristic features of the basic *k*-means and at the same time eliminates the possibility of generation of empty clusters. It has been shown that the present algorithm is semantically equivalent to the serial *k*-means algorithm. A detailed comparison of this new algorithm with the basic *k*-means has been reported. Experimental results show that the proposed clustering scheme is able to solve the empty cluster problem, to a great extent, without any significant performance degradation. The use of wavelet based feature extraction scheme is presented.

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