Impact Factor Value 4.046 e-ISSN: 2456-3463
National Conference on "Recent Advances in Engineering and Technology" SAMMANTRANA 19
Organized by Government College of Engineering, Nagpur
International Journal of Innovations in Engineering and Science, Vol 4 No.8, 2019
www.ijies.net

Image Indexing Using Integration of Gabor Filter And HSV Algorithm

A.Nikhitha[1], A.Nithish[2], A.Vennela[3] ,R.Arunraj[4] ,P.Smitha Mayuri[5] ,M.Ramesh[6]

[1,2,3,4,5] IV B.Tech, Department of ECE, Jyothishmathi Institute of Technology and Science, Karimnagar, India-505481

[6]Assistant Professor, Department of Electronics and Communication Engineering, Jyothishmathi Institute of Technology and Science, Karimnagar, India-505481

Abstract

Content based image retrieval (CBIR), is one of the most important areas of digital image processing and has become a new and fast way to retrieve images. As the image database grows faster, a better mechanism is needed to retrieve images and get better results. CBIR allows the user to provide a query image to retrieve images stored in the database according to their similarity to the query image. In this paper, content-based image retrieval is used to retrieve a query image from a large image database using two attributes such as color and texture. The color features are extracted through the HSV color space and we use Gabor filters to extract texture features from random, separate regions of the image after the segmentation to increase system efficiency. This Reduces recovery time and increases image resolution.

Keywords: *Content based image retrieval (CBIR), HSV, Gabor filters*

I. INTRODUCTION

Nowadays, in communication and information image retrieval is a major topic. Image collection is increasing speedily as enhance in image capturing devices like smart phones, digital cameras, and also with increased use of multimedia data. To search and retrieve image from such large image data collection effective tools are needed for different. In early era, text based image retrieval used. All text based image retrieval systems require the text description with images in large scale data bases and manually this task is not effective. Because of this, text based image retrieval systems were not applicable for task dependent queries. To overcome these problems content-based image retrieval (CBIR) was introduced. Content based image retrieval is a powerful tool used to retrieve the image based on visual contents such as color, texture and shape from large database. To deal with image retrieving and indexing brief knowledge of image classification is required.

1.1 Image Classification:

a) Indexed Images

An indexed image consists of two matrix as color map matrix and data matrix. The data matrix has the same size as the image and single number for each pixel. Color map matrix has size may be different from different images.

b) Scaled indexed images

A scaled indexed image uses matrix values and these values are linearly scaled to form look up table. MATLAB image display function generally used to give a matrix as scaled indexed image retrieval.

c) Intensity Images

It represents an image as a matrix form where every element has a value based on brightness or darkness of pixel at the area be supposed to be colored by assigning a floating number between 0 and 1.

d) Binary Images

In this format image can stores like matrix and pixel paint as a black or white as it assigns 0 for black and 1 for white.

1.2 Content Based Image Retrieval

Image-based image retrieval, a feature-extraction technique for searching images from large image databases according to user interests, has been inactive and fast in search since the 1980s. During the past years, remarkable progress has been made in research and system development. Hence, there are remaining challenging research problems still attract researchers from multiple disciplines. Previous techniques were based on the textual annotation of image but not on the visual content of images. From text descriptions, images can be organized by topical or semantic hierarchies from lookup table and to facilitate easy navigation and browsing based on standard Boolean queries.

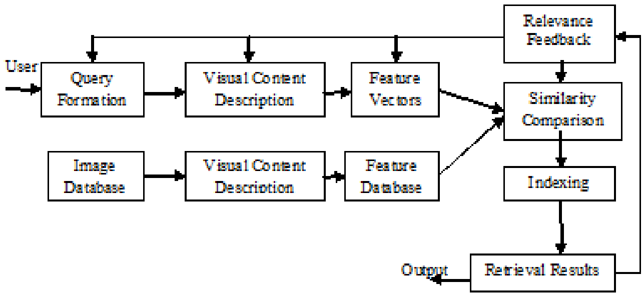

Figure1. Diagram of content based image retrieval

Content Based Image retrieval uses features extraction of an image such as color, shape, and texture to represent and index the image. In Content Based Image retrieval systems, the visual contents of the images in the database are compared and extracted by their feature vectors. The feature vectors of the images in the database form a feature database as shown in figure 1.To retrieve images, users provide example images or sketched images to retrieve related images from large scale database.

