Content Based Image Retrieval using Color feature

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Abstract

Content-based image retrieval is a very important area of research nowadays. Content-Based Image Retrieval (CBIR) uses the visual contents of an image such as color, shape, texture, and spatial layout to represent and index the image. Active research in CBIR is geared towards the development of methodologies for analyzing, interpreting cataloging and indexing image databases. In addition to their development, efforts are also being made to evaluate the performance of image retrieval systems. The quality of response is heavily dependent on the choice of the method used to generate feature vectors and similarity measure for comparison of features. In this paper color analysis has shown and the information about object location, shape, and texture is discarded. Thus the images retrieved by using the mat lab tool.

Keywords: - *Content Based Image Retrieval, Shape, Color Coherence Vector, Centroid, Segmentation*

1. INTRODUCTION

1.1 Content Based Image Retrieval

Content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR) is the application of computer vision to the image retrieval problem, that is, the problem of searching for digital images in large databases. "Content-based" means that the search will analyze the actual contents of the image. The term 'content' in this context might refer colors, shapes, textures, or any other information that can be derived from the image itself. Without the ability to examine image content, searches must rely on metadata such as captions or keywords. Such metadata must be generated by a human and stored alongside each image in the database.

2. LITERATURE SURVEY

2.1 The growth of digital imaging

The use of images in human communication is hardly new –cave-dwelling ancestors painted pictures on the walls of their caves, and the use of maps and building plans to convey information almost certainly dates back to pre-Roman times. But the twentieth century has witnessed unparalleled growth in the number, availability and importance of images in all walks of life. Images now play a crucial role in fields as diverse as medicine, journalism, advertising, design, education and entertainment [1].

Technology, in the form of inventions such as photography and television, has played a major role in facilitating the capture and communication of image data. But the real engine of the imaging revolution has been the computer, bringing with it a range of techniques for digital image capture, processing, storage and transmission which would surely have startled even pioneers like John Logie Baird [2]. The involvement of computers in imaging can be dated back to 1965, with Ivan Sutherland’s Sketchpad paper, which demonstrated the feasibility of computerized creation, manipulation and storage of images, though the high cost of hardware limited their use until the mid-1980s [3].

Once computerized imaging became affordable (thanks largely to the development of a mass market for computer games), it soon penetrated into areas traditionally depending heavily on images for communication, such as engineering, architecture and medicine [4]. Photograph libraries, art galleries and museums, too, began to see the advantages of making their collections available in electronic form. The creation of the World-Wide Web in the early 1990s, enabling users to access data in a variety of media from anywhere on the planet, has provided a further massive stimulus to the exploitation of digital images. The number of images available on the Web was recently estimated to be between 10 and 30 million [Scarf et al, 1997] – a figure which some observers consider to be a significant underestimate [5].

2.2 Current level 1 CBIR techniques

2.2.1 Color retrieval

Several methods for retrieving images on the basis of color similarity have been described in the literature, but most are variations on the same basic idea. Each image added to the collection is analyzed to compute a color histogram which shows the proportion of pixels of each color within the image. The color histogram for each image is then stored in the database. At search time, the user can either specify the desired proportion of each color (75% olive green and 25% red, for example), or submit an example image from which a color histogram is calculated. Either way, the matching process then retrieves those images whose color histograms match those of the query most closely. The matching technique most commonly used, histogram intersection, was first developed by Swain and Ballard [1991]. Variants of this technique are now used in a high proportion of current CBIR systems.

2.2.2 Texture retrieval

The ability to retrieve images on the basis of texture similarity may not seem very useful. But the ability to match on texture similarity can often be useful in distinguishing between areas of images with similar color. Alternative methods of texture analysis for retrieval include the use of Gabor filters and fractals. A recent extension of the technique is the texture thesaurus, which retrieves textured regions in images on the basis of similarity to automatically-derived code words representing important classes of texture within the collection.

2.2.3 Shape retrieval

Shape matching of three-dimensional objects is a more challenging task – particularly where only a single 2-D view of the object in question is available. While no general solution to this problem is possible, some useful inroads have been made into the problem of identifying at least some instances of a given object from different viewpoints. One approach has been to build up a set of plausible 3-D models from the available 2-D image, and match them with other models in the database. Another is to generate a series of alternative 2-D views of each database object, each of which is matched with the query image. Related research issues in this area include defining 3-D shape similarity measures, and providing a means for users to formulate 3-D shape queries.

