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Concept Content Based Retrieval Performance using Texture Analytics

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ABSTRACT

Image retrieval is a poor stepchild to other forms of information retrieval (IR). Image retrieval has been one of the most interesting and research areas in the field of computer vision over the last few decades. Content-Based Image Retrieval (CBIR) systems are used in order to automatically index, search, retrieve, and browse image databases. Color and texture analytics are important properties in content-based image retrieval systems. In this paper we have mentioned detailed classification of CBIR system. We have defined different techniques as well as the combinations of them to improve the performance. We have also defined the effect of different matching techniques on the retrieval process.

Most content-based image retrievals (CBIR) use color as image analytics. However, image retrieval using color analytics often gives disappointing results because in many cases, images with similar colors do not have similar content. Color methods incorporating spatial information have been proposed to solve this problem; however, these methods often result in very high dimensions of analytics which drastically slow down the retrieval speed. In this paper, a method combining both color and texture analytics of image is proposed to improve the retrieval performance. Given a query, images in the database are firstly ranked using color analytics. Then the top ranked images are re-ranked according to their texture analytics.

Keywords : Color, Feature Extraction, Image Retrieval, Texture, SVM

I. INTRODUCTION

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. A large collection of images is referred to as image database. An image database is a

system where image data are integrated and stored. Image data include the raw images and information extracted from images by automated or computer assisted image analysis. 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 architectural and engineering design, image database exists for design projects, finished projects, and machine parts. 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 Efficient Content Based Image Retrieval that include arts, sociology, and medicine. In a small collection of images, simple browsing can identify an image. This is not the case for large and varied collection of images, where the user encounters the image retrieval problem. An image retrieval problem is the problem encountered when searching and retrieving images that are relevant to a user's request from a database. To solve this problem, text-based and content-based are the two techniques adopted for search and retrieval in an image database. In text-based retrieval, images are indexed using keywords, subject headings, or classification codes, which in turn are used as retrieval keys during search and retrieval. Text-based retrieval is non-standardized because different users employ different keywords for annotation. Text descriptions are sometimes subjective and incomplete because they cannot depict complicated image analytics very well. Examples are texture images that cannot be described by text. Textual information about images can be easily searched using existing technology, but requires humans to personally describe every image in the database. This is impractical for very large databases, or for images that are generated automatically, e.g. from surveillance cameras. It is also possible to miss images that use different synonyms in their descriptions. Systems based on categorizing images in semantic classes like "cat" as a subclass of "animal" avoid this problem, but still face the same scaling issues. The Content Based Image Retrieval (CBIR) technique uses image content to search and retrieve digital images. Content-based image retrieval systems were introduced to address the problems associated with text-based image retrieval. Content based image retrieval is a set of techniques for retrieving semantically-relevant images from an image database based on automatically-derived image analytics. The main goal of CBIR is efficiency during image indexing and retrieval, thereby reducing the need for human intervention in the indexing process. The computer must be able to retrieve images from a database without any human assumption on specific domain (such as texture vs. non-texture, or indoor vs. outdoor). One of the main tasks for CBIR systems is similarity comparison; extracting feature signatures of every image based on its pixel values and defining rules for comparing images. These analytics become the image representation for measuring similarity with other images in the database. An image is compared to other images by calculating the difference between their corresponding analytics.

I. LITERATURE SURVEY

In this paper, in the medical field accurate diagnosis is very crucial for successful treatment. With the rapid development of technology, the ever increasing quantity of medical images is

produced in hospitals for diagnosing. Content-Based Image Retrieval (CBMIR) is a technique retrieves similar medical images from large database using visual analytics such as color, texture and shape. This paper focuses a novel method to increase the performance of Content Based Medical Image Retrieval System (CBMIRS). A multiple analytics vector gives better quality performance as compared to a single feature. This paper presents a new approach which takes the advantages of each individual feature. The content of the image extracted with the help of texture and region based shape descriptor, which have better analytics representation capabilities and are more robust to noise. The texture analytics are extracted with the help of Gabor filter and chebichef Moments used for Shape analytics extraction. The similar medical images will be retrieved by comparing the feature vector of the query image with the corresponding feature vectors of the data base images using Euclidian distance as a similarity measure. Experimental results show that proposed method achieves highest retrieval performance in comparison withindividual feature based retrieval system.

D. Zhang et al. in this paper, a method combining both color and texture analytics of image is proposed to improve the retrieval performance. Given a query, images in the database are firstly ranked using color analytics. Then the top ranked images are re-ranked according to their texture analytics. Results show the second process improves retrieval performance significantly. However, image retrieval using color analytics often gives disappointing results because in many cases, images with similar colors do not have similar content.