1.3 Applications of CBIR system:

Some of the main applications of CBIR system are biomedical imaging, Face Recognition, Geographical changes, Identification of Fingerprint, Crime Prevention, Digital Libraries, Graphic and Fashion Design, Cultural Heritage, skin detection etc.

I. LITERATURE REVIEW

Blaser had presented Content-based image retrieval, a technique which uses visual contents to search images from large scale image databases according to users wish, has been fast advancing research area since the 1990s. During the past years, excellent progress has been made in theoretical research and system development. However, there remain many different types of challenging research problems that continue to attract researchers from multiple disciplines using new research methods[1].

Ivan Lee, et.al. have present the analysis of the CBIR system with high level segmentation methods including the human controlled and the machine controlled with relevance feedback. In their experiment for interactive feedback related to the use of RBF, they observe higher retrieval and retrieval through the introduction of quasi-supervision of RBF-related adverse feedback.

Ns change had developed advances in image processing, database management, and information retrieval has resulted in content- based multimedia retrieval to emerge as an important research area. Traditionally, content-based multimedia retrieval was supported by augmenting multimedia objects with textual annotations. Information retrieval techniques on textual descriptions were then used to support content-based retrieval. There are numerous limitations of this approach. First, this approach is not efficient because object needs to be manually annotated with keywords and/or textual descriptions making it impractical for large database. Second, due to the subjectivity of the human annotator, the annotations may not be consistent which negatively affects retrieval effectiveness. Furthermore, it may be infeasible to describe visual content (e.g., shape of an object) using simply words. To overcome the above problems, over the past few years' content-based retrieval over visual features has emerged as a promising research direction[2].

Pattanaik ,Bhalke(2012) has proposed method to prove that Content Based Image Retrieval has overcome the limitation of Text Based Image Retrieval by considering the contents or features of image. By giving query image as input can be retrieved efficiently from a large database. A Database consists of different types of images has implemented on the system in large dataset. Various features such as graph, average color, structure and color descriptor are taken into account to extract similar images from the database. From the experimental results, it can be seen that embedded features can give better performance than the individual feature. Therefore, selecting the feature is an important problem in retrieving images. The system is said to be effective if the semantic gap is minimal. The outcome can be improved in the future by providing feedback and user selection in the system.

R. Jainhad implemented a scheme for visual feature based image indexing. The aim of this report is to review the current state of the art in content-based image retrieval (CBIR), a technique for retrieving images based on features such as color, texture and shape. The need to find a desired image from a large data collection is shared by different methods like design engineers and art historians. While the requirements of image users can varies that depends on situation, it can be useful to characterize image queries into three levels of abstraction: primitive features such as color, texture or shape, logical features such as the identity of objects and abstract attributes such as the significance of the scenes depicted[8].

E. Cawkill had developed a combination of three features color, texture, and edge histogram descriptor. There is a chance to add new features in for better retrieval efficiency. Using different research methods, accuracy will be improved. This is possible through User Interface (UI) in the form of relevance feedback. The image properties analyzed in this work are using computer vision algorithms and image processing. For color the histogram of images are computed, for texture co-occurrence matrix based energy and standard deviation. For retrieval of images, a novel idea is developed based on greedy strategy to reduce the computational complexity[9].

A. M. W. Smeulders had developed the virtual image, an iconic index suited for pictorial representation in database, and a similar image retrieval approach based on virtual images to perform CBIR. The virtual image represents the spatial information in the real image clearly through a set of spatial relationships. This is useful to effectively compute the similarity between a query and an image in the database[17].

M.K. Mandal had proposed a new fusion approach using non local and local features. Generally Color Histogram (CH) is used as global feature and Block Bit Plane (BBP) as a local feature. For similarity measurement for query image and target image, distance d1 is used for CH features and BBPs are compared bit by bit using Hamming distance. Finally the overall similarity is computed as a weighted combination of global and local features[21].