2.3 Motivational factors

2.3.1 Social factors:

It is a truism to observe that images are currently used in all walks of life. The influence of television and video games in today's society is clear for all to see. The commonest single reason for storing, transmitting and displaying images is probably for recreational use, though this category includes a wide variety of different attitudes and interaction styles, from passively watching the latest episode of a soap opera to actively analyzing a tennis star's shots in the hope of improving one's own game. Images are increasingly used to convey information, in areas as diverse as map-making, weather forecasting and mail-order shopping, and to persuade or convey a mood, as in advertising. They can also be appreciated in their own right, as works of art.

2.3.2 Industrial factors:

In the realm of professional image use, the situation is rather different. Some groups of people use images in their job on a daily basis, such as graphic designers and illustrators, whilst others may never be required to use them, such as bank managers and accountants. There is a wide range of professions lying between these two extremes, including medicine and law. Other groups of workers, such as librarians and museum curators, may be required to find images on behalf of clients rather than for themselves. It is impossible to give a full picture here of the uses being made of visual information. The following examples should be interpreted as being merely a snapshot of the situation.

2.3.3 Crime prevention:

The police use visual information to identify people or to record the scenes of crime for evidence; over the course of time, these photographic records become a valuable archive. In the UK, it is common practice to photograph everyone who is arrested and to take their fingerprints. In a computer-based system, the photograph will be digitized and linked to the corresponding textual records. Until convicted, access to photographic information is restricted and, if the accused is acquitted, all photographs and fingerprints are deleted. If convicted, the fingerprints are passed to the National

Fingerprint Bureau. Currently, there is a national initiative investigating a networked Automated Fingerprint Recognition system involving BT and over thirty regional police forces. Other uses of images in law enforcement include face recognition DNA matching, shoe sole impressions, and surveillance systems. The Metropolitan Police Force in London is involved with a paper which is setting up an international database of the images of stolen objects

2.3.4 Medicine:

The medical and related health professions use and store visual information in the form of X-rays, ultrasound or other scanned images, for diagnosis and monitoring purposes. There are strict rules on confidentiality of such information. The images are kept with the patients' health records which are, in the main, manual files, stored by unique identifier (NI number). Visual information, provided it is rendered anonymous, may be used for research and teaching purposes. Much of the research effort related to images is undertaken in the medical physics area. Aspects of concern include effective image processing (e.g. boundary/feature detection) systems which aid the practitioner in detecting and diagnosing lesions and tumors and tracking progress/growth.

2.3.5 Fashion and graphic design:

Imagery is very important for graphic, fashion and industrial designers. Visualization seems to be part of the creative process. Whilst there will be individual differences in the way designers approach their task, many use images of previous designs in the form of pictures, photographs and graphics, as well as objects and other visual information from the real world, to provide inspiration and to visualize the end product. 2-D sketches, and, increasingly, 3-D geometric models are used to present ideas to clients and other colleagues. There is also a need to represent the way garments hang and flow.

2.3.6 Architectural and engineering design:

Photographs are used in architecture to record finished paper, including interior and exterior shots of buildings as well particular features of the design.
The images used in most branches of engineering include drawings, plans, machine parts, and so on. Computer Aided Design (CAD) is used extensively in the design process. Hence many engineering firms maintain extensive design archives. CAD and 2-D modeling are also extensively used in architectural design, with 3-D modeling and other visualization techniques increasingly being used for communicating with clients. A recent survey of IT in architectural firms emphasized the dominance of CAD (especially 2-D) in the design process, though it concluded that object-based, intelligent 3-D modeling systems will become more important in the future.

3. IMPLEMENTATION

MATLAB is a software package for high-performance numerical computation and visualization. It provides an interactive environment with hundreds of built-in functions for technical computation, graphics and animation. It also provides easy extensibility with its own high level programming language. The name MATLAB stands for Matrix Laboratory. MATLAB is an efficient program for vector and matrix data processing. It contains ready functions for matrix manipulations and image visualization and allows a program to have modular structure. Because of these facts MATLAB has been chosen as prototyping software.

