ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 11, November 2013

Image Mining- Similar Image Retrieval Using Multi-Feature Extraction and Content Based Image Retrieval Technique

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Abstract: In CBIR (Content-Based Image Retrieval), graphical features such as shape, color and texture are extracted to depict images. Each of the features is represented using one or more visual feature descriptors. An image mining using Content based Image Retrieval (CBIR) is an automatic process to search relevant images based on user input. A Global color Descriptor color distribution over an entire image. It is defined in the hue-saturation-value (HSV) color space and produces a 256 bin color histogram is a four-bit integer value, and then encoded by canny's Edge detection. Similarity measure is also very essential part of CBIR to find the closeness of the query image with the database images. We have used two similarity measures namely Euclidean distance (ED) and sum of precision and recall. The overall performance of retrieval of the algorithm has been measured by average precision and recall performance.

Keywords: CBIR; Graphical Feature; Harr wavelet transform; Global color descriptor; Similarity measures

I. INTRODUCTION

In various computer vision applications widely used is the process of retrieving desired images from a large collection on the basis of features that can be automatically extracted from the images themselves. These systems called CBIR (Content-Based Image Retrieval) have received intensive attention in the literature of image information retrieval since this area was started years ago, and consequently a broad range of techniques has been proposed. Multimedia mining systems that can automatically extract semantically meaningful information (knowledge) from multimedia files are increasingly in demand[1]. Generally, multimedia database systems store and manage a large and varied collection of multimedia objects such as image, video, audio and hypertext data [1,3] Knowledge discovery from multimedia documents thus involves the analysis of non-structured information. To 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.

The features of the query image are compared with the features of all images in the large database using various similarity measures. These mathematical similarity measuring techniques checks the similarity of features extracted to classify the images in the relevant and irrelevant classes. The research in CBIR needs to be done to explore two things first is the better method of feature extraction having maximum components of uniqueness and faster the accurate mathematical models of similarity measures[6].

The typical CBIR system performs two major tasks. The first one is feature extraction (FE), where a set of features, called feature vector, is generated to accurately represent the content of each image in the database. The second task is similarity measurement (SM), where a distance between the query image and each image in the database using their feature vectors is used to retrieve the "closest" images[7],[9].

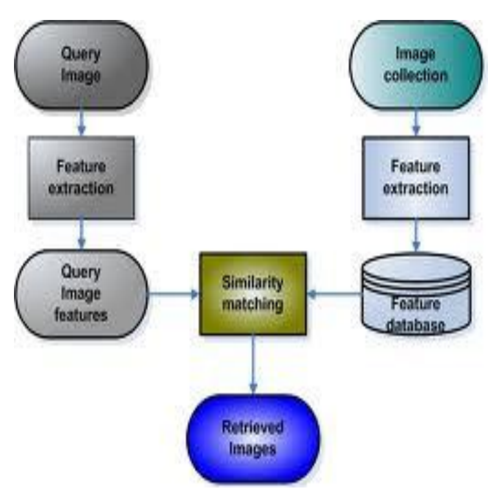

Figure 1: CBIR Process

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II. RELATED WORK

For CBIR feature extraction the two main approaches are feature extraction in spatial domain and feature extraction in transform domain. The feature extraction in spatial domain includes the CBIR techniques based on histograms. Image content may include both visual and semantic content. Visual content can be very general or domain specific. General visual content include color, texture, shape, spatial relationship etc. Domain specific visual content, such as human faces, is application dependent and may involve domain knowledge. Semantic content is obtained either by textual annotation or by complex inference procedures based on visual content. 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.

II.FEATURE EXTRACTION

Feature (content) extraction is the basis of content-based image retrieval. Visual features (color, texture, shape, faces). However, since there already exists rich literature on Content-based feature extraction in information retrieval research communities[10], we will confine ourselves to the techniques of visual feature extraction. Within the visual feature scope, the features can be further classified as general features and domain specific features. The former include color, texture, and shape features.

The domain-specific features are better covered in pattern recognition literature. The remainder of the section will concentrate on those general features which can be used in most applications. Because of perception subjectivity, there does not exist a single best presentation for a given feature. As we will see soon, for any given feature there exist multiple representations which characterize the feature from different perspectives.

A) Color Extraction Feature

Color feature extraction involves evaluating the absolute color value of each pixel. Color is generally represented by the color distribution of the image[1]. Color distribution is a statistical feature and techniques such as moments and color histogram are commonly used Pixel-level features: Features calculated at each pixel, e.g. color, location.

Typically, the color of an image is represented through some color model. There exist various color models to describe color information. A color model is specified in terms of 3-D coordinate system and a subspace within that system where each color is represented by a single point. The more commonly used color models are *RGB* (red, green, blue), *HSV* (hue, saturation, value)[1].Thus the color content is characterized by 3-channels from some color model. One representation of color content of the image is by using color histogram.

Figure 2: Raw image data

173	154	15	9	9	23	153	17	23
177	118	12	8	9	53	110	15	43
178	74	10	8	10	101	67	15	74
177	37	10	9	11	141	41	14	117
171	20	10	10	15	165	25	15	149

Figure 3 : Pixel information for Raw image data

Statistically, it denotes the joint probability of the intensities of the three color channels are RGG or HSV Color models.