II. IMAGE FEATURES

1. Color:

Color features are the most widely used in image retrieval and indexing color features are easier to extract features of object than texture and shape information. Color feature robust to background and is not depends on image size and orientation, and it denotes the combined probability of the intensities of the three color channels. Color distribution features can be matched more strongly than color histograms as histograms do not capture spatial association and they have restricted selective power .color features. color regions of spatial correlation and the global distribution of local spatial correlation of colors can be combined in color correlogram and color coherence vector. These techniques give better efficiency than traditional color histograms. However, they need very costly computation. Color moments have been efficiently used in content based image retrieval systems. It has been clear that characterizing one dimensional color distributions with the three moments is more powerful and runs faster than the histogram based methods.

a) Color Space:

Color Space is used for description of image retrieval based on color. Vector of three dimensional spaces and color in it and it is a part of color space, the choice of color space is made from characteristics of uniformity and uniformity means to having similar distance between color points in color space as perceived by human eye, generally RGB, HSV, YCrCb and opponent color space are used.

Red-Green-Blue (RGB) Color Space

The color representation RGB used in image retrieval. In this representation, the values of the red, green, and blue color channels are stored in particular manner. They can range from 0 to 255, with 0 being not present, and 255 being maximum value. A channel, alpha also provides a measure of transparency for the image pixel.

The distance between two pixels is measured as:

$$\frac{(255-|\Delta \mathrm{Re}\, d|).(255-|\Delta Green|).(255-|\Delta Blue|)}{255^3}$$

Where ΔRed is the red channel difference value, ΔGreen is the green channel difference value, and ΔBlue is the blue channel difference value between the two pixels being compared. This distance matrix has an output in the range. When used to compare pixels, a cut-off, generally between 0.6 and 0.8, and is used to describe whether the two pixels are similar to each other. Because distance measurement depends on the difference between pixel color values, the area of the similarity to the value of a particular image segment is the same pixel value location is compared to the RGB color space.

Hue-Saturation-Value (HSV) Color Space

Hue-Saturation-Value (HSV) color space is alternative of RGB. Instead of looking at each value of red, green and blue individually, a HSV creates a different continuum of colors, in terms of the different hues each color possesses. The hues are then differentiated with the amount of saturation they have, that is, in terms of how little white they have mixed in, as well as on the magnitude of the hue. In the value range, large numbers denotes bright colorations, and low numbers denotes dim colorations.

The gradient, saturation and value calculation can be done as detailed below. From the figure below, *h* stands for hue, *v* stands for value, and *s* stands for saturation. The RGB colors are also represented same with r for red, g for green, and b for blue. The remainders of the variables are temporary computation results.

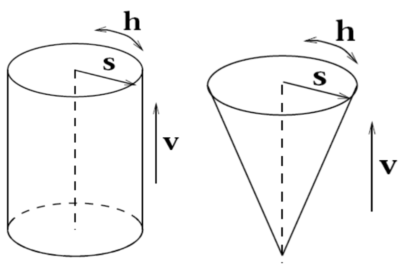

Figure 3.2 Two HSV color space representation

The cylindrical representation is a good approximation, but the conical representation results in better performance.

$$v = \max(r, g, b)$$

$$s = \frac{v - \min(r, g, b)}{v}$$

Here, max denotes a function returning the maximum (255) value among its arguments, and where min denotes a function returning the minimum (0) value among its arguments.

$$h = \begin{cases} \text{if r } = \max(\text{r,g,b}) \text{ and g } = \min(\text{r,g,b}) \text{ then } 5+\text{bpoint} \\ \text{if r } = \max(\text{r,g,b}) \text{ and b } = \min(\text{r,g,b}) \text{ then } 1+\text{gpoint} \\ \text{if g } = \max(\text{r,g,b}) \text{ and b } = \min(\text{r,g,b}) \text{ then } 1+\text{rpoint} \\ \text{if g } = \max(\text{r,g,b}) \text{ and r } = \min(\text{r,g,b}) \text{ then } 3-\text{bpoint} \\ \text{if b } = \max(\text{r,g,b}) \text{ and r } = \min(\text{r g,b}) \text{ then } 3+\text{gpoint} \\ \text{if b } = \max(\text{r,g,b}) \text{ and g } = \min(\text{r, g,b}) \text{ then } 5-\text{rpoint} \end{cases}$$

where

$$rpo\text{int} = \frac{v - r}{v - \min(r, g, b)}$$

$$gpo\text{int} = \frac{v - g}{v - \min(r, g, b)} \text{ and}$$

$$bpo\text{int} = \frac{v - b}{v - \min(r, g, b)}$$

The value computation, maps to the range of values which r, g, and b can take.