MATLAB provides a suitable environment for image processing. Although MATLAB is slower than some languages (such as C), its built in functions and syntax makes it a more versatile and faster programming environment for image processing. Once an algorithm is finalized in MATLAB, the programmer can change it to C (or another faster language) to make the program run faster.

3.1 Image Representation in **MATLAB**

An image is stored as a matrix using standard Mat lab matrix conventions. There are five basic types of images supported by Mat lab:

1. Indexed images
2. Intensity images
3. Binary images
4. RGB images
5. 8-bit images

MATLAB handles images as matrices. This involves breaking each pixel of an image down into the elements of a matrix. MATLAB distinguishes between color and grayscale images and therefore their resulting image matrices differ slightly.

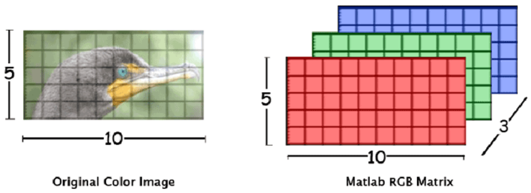

Fig: 3.1.1 Color image representation and RGB matrix

A color is a composite of some basic colors. MATLAB therefore breaks each individual pixel of a color image (termed ‘true color’) down into Red, Green and Blue values. What it get as a result, for the entire image, are 3 matrices, one representing each color. The three matrices are stacked next to each other creating a 3 dimensional m by n by 3 matrixes. For an image which has a height of 5 pixels and width of 10 pixels the resulting in MATLAB would be a 5 by 10 by 3 matrixes for a true color image.

A grayscale image is a mixture of black and white colors. These colors, or as some may term as ‘shades’, are not composed of Red, Green or Blue colors. But instead they contain various increments of colors between white and black. Therefore to represent this one range, only one color channel is needed. Thus only need a 2 dimensional matrix, m by n by 1. MATLAB terms this type of matrix as an Intensity Matrix, because the values of such a matrix represent intensities of one color.

For an image which as height of 5 pixels and width of 10 pixels the resulting matrix would be a 5 by 10 matrix for grayscale image.

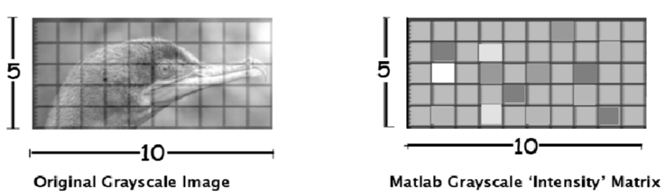

Fig: 3.1.2 Grayscale image representation

3.2 RGB color model

The RGB color model is composed of the primary colors Red, Green, and Blue. This system defines the color model that is used in most color CRT monitors and color raster graphics. They are considered the "additive primaries" since the colors are added together to produce the desired color. In Figure 3.2.1. Notice the diagonal from (0, 0, 0) black to (1, 1, 1) white which represents the grey-scale.

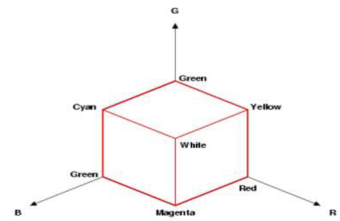

Fig 3.2.1: RGB coordinates system

- Figure 3.2.2 is a view of the RGB color model looking down from "White" to origin.

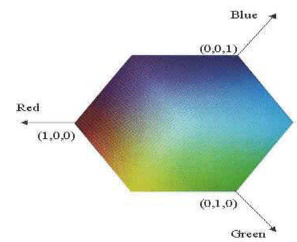

Fig 3.2.2: RGB color model

3.3 HSV Color Model

The HSV stands for the Hue, Saturation, and Value based on the artists (Tint, Shade, and Tone). The coordinate system in a hexagon in Figure 3.3.1 And Figure 3.3.2 a view of the HSV color model. Hue and saturation components are intimately related to the way human eye perceives color resulting in image processing algorithms with physiological basis.