The Haar transform is derived from the Haar matrix. The Haar transform is separable and can be expressed in matrix form[4]

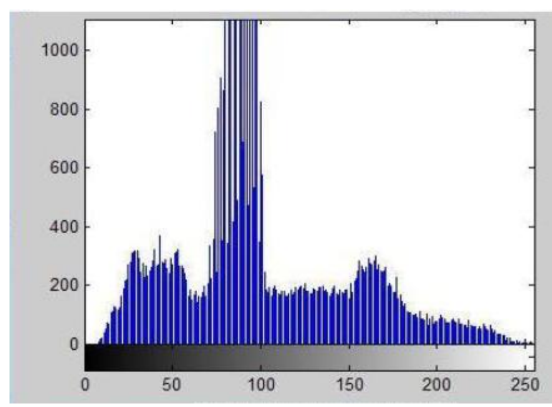

Figure 4 : Haar method histogram

B) Shape Extraction Feature

Shape based image retrieval is the measuring of similarity between shapes represented by their features. Shape is an important visual feature and it is one of the primitive features for image content description. Shape content description is difficult to define because measuring the similarity between shapes is difficult. Therefore, two steps

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are essential in shape based image retrieval, they are: feature extraction and similarity measurement between the extracted features Region-based methods use the whole area of an object for shape description, while contour-based methods use only the information present in the contour of an object[3]. Shape of an image describes more or less each and every object presented in an image. Edge extracted from an image tells about the full content of an image. There are various techniques of edge detection available i.e. Prewitt method, Sobel method.

Figure 5: Canny's Edge detection

I have to proposed system Canny's method is used. It can derived optimal smoothing filter algorithm by giving criteria of detection, localization and minimizing multiple responses to a single edge and used a filter that is well approximated by first-order derivatives of Gaussians.

III. SIMILARITY MEASURE

The Euclidean distance or Euclidean metric is the "ordinary" distance between two points that one would measure with a ruler, and is given by the Pythagorean formula. By using this formula as distance, Euclidean space (or even any inner product space) becomes a metric space. This is the familiar straight line distance that most people are identified with if the two pixels that we are considering have coordinates (x_1,y_1) and (x_2,y_2) then the Euclidean distance given by

$$\mathbf{D_{Euclid} = (x_2\text{-}x_1)^2 + (y_2\text{-}y_1)^2}$$

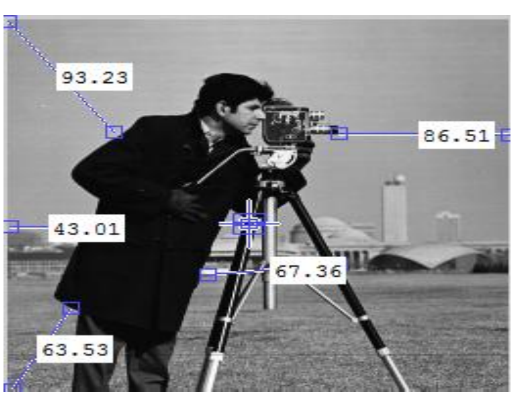

Figure 6: Euclidean Distance Measures

Table 1: Class wise image in the image data base

Class	No of Images
	67
	40
	51
	15

Figure 7: Query image

Figure 8: First 20 Retrieved Images sectorization of Full Haar wavelet and Eulidean distance method

The query image of the class rose has been shown in Figure 8. For this query image the result of retrieval of both approaches of Haar wavelet and Euclidean distance method transformed image sectorization. The Figure 9 shows First 20 Retrieved Images sectorization of Full Haar wavelet with sum of absolute difference as similarity measure. It can be observed that the retrieval of first 20 images is relevant class i.e. rose; there are number of irrelevant images till first 45 retrievals in first case.

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Figure 7 gives the sample database images from all categories of images including Rose, Moutains, Horse and revolver. To assess the retrieval effectiveness, we have used the precision and recall as statistical comparison parameters [1,2] for the proposed CBIR techniques. The standard definitions of these two measures are given by following equations.

$$\textbf{Precision} = \frac{\textbf{(Number of relevant images retrieved)}}{\textbf{(No of images retrieved)}}$$

$$\textbf{Recall} = \frac{\textbf{Number of relevant images retrieved}}{\textbf{Number of relevant images in database}}$$

The average precision and average recall are computed by grouping the number of retrieved images sorted according to ascending average Euclidian distances with the query image. In all transforms, the average precision and average recall values for CBIR using fractional coefficients are higher than CBIR using full set of coefficients.

Table 2: Evaluation value for Harry wavelet and Euclidean

Image Category	Precision Value	Recall value	Accuracy rate
Rose	0.84	0.794	0.817
Mountain	0.845	0.82	0.833
Horse	0.786	0.743	0.765
Revolver	0.865	0.87	0.868

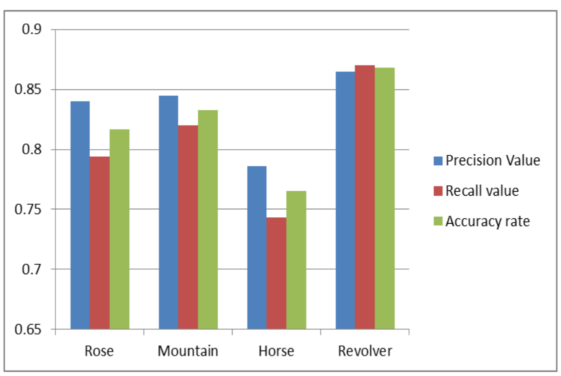

Figure 9: Performance chart for Precision and recall value

CONCLUSION

Content Based Image Retrieval is a challenging method of capturing relevant images from a large storage space. A new low level feature contains histogram, color and shape information. In this work, the precision and recall value using Haar wavelet transform, HSV Color Histogram and calculated and their accuracy value is measured. The future enhancement and new operations can be included in the system.

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