S.Selvarajah et al., an experimental comparison of a number of different texture analytics for content-based image retrieval is presented in this paper. The primary goal is to determine which texture feature or combination of texture analytics is most efficient in representing the spatial distribution of images. In this paper, authors analyze and evaluate both Statistical and Structural texture analytics. For the experiments, publicly available image databases are used. Analysis and comparison of individual texture analytics and combined texture analytics are presented. The First-order statistics, second-order statistics, Gabor transform and 2D Wavelet transforms were considered for retrieval. The retrieval efficiency of the texture analytics was investigated by means of relevance. According to the results obtained it is difficult to claim that any individual feature is superior to others. The performance depends on the spatial distribution of images.

Ahmed J. et al. in this paper, authors presented a CBIR system that uses Ranklet Transform and the color feature as a visual feature to represent the images. Ranklet Transform is proposed as a preprocessing step to make the image invariant to rotation and any image enhancement operations. To speed up the retrieval time, images are clustered according to their analytics using k-means clustering algorithm.To evaluate the proposed system, authors used each image in our database to be a query image and submit it to the system and calculated the precisions for each query in all classes. Then for each class average of all precisions was calculated.

M. Singha et al. in this study, an attempt has been made to study an image retrieval technique based on the combination of Haar wavelet transformation using lifting scheme and the colour histogram (CH) called lifting wavelet-based colour histogram. The colour feature is described by the CH, which is translation and rotation invariant. The Haar wavelet transformation is used to extract the texture analytics and the local characteristics of an image, to increase the accuracy of the retrieval system. The lifting scheme reduces the processing time to retrieve images. The experimental results indicate that the proposed technique outperforms the other schemes, in

terms of the average precision, the average recall and the total average precision/recall.

II. PROBLEM DEFINITION

We have implemented the CBIR system which takes into consideration the low level analytics of image which is more comprehensive when compared to high level analytics and it also gives user a higher level of retrieval. We have divided an Image into two very basic categories of color and grayscale and used different analytics vector for similarity comparison and retrieval. We have used columnar mean, diagonal mean and histogram for grayscale and RGB values and Euclidean methods for color image. User always wants a friendly environment so that they can easily and effectively use the system without actually going into the finer details of the working. So, to create such a user friendly platform for the system we have designed a Graphic User Interface where user can actually select the method which they want to be used for the image retrieval and that will give them an option of using different method if the result is not as per their requirement.

Users needing to retrieve images from a collection come from a variety of domains, including crime prevention, medicine, architecture, fashion and publishing. Remarkably little has yet been published on the way such users search for and use images, though attempts are being made to categorize users' behavior in the hope that this will enable their needs to be better met in the future. Attempts are also going on integrating the search for all kind of images and combining all above mentioned feature vectors for comparison and retrieval so as to achieve the best possible efficiency.

III. MOTIVATION

Content based image retrieval (CBIR) for general-purpose image databases is a highly challenging problem because of the large size of the database, the difficulty of understanding images, both by people and computers, the difficulty of formulating a query, and the issue of evaluating results properly. The common method for CBIR systems is to extract a signature for every image based on its pixel values and to define a rule for comparing images. The signature serves as an image representation in the view of a CBIR system. The components of the signature are called analytics. After extracting signatures, the next step is to determine a comparison rule, including a querying scheme and the definition of a similarity measure between images. For most image retrieval systems, a query is specified by an image to be matched. Color histogram as a global color feature and histogram intersection as color similarity metric combined with texture have been proved to give approximately good retrieval results.

Following are Motivational factors:

1. Societal factors
2. Industrial factors
3. Crime prevention
4. Medicine
5. Fashion and graphic design
6. Architectural and engineering design

IV. OBJECTIVE

- To extract color and texture analytics from input image.
- To speed up retrieval and similarity computation, by reducing the size of feature vectors.
- To further increase the retrieval accuracy of our system, we combine the color and texture analytics of image.
- The objective of our project is on the implementation of image retrieval system that

uses color and texture as visual analytics to describe the content of an image. Our contribution will be focused on three directions. First, to extract color and texture analytics from input image. Secondly to speed up retrieval and similarity computation, by reducing the size of feature vectors. Finally, to further increase the retrieval accuracy of our system, we combine the color and texture analytics of image.

