SURVEY ON CONTENT BASED IMAGE RETRIEVAL USING COLOR AND TEXTURE FEATURES

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ABSTRACT

Content based image retrieval is a research topic since last decade and it is used to solve different problems such as construction of feature vectors, multidimensional indexing, and design of user interface and data visualization. The main problem of content based image retrieval system is with retrieval accuracy and the computational complexity (or retrieval time).This paper provides information about color features such as color space, color moment and also texture features such as Gabor filters, Wavelets. The CBIR system is useful in many applications such as medical imaging, data mining, weather forecasting, crime prevention, education etc. This paper mainly concentrated on the color and texture feature of content based image retrieval techniques.

I. INTRODUCTION

Traditional image retrieval technique uses text index, which was introduced in 1970's[6].compared to text based approach, CBIR is fast and automated retrieval technique where instead of keywords the image is indexed by its visual content[4][5].The CBIR is active research oriented topic which was introduced in early 1980's[6].

This technique is used for extraction of image from large collection of database using the low level features such as color, texture and shape. The extraction of image will be automated or computer assisted image analysis. The main advantage of CBIR system is the system uses image features instead of image itself. So it is cheap and fast compared to image search methods. Since individual features such as color and texture are not sufficient to describe the image, so combination of color and texture features are better.

1.1 Existing System

Currently, we have many content based image retrieval systems. Some of them are created in research laboratories and some are commercial available systems. The information about existing systems are found in [1].And more detailed description about existing systems are found in [6] which are shown below.

Some existing CBIR systems are:

- *QBIC or Query by image content*: It is first commercial content based retrieval system. Here, the users are allowed to graphically pose and refine queries based on features such as color, texture and shape.
- *Visual SEEK and Web SEEK*: Web SEEK is a text/image search engine where as Visual SEEK is a visual feature search engine both are developed at Columbia University.
- *Virage*: It is also a content based image search engine which supports color and texture matching.
- *NeTra*: It supports color, shape and texture matching.
- *MARS*: Multimedia Analysis and Retrieval System supports color, texture, Spatial layout, shape matching.

- *Viper*: Visual Information Processing for Enhanced Retrieval makes use of color and texture matching for image retrieval.

1.2 Color Feature Extraction

Color is one of the most widely used low level visual features and it will not vary with respect to image size and its orientation [1].Quality of color feature depends on color space selection.

1.2.1 Color Space

Color space is also called as color system or color model. It is specification of a co-ordinate system where each color represents a single point. And each color in a color space has its color co-ordinates [1]. Most widely used color space are: RGB (Red, Green, Blue), CMY (Cyan, Magenta, Black), CMYK (Cyan, Magenta, Yellow, Black), HSV (Hue, Saturation, Value).

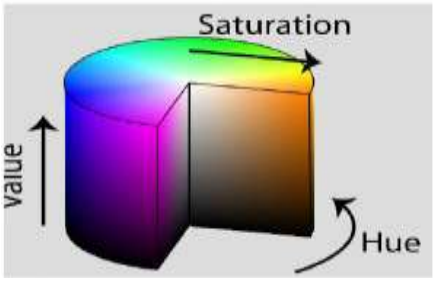

Fig 1. The HSV space color [6].

Hue is nothing but color type range from 0 to 360. Saturation is the "Vibrancy" of the color range from 0 to 100% and occasionally called as the "purity". Value means brightness of color range from 0 to 100% [7]. The HSV color space is used to reduce computation and improve efficiency.HSV color space closer to human conceptual understanding of colors and has ability to separate achromatic and chromatic components [5].

1.2.2 Color Moments

The methods which describes color feature are: color histogram, color correlation, color moments etc. The color moment has lower computational complexity and lowest feature vector dimension[3].From R,G,B color space the mean μ,standard deviation σ and skew g are extracted to form 9 dimensional feature vector. This color space is seen in the cube where x-axis represents red values increases to the left, Blue increasing to the lower right at y-axis and vertical z-axis as green increased towards top[6].

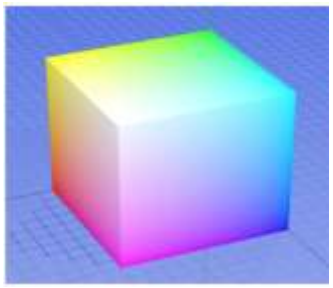

Fig 2. The RGB Color Model Mapped To The Cube. The Origin, Black, Is Hidden Behind the Cube [6].

1.3 Texture Feature Extraction

Texture is one of the important features used for image retrieval. It can be represented by grey level co-occurrences [8].It also gives information about structural arrangement of surface and objects on the image [1]. The measures for capturing the image based on texture are Gabor filters and wavelets. These texture measures retrieve images based on the changes in certain directions and the scale of the images. This is most useful in case of homogeneous texture [6].

Fig 3. Examples of Textures [6]

1.3.1 Gabor Filters

These are set of wavelets and each wavelets capture image at a particular frequency and at specific orientation. These two features make texture analysis useful NeTra is an example of CBIR system where Gabor filter are used to describe and compare texture.