In this HSV 64 bins are used for each color channel. Totally we obtain 192 features for each image. These 192 features are used for retrieving the image by computing feature vectors.

b) Color Histogram:

Color histogram is used as color representation technique for image retrieving. Color histograms is not giving spatial data, it is only effective for local as well as global features of colors. It calculates the local and global image information and invariant of image along the view axes for translation and rotation. It is an efficient expression of color attribute in CBIR systems. Histograms mostly use RGB color space. When histogram is computed for large scale image database, it gives average efficient result; to overcome this joint histogram technique is given.

c) Color Distributions:

Color distributions were used for efficiently retrieving most of the similar images from the large image databases, Luet al uses the, the mean value and the standard deviation , to represent global characteristics of image, and specially the image bitmap is used to represent the local characteristics of image for increasing accuracy of the image retrieval.

2. Texture:

Texture refers to property of natural and artificial surfaces, including clouds, trees, bricks, hair, fabric and their surrounding background. Texture properties contain important information about the structural arrangement of surfaces and their relationship to the background. Common texture properties are coarseness, regularity, directionality, contrast, line likeness and roughness. Because of its importance of pattern recognition of texture pattern recognition, there are rich research results from the past years. Now more and more research achievements are being added to it. The natural world having texture: the surface of any object is textured in particular scale. A wealth of textures is observed on both artificial and natural objects like wood, plants, materials and skin. In a general sense, the word texture refers to surface characteristics of the object and appearance of an object based on the size, shape, density, rough, arrangement, and proportion of its elementary parts. The texture is usually described as soft or coarse, soft or hard, smooth coarse, matte or glossy, and so on. Different tools for extract the features of texture are Gabor filter, standard wavelet, Haar wavelet etc.

Figure 3.1 Texture Images

a) Gabor Filters:

Basically Gabor filters are group of wavelets and related to Gabor wavelet, with each wavelet capturing energy at a particular dilations and specific rotation. The scale and orientation property of Gabor filter useful for texture analysis. Gabor filter is one of the most important techniques for retrieving the image.

b) Standard Wavelet Transform:

A wavelet is an important tool in image processing like oscillation with amplitude that starts at zero then increases, and decreases back to zero. Wavelets are purposefully crafted to have particular properties and useful for signal processing. The waves can be combined using a "shift, multiply and sum" technique called convolution, with parts of an unknown signal to extract information from the unknown signal. These features compression and locality of query image.

There a new segmentation method for images consisting of texture regions using local spectral histograms. By analyzing the algorithm into three stages, we can derive probabilistic models and extract the matrimonial features with fragmentation through the iterative update. These lead to more accurate area boundaries, which are more centered through the resettlement phase. Comparisons with other methods show that our method gives a more accurate segmentation. It is provided as a result of a 95% partition using a density filter or also uses a different partition filter. Accuracy of existing methods is given below in table by analyzing different research papers. Some of these are intensity filers, two gradient, three gradient intensity filters, standard wavelet and Gabor wavelets.

Table 3.1: Texture Segmentation Accuracy by using different combination of the Eight Filters.

Filter(s)	**Accuracy (%)**	
	Without Localization	**With Localization**
Intensity filter	95.2	99.2
Two gradient filters	82.4	97.8
Intensity + two gradient filters	94.4	98.9
Two LOG filters	91.4	98
Three Gabor filters	88.9	99.3
Two LOG + three Gabor filters	93.2	98.7
Intensity + two LOG filters	94.3	99.2

Two gradient + three Gabor filters	90.9	98.7

3. Shape:

The shape of objects plays an important role in CBIR. It is an effective feature when used in similarity image retrieval. If a shape is used as feature, edge detection must be the first step to extract that feature of image. In our work, the canny edge detector is used to detect the edge of the object. After detecting the edge the most important step is tracing the contour of the object. For this the edge image is scanned from four directions (left to right, right to left, bottom to top, top to bottom) and the first layer of the edge occurred is detected as contour of image. To avoid discontinuities in boundary of object the contour image is then re-sampled. After the object contour has been detected the first step in shape representation for an object is to locate the central point of the object. In our work, shape based image retrieval experiment is performed on a color image database.