V. PROPOSED WORK

Content-based retrieval uses the contents of images to represent and access the images. A typical content-based retrieval system is divided into off-line feature extraction and online image retrieval. A conceptual framework for content-based image retrieval is illustrated in Figure 1. In off-line stage, the system automatically extracts visual attributes (color, shape, texture, and spatial information) of each image in the database based on its pixel values and stores them in a different database within the system called a feature database. The feature data (also known as image signature) for each of the visual attributes of each image is very much smaller in size compared to the image data, thus the feature database contains an abstraction (compact form) of the images in the image database. One advantage of a signature over the original pixel values is the significant compression of image representation. However, a more important reason for using the signature is to gain an improved correlation between image representation and visual semantics. In 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 distances (i.e., similarities) between the feature vectors of the query example and those of the media in the feature database are then computed and ranked. Retrieval is conducted by applying an indexing scheme to provide an efficient way of searching the image database. Finally, the system ranks the search results and then returns the results that are most similar to the query examples. If the user is not satisfied with the search results, he can provide relevance feedback to the retrieval system, which contains a mechanism to learn the user's information needs.

Color is a powerful descriptor that simplifies object identification, and is one of the most frequently used visual analytics for content-based image retrieval. To extract the color analytics from the content of an image, a proper color space and an effective color descriptor have to be determined.

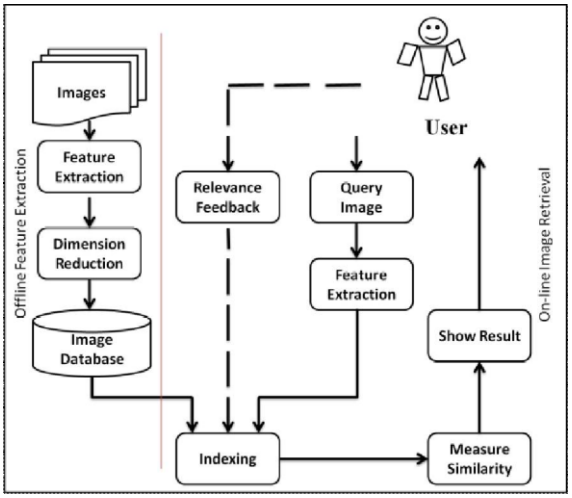

Figure 1: Conceptual framework for content-based image retrieval

The purpose of a color space is to facilitate the specification of colors. Each color in the color space is a single point represented in a coordinate system. Several color spaces, such as RGB, HSV, CIE L*a*b, and CIE L*u*v, have been developed for different purposes. Although there is no agreement on which color space is the best for CBIR, an appropriate color system is required

to ensure perceptual uniformity. 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 commonly used method to represent color feature of an image is the color histogram. Since there is no accepted mathematical definition for texture, many different methods for computing texture analytics have been proposed over the years. Unfortunately, there is still no single method that works best with all types of textures. According to the commonly used methods for texture feature description are statistical, model-based, and transform-based methods. The word transform refers to a mathematical representation of an image. There are several texture classifications using transform domain analytics in the past, such as discrete Fourier transform, discrete wavelet transforms, and Gabor wavelets. Wavelet transform is a good multi-resolution approach that represents the texture of an image in an effective way using multiple orientations and scales. This approach has a spatial property that is similar to mammalian perceptual vision, thereby providing researchers a good opportunity to use it in image processing.

1. Proposed Methodology

1. Input query color image.
2. Color feature extraction using color histogram.
3. Texture feature extraction using wavelet transforms.
4. Creation of database of images with analytics extracted.
5. Comparison of input image with database images
6. Display of similar images
7. Performance evaluation of CBIR System

a. Precision
b. Recall

2. Probable Outcome

Developed content based image retrieval system based on color and texture feature extraction method can be effectively retrieve similar images from the given database of images.

CBIR finds application in the area of publishing and advertising, historical research, fashion and graphic design, architectural and engineering design crime prevention, medical diagnosis, geographical information and remote sensing systems, etc.

VI. CONCLUSIONS

In this paper, an image retrieval method using both color analytics and combined analytics has been proposed method based on color moments and Gabor texture. Our method outperforms the common color feature retrieval significantly. A robust texture feature which is suitable for image retrieval has also been presented in the paper. In contrast to most conventional combined approaches which may not give better performance than individual analytics, our approach provides users with two alternatives, i.e., retrieval using color analytics only and retrieval using combined analytics. Since we give the users control to select the type of retrieval, the improvement of retrieval performance is guaranteed.

We calculate the similarity with combined analytics of color and texture using Canberra distance as similarity measure. The proposed method has higher retrieval accuracy than other conventional methods combining color moments and texture analytics based on global

analytics approach.There is considerable increase in retrieval efficiency when both color and texture analytics are combined. Thus it is rightly said that only color or only texture cannot differentiate a cheetah and a tiger.

In the future, we plan to segment image automatically into homogenous texture regions using split and merging technique. By using regional analytics instead of global analytics, we will be able to improve retrieval performance of combined analytics further. We also plan to use more queries to test the retrieval performance.

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