1.3.2 Wavelets

Wavelet is a method which is used for solving texture classification and analyses of the problems [1].The wavelet transform represents a family of basis function called wavelets. It provides good energy compaction and multi-resolution capability and it is computed linearly with time. The wavelet transform is a multi-resolution approach which uses sub-sampling and recursive filtering [2].

Wavelet transform is the improved version of Fourier transform. This method is used to solve problem in many fields like physics, pattern recognition, image processing, signal processing, medical image technology etc [6].

1.4 Applications of CBIR

There are many applications of CBIR technology some of them are listed below:

- Automated Face recognition system.
- Medical diagnosis: Tumors detection, MRI, CT, Ultrasound [9].
- Remote sensing: Weather forecast, satellite images.
- Cartography: Synthesis of weather maps, map making from photographs [9].
- Digital Forensics: Finger prints matching for crime detection [9].
- Trademark Image Registration.
- Art Collections: Fine Arts Museum of San Francisco.

II. RELATED WORK

Ahmed J Afifi, Wesam M Ashour(2012)[3]: mainly concentrated on two low level features such as color and texture. It consists of new CBIR methods that use the combination of both Ranklet texture moment feature and HSV color moment feature for retrieval of image. For this method he took the experimental results of ten class

images and made use of WANG image database for system evaluation. This system provides higher accuracy then those of color and texture feature respectively.

Ching-Hong su, et.al(2012)[7]:have proposed a combination of two features such as HSV color space and edge histogram descriptor in mpeg-7 for transfers of each pixel of image to a quantized color code. Experimental database contain 1200 images which include flowers, plants, animals, sceneries from internet and 1000 test images from wang's image database. Based on experiments results he concluded that proposed system is better than then X-RGB color space schema.

P.Gangadhara Reddy(2010)[5]: Proposed a combined method of color feature and grey level co-occurrence matrix as well as color feature and CCM(Color Co-occurrence Matrix) using Euclidean distance classifier, which improves the performance of image retrieval. The retrieval of image using these methods are superior then using individual methods. By experiment results color+CCM (precision-42%) is better then color+GLCM (39.8%) and color (37.8%).

Lienina Birgale, et.al (2006)[11]: paper consists of experimental results of performance of image retrieval. He calculated results based on color and texture and also by combining both color and texture. In CBIR color gives only 62.5% average retrieval efficiency and for texture 68.75%. This shows that only texture and only color feature is not sufficient to describe image, so by combining of both color and texture average retrieval efficiency has increased to 75%.

Pengyu Liu, et.al [12]: paper provides experimental results of image database that holds 1550 color pictures which consists of car, animals, landscape and construction etc. The output will be of 10 images which are of similar distance. It provides advantage for combining of color and texture features, different features can complement each other and can enhance system retrieval precision, and make CBIR system more agile.

S.Vidivelli, S.Sathiyadevi(2011)[14]: Proposed Wavelet method for searching of image using color and texture. Wavelet coorelogram will acquire less computational time when compared with other methods. The computational time and memory buffer increases when combined with other features. Experimental results show that in database there are 160 images which consist of images of Bus, Sunflower, Lion, Elephant and Penguin. Compared to color histogram and color correlogram, the Wavelet corrlogram has improved the search efficiency.

Mond.Danish, et.al (2013) [6]: concluded that most system uses color and texture features and few systems uses only shape features. It gives overview of content based image retrieval system along with applications and challenges.

Ashwani Kr.Yadav, et.al (2014) [9]: mainly concentrated on texture analysis problems. Problems are divided into four broad categories such as texture segmentation, texture classification, texture synthesis and shape from texture and it also consist of some applications of CBIR system.

Mehwish Rehman, et.al (2012) [10]: paper consists of drawbacks of already existing technique whether they are statistical or hybrid with respect to texture is computational cost. Human visual perception seems to work perfectly in this case. Relevance feedback algorithm is used to reduce the gap between two levels of features i.e. high and low.

Hanife Kebapci, et.al (2009) [13]: This paper gives information about extraction of plant regions from image by the max-flow min-cut segmentation technique. Further combining of color and texture feature gives the accuracy of the system.

Dong Wenfei, et.al (2014) [15]: Proposed new methods such as color histogram, color correlogram, co occurrence matrix, Tamura, Hu moments which are used for extraction of images. Image retrieval experiment uses Window7 Os and core l test image database. This database consist of 100 images they are indigenous, beaches, building, buses, dinosaurs, elephants, flowers, horses, snow-capped mountains and food. The multi feature fusion improves precision rate and enhanced retrieval capability.

III. CONCLUSION

The content based image retrieval is an interesting and complex problem studied by many researchers all over the world. The complexity is due to retrieval accuracy and retrieval time. From literature survey it is concluded that a wide variety of CBIR method have been proposed in different papers. The selection feature is one of the important aspects of image retrieval system to better capture user's intentions. The purpose of this survey is to provide an overview of content based image retrieval systems. Finally it is concluded that combination of color and texture feature for extraction of image is better than the individual color and texture features.

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