Content And Metadata Based Image Retrieval System For Art Images

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Abstract

In this paper a new approach for image retrieval is analyzed using image content and metadata. Conventional content-based image retrieval systems are already in use but they are useful for some specific domains. This system provides an integrated approach with content and metadata. Pyramid wavelet transform is used for image decomposition and Daubechies family of filters is used for noise removal and filtering operations. The Euclidean distance classifier is used for finding the similarity measures between the query image and the images in the database. The same will also be used for sub-image matching. Calculating the low frequency band for the image has many advantages to reduce memory space, because all other higher frequency bands are eliminated. Clustered metadata is stored in various categories, which is used to form a query-by-text and to retrieve images. This clustered metadata is used to reduce searching time. All these methods are integrated to get higher performance. This image retrieval system is analyzed and simulated to show the performance analysis of the new approach

1 Introduction

Image retrieval techniques are useful in many image-processing applications. Content-based image retrieval systems work with whole images and searching is based on comparison of the query. General techniques for image retrieval are color, texture and shape. These techniques are applied to get an image from the image database. They are not concerned with the various resolutions of the images, size and spatial color distribution. Hence all these methods are not appropriate to the art image retrieval. Moreover shape based retrievals are useful only in the limited domain. The content and metadata based system gives images using an effective image retrieval technique.

Many other image retrieval systems use global features like color, shape and texture. But the prior results say there are too many false positives while using those global features to search for similar images. Hence we give the new view of image retrieval system using both content and metadata.

2 Basic Architecture

The system has the user interface design to add the images to its database and also to delete images. Moreover proper descriptions of images are stored in the database. This metadata is used for query by text type of image retrieval system. The next type of image retrieval system is query by example that uses image content.

Both the methods are used separately to find similar images and both are together used to retrieve images. Various collection of metadata makes the user to give their input easier[7]. For the content-based search a pyramid wavelet transform is used to get the feature vectors of the image. These feature vectors are stored in the database to search for the similar images. The next section will give the detailed work of our approach.

3 Wavelets

Image enhancement techniques fall into two broad categories. They are spatial domain methods and frequency domain methods. The spatial domain refers to the image plane itself and approaches in this category are based on direct manipulation of pixels in the image. Frequency domain processing techniques are based on modifying the Fourier transform of an image. Hence Fourier transform is widely used previously but now it was replaced by wavelet transforms[6]. The reason is it can be specified in spatial and frequency domains but the Fourier transform can be specified in only frequency domain [2]. Wavelet transforms are also useful in image compression and image reconstruction. In this project a Pyramid wavelet transform is used to get the image content. This wavelet transform uses low pass and high pass filters for separating the low and high frequency contents [4].

4 Query By Text

Every image should be described using its content and characteristics so called metadata. A user interface is designed to get the textual input from the user. This will be converted into proper query to the database that will search for the images. The output of the query is then used to get the images from the database and to show it to the users in the user interface.

The general drawback of this type of image retrieval is that all the users are not able to give the appropriate query because specifying an image differs from each one to other. Moreover there is no proper method for classifying the metadata of the image. Hence the user is given with another option to give the query that is query by example.

4 Queries By Example

This method takes the image content as a query to find the similar images. The general flow of this work is as follows.

The steps involved in the process flow.

1. Specifying the user input image as a query.
2. Precomputing of feature vector for each image in the database.
3. Storing the feature vectors in database.
4. Search procedure based on Euclidean distance measurement between the query image and the images in the database.
5. Output the results.

The standard Pyramid Wavelet Transform is shown in the Figure 1. The first step is to resize the image size into 256X256 in a matrix format. Then the pyramid wavelet

transform is applied to get the sub bands of the image. To find the energy measures of the image Daubechies filter is applied. The decomposition is applied to 6 levels so that we can able to get the low frequency contents in the LL sub band and other frequencies in LH, HL and HH bands separately. Finally we will get the 4X4-sized image.