Edge Detection: Edge Detection is a process to discover important features of an image. Here, features mean the properties of image like discontinuities in variation intensity of image. The quality of edges is depends on the appearance of objects in similar illumination, noise and density of edges. The variation in quality of edge can leads to the variation in intensity of image and variation in gray level of image. Edge detection represents a step for higher-level image analysis. It allows an object to be analyzed from its surroundings of its outline. Shape can be represented based on two categories:

a) Boundary-based - Only outer line of the shape used for represent the shape. It is done by relating the considered region using its external properties as the pixels along the object boundary line.

b) Region-based - Entire shape region with its internal characteristics are used to describe shape i.e. the pixels contained in that region.

II. USER INTERACTION

In retrieving content-based images, user interaction with the retrieval system is difficult. Flexible configuration and query modification can only be obtained by engaging the user in the loopback procedure. User interfaces in image retrieval systems typically consist of the Query Forming part and the View Results part. Different types of query images are following.

1) Query via Example

Query by example allows the user to give sample image as query to retrieve the image from large database. Query by example can be classified into query by external image example, if the query image is not present in the dataset, and query by internal image example, if otherwise. For query by internal image, all relationships between images in database can be pre-computed. The advantage of query by example is that the user is not required to provide an external description of the target, which is computed by the system. It is suitable for most of the applications where the target is an image of the same object or different of objects under different viewing conditions. Most current systems provide this form of querying.

2) Query by sketch:

Query by sketch allows user to sketch query image with a graphic interface tool provided either by the retrieval system or by some other software. Queries may be drawn by several objects with certain properties like color, texture, shape, sizes and locations. In most cases, a coarse sketch is enough, as the query can be refined based on retrieval results.

3) Query through Group Example:

Query by group example allows user to select multiple images as sample query.. The system will then detect the images that best match the features of the group of examples. In this way, a target can be defined more precisely by specifying the related feature variations and removing unrelated variations in the query image.

4) Category Browsing:

Category browsing is to search the image in database according to the category specified of the image.

V.CONCLUSION

In this report, current technical achievements in visual feature extraction, CBIR using Genetic Algorithm, and system design are presented. In CBIR, images are indexed by their visual content, such as color and texture. The fundamental difference between content-based and text-based retrieval is that the human interaction. In text-based retrieval human plays a crucial role of annotation of images while in content based retrieval, different low level features are extracted using computer vision techniques.

In existing method for content based image retrieval using color, texture and shape features. For color features, color histograms of each color band have been extracted. Here two types of color spaces were implemented and compared in terms of average precision and average recall. Color-based retrievals in HSV color space gives better performance than in RGB color space. For texture features mean, standard deviation, and energy have been extracted from every decomposed sub band of image. Wavelet and Gabor transforms decompose the sub band of image and Canon edge detection is used to detect variation in intensity of image and it gives better performance. We found some drawbacks to extract features for relevant image retrieval from large scale database, in future we will try to overcome from existing methods by using new method. From the above methods we found that K-mean clustering, Hidden Markov model, discrete wavelet frames decomposition and a mean shift algorithm, Haar wavelet and Intensity filter methods give better accuracy to retrieval.

REFERENCES

[1] A. Blaser, "Database Techniques for Pictorial Applications," Lecture Notes in Computer Science, Vol.81, Springer Verlag GmbH, 1979.

[2] N. S. Chang, and K. S. Fu, "A relational database system for images," Technical Report TR-EE79-82, Purdue University, May 1979.

[3] N. S. Chang, and K. S. Fu, "Query by pictorial example," IEEE Trans. on Software Engineering, Vol.6, No.6, pp. 519-524, Nov. 1980.

[4] S. K. Chang, and T. L. Kunii, "Pictorial database systems," IEEE Computer Magazine, Vol. 14, No.11, pp.13-21, Nov. 1981.