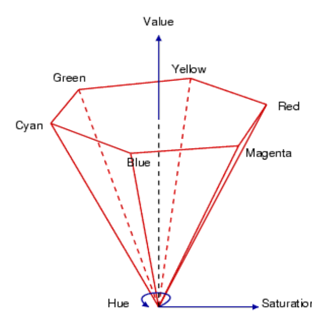

Fig 3.3.1: HSV coordinates system

As saturation varies from 0 to 1.0, the corresponding colors (hues) vary from unsaturated (shades of gray) to fully saturated (no white component). As value, or brightness, varies from 0 to 1.0, the corresponding colors become increasingly brighter.

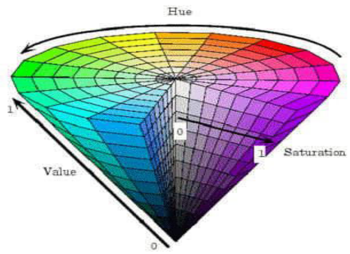

Fig3.3.2: HSV color model

4. RESULT

4.1 GRB conversion using MATLAB

Fig 4.1.1: red conversion

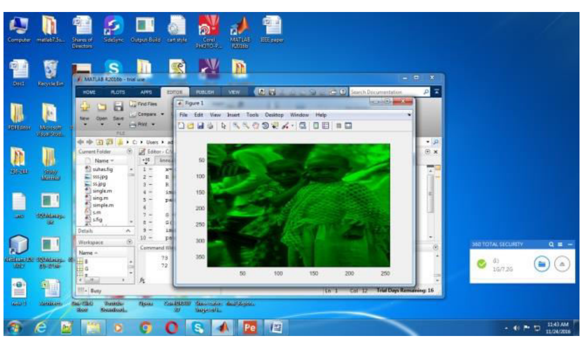

Fig 4.1.2: green conversion

Fig 4.1.3: blue conversion

4.2 Used MATLAB tool to HSV

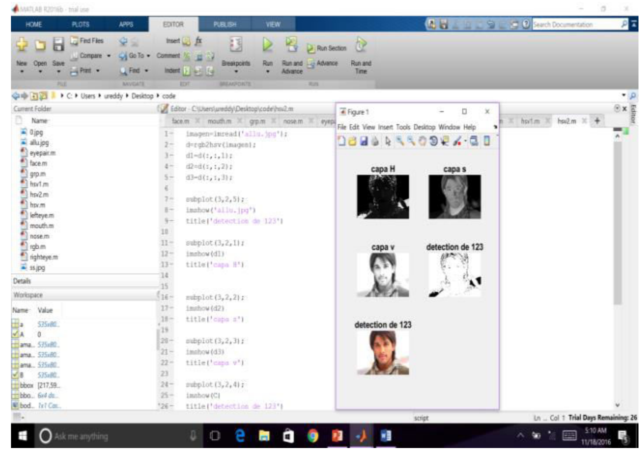

Fig 4.2.1: HSV

5. CONCLUSION

The extent to which CBIR technology is currently in routine use is clearly still very limited. In particular, CBIR technology has so far had little impact on the more general applications of image searching, such as journalism or home entertainment. Only in very specialist areas such as crime prevention has CBIR technology been adopted to any significant extent. This is no coincidence – while the problems of image retrieval in a general context have not yet been satisfactorily solved, the well-known artificial intelligence principle of exploiting natural constraints has been successfully adopted by system designers working within restricted domains where shape, color or texture features play an important part in retrieval.

The process of designing of CBIR system has been successfully carried out and the expected outcome is achieved. The main functions that a CBIRS should perform are:

- Constructing feature vectors from the image based on its content and storing it in the database.
- Similarity comparison and segmentation.
- Retrieving the images based on the feature vectors.

The above mentioned functions are thoroughly checked using software called MATLAB. Also the design is very simple and easy to implement.

FUTURE ENHANCEMENTS

Developments and studies are going on for further improvements in design and performance of "CONTENT BASED IMAGE RETRIEVAL SYSTEMS".

In this paper image is retrieved using color feature has proved and the information about object location, shape, and texture is discarded. Thus this paper showed that images retrieved by using the above mentioned methods may not be semantically related even though they share similar color distribution in some results.

In the future enhancements can implement:

- Shape and Texture analysis.
- Color Image histogram.
- Image ranking in Euclidean Distance method.

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BIOGRAPHIES

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