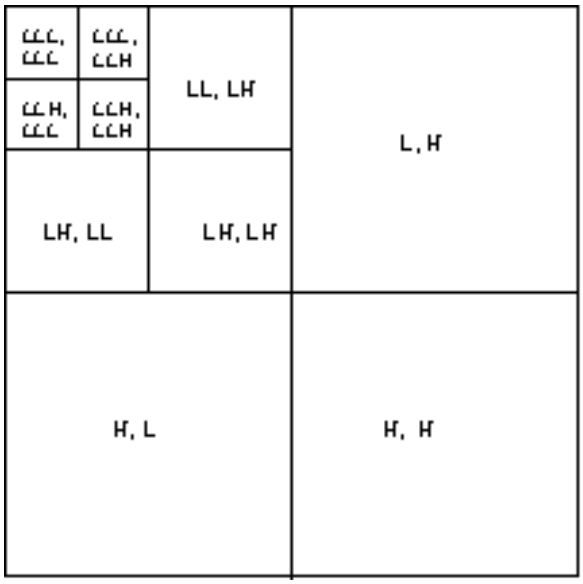

Fig.1: Pyramid Wavelet Transform (Level 3)

Once the wavelet coefficients of an image are available, features are computed from each sub-band, resulting in 19 features for each image. The mean μ is the energy measure used to compute the features, then the feature vector f, for a particular image is calculated using the given formula [3].

We use μmn as the energy measure for the decomposition level and the sub bands. Now we get the energy coefficients and stored in the database.

When the user gives the query image then it will be converted into the same above operations and finally gives the energy measure coefficients[5].

The distance between the two images is calculated using Euclidean distance classifier [1].

Thus the similar kind of images can be retrieved using the above-described method and they are optimized using K-nearest neighbor algorithm [1]. This paper is analyzed using these specified methods and the results were shown.

5 Experimental Results

We describe the results of three major type of approach on image retrieval system, an approximate time measurement of system performance has been conducted. Content-based image retrieval averages 2.36 seconds, Metadata based image retrieval averages 1.2 seconds and for texture based retrieval averages 16.140 seconds for retrieval. These timing results where measured for 200 images on a computer with a 1Ghz Pentium IV CPU. The initial image size is about 256x256 pixels width and height. The resulting image size is an average of 4x4 pixels. All timing does not take into account any image upload/download time.

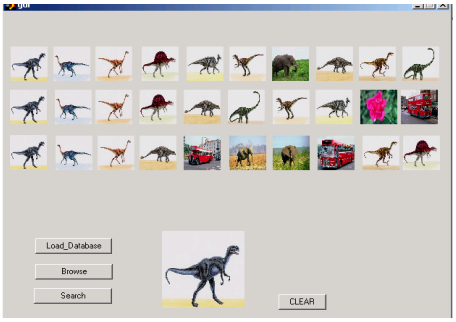

Fig.2: search results for CBIR

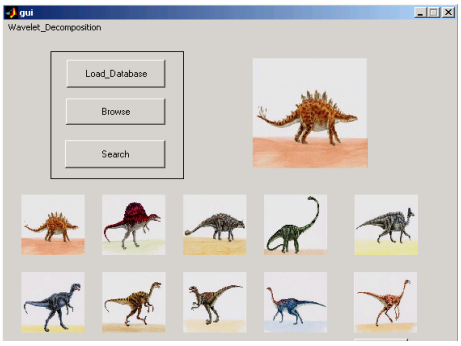

Fig.3: search results for texture based

6 Conclusions

In this paper we have analyzed an integrated approach of content and metadata based system. This proposed algorithm provides an effective approach for query based image retrieval system. The timing results for the integrated approach is less and accurate, this can be improved by integrating other spatial relationship. Our future work will integrate other methods such as spatial relationship or texture etc, for searching the object from the image directly, professionally and efficiently.

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