[5] S. K. Chang, C. W. Yan, D. C. Dimitroff, and T. Arndt, "An intelligent image database system," IEEE Trans. on Software Engineering, Vol.14, No.5, pp. 681-688, May 1988.

[6] S. K. Chang, and A. Hsu, "Image information systems: where do we go from here?" IEEE Trans. On Knowledge and Data Engineering, Vol.5, No.5, pp. 431-442, Oct.1992.

[7] H. Tamura, and N.Yokoya, "Image database systems: A survey," Pattern Recognition, Vol.17, No.1, pp. 29-43, 1984.

[8] R. Jain, Proc. US NSF Workshop Visual Information Management Systems, 1992.

[9] A. E. Cawkill, "The British Library's Picture Research Projects: Image, Word, and Retrieval," Advanced Imaging, Vol.8, No.10, pp.38-40, October 1993.

[10] J. Dowe, "Content-based retrieval in multimedia imaging," In Proc. SPIE Storage and Retrieval for Image and Video Database, 1993.

[11] C. Faloutsos et al, "Efficient and effective querying by image content," Journal of intelligent information systems, Vol.3, pp.231-262, 1994.

[12] Y. Gong, H. J. Zhang, and T. C. Chua, "An image database system with content capturing and fast image indexing abilities," Proc. IEEE International Conference on Multimedia Computing and Systems, Boston, pp.121-130, 14-19 May 1994.

[13] R. Jain, A. Pentland, and D. Petkovic, Workshop Report: NSF-ARPA Workshop on Visual Information Management Systems, Cambridge, Mass, USA, June 1995.

[14] H. J. Zhang, and D. Zhong, "A Scheme for visual feature-based image indexing," Proc. of SPIE conf. on Storage and Retrieval for Image and Video Databases III, pp. 36-46, San Jose, Feb. 1995.

[15] B. Furht, S. W. Smoliar, and H.J. Zhang, Video and Image Processing in Multimedia Systems, Kluwer Academic Publishers,1995.

[16] Y. Rui, T. S. Huang, and S. F. Chang, "Image retrieval: current techniques, promising directions and open issues," Journal of Visual Communication and Image Representation, Vol.10, pp. 39-62, 1999.

[17] A. M. W. Smeulders, M. Worring, S. Santini, A. Gupta, and R. Jain, "Content-based image retrieval at the end of the early years," IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol.22, No.12, pp. 1349-

[18] M. Swain and D. Ballad, "Color indexing," international Journal of Computer Vision, 7(1):11-32, 1991.

[19] M. Flickcrelal., "Query by image and video content: The QBIC system," IEEE Computer, 28(9):23-32, 1995.

[20] J.Z. Wang, G. Wiederhold, O. Firschein, S.X. Wei, "Content based image indexing and searching using Daubechies' wavelets," Int. J. Digital Libraries 1 (4), pp. 311–328, 1998.

[21] M.K. Mandal, S. Panchanathan, T. Aboulnasr, "Fast wavelet histogram techniques for image indexing," J. Comput. Vis. Image Understanding 75 (1/2), pp. 99–110, 1999.

[22] Gonzalez. R.C, Woods.R.E, Eddins.S.L, Digital Image Processing using MATLAB, Pearson Education, pp. 482, 2005.

[23] Dr.Fuhui Long, Dr. Hong jiang Zhang and Prof. David Dagan Feng. "Fundamentals of content-based image retrieval," In Multimedia Information Retrieval and Management, D. Feng on 15/06/200URL: http://www.nmis.isti.cnr.it/casarosa/BDG/supporto/CBIR_Introduction.pdf

[24] Yong Rui and Thomas S. Huang, "Image Retrieval: Current Techniques, Promising Directions, and Open Issues," Journal of Visual Communication and Image Representation 10, pp. 39-62, 1999.

[25] ManolisKamvysselis and Ovidiu Marina, "Imagina: A Cognitive Abstraction Approach to Sketch-Based Image Retrieval," Submitted to the Department of Electrical Engineering and Computer Science in MIT, May 1999. Available on 15/06/2009 at URL: http://web.mit.edu/manoli/www/imagina/imagina.pdf