A Content Based Image Retrieval System Study Using Fuzzy Approach

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Abstract -- This paper aims to study and analyze the Content Based Image Retrieval System using fuzzy approach. The problem involves entering an image as a query into a software application MATLAB that is designed to employ CBIR techniques in extracting properties of image and matching them. This is done to retrieve images from the database that are visually similar to the query image. The query image features under consideration were color, shape and fuzzy rule sets. Using matching and comparison algorithms the color, shape and fuzzy rule sets extracting feature of one image are compared and matched to the corresponding feature of another image. This comparison is performed using color histogram, shape with Euclidian distance metrics and fuzzy rule sets, these metrics are performed one after another, so as to retrieve database images that are similar to query image.

Keywords: Fuzzy Approach, Image Retrieval System, Fuzzy Logic.

I. Introduction

A. CBIR System

Content Based Image Retrieval is the image retrieval system is based on the visual features such as color, texture, and shape. Reason for its development are that in many image database, traditional method of image indexing have proven to be insufficient, laborious and extremely time consuming. In CBIR each image that is stored in the database has its feature extracted and compared to the feature of the query image.

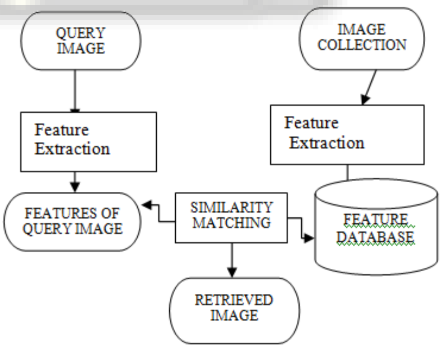

Fig. 1: Basic CBIR System

B. Fuzzy Approach

Fuzzy logic has two different meanings. In a narrow sense, fuzzy logic is a logical system, which is an extension of multi valued logic. Even in its more narrow definition, fuzzy logic differ both concept and substance from traditional multi valued logic systems. Fuzzy logic is a convenient way to map an input space to output space. Mapping input to output is starting point for everything.

C. Fuzzy Set

Fuzzy logic start with the concept of a fuzzy set. To understand what a fuzzy set is, first consider the definition of a classical set. A classical set is a container that wholly includes or wholly excludes any given element. In fuzzy logic, the truth of any statement becomes a matter of degree. Any statement can be fuzzy. The major advantage that fuzzy reasoning offers is the ability to reply to a yes-no question with a not-quite-yes-or-no answer. If you give true the numerical value of 1 and false the numerical value of 0, this value indicates that fuzzy logic also permits in-between values like 0.2 and 0.7453.

D. Foundations Of Fuzzy Logic

A classical set might be expressed as A={x|x>6}. A fuzzy set is an extension of a classical set. If X is the universe of discourse and its elements are denoted by x, then a fuzzy set A in X is defined a set of ordered pairs. A={x,µA(x)|x X}µA (x) is called the membership function (or MF) of x in A. The membership function maps each element of X to a membership value between 0 and 1. The toolbox includes 11 built-in membership function types. These 11 functions are, in turn, built from several basic functions:

– piece-wise linear functions
– the Gaussian distribution function
– the sigmoid curve
– quadratic and cubic polynomial curves

By convention, all membership functions have the letters mf at the end of their names. The simplest membership functions are formed using straight lines. Of these, the simplest is the triangular membership function, and it has the function name trimf. This function is nothing more than a collection of three points forming a triangle. The trapezoidal membership function, trapmf, has a flat top and really is just a truncated triangle curve. These straight line membership functions have the advantage of simplicity.

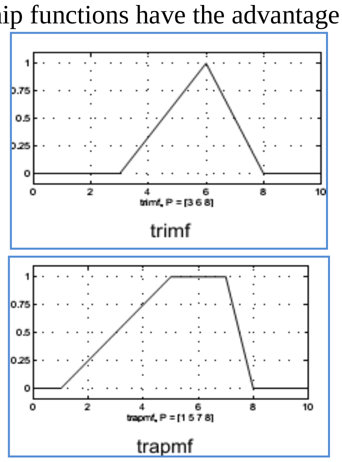

Fig. 2: Degree Function Trimf And Trapmf Curve

Two membership functions are built on the Gaussian distribution curve: a simple Gaussian curve and a two-sided composite of two different Gaussian curves. The two functions are gaussmf and gauss2mf. The generalized bell membership function is specified by three parameters and has the function name gbellmf. The bell membership function has one more parameter than the Gaussian membership function, so it can approacha non-fuzzy set if the free parameter is tuned. Because of their smoothness and concise notation, Gaussian and bell membership functions are popular methods for specifying fuzzy sets. Both of these curves have the advantage of being smooth and non zero at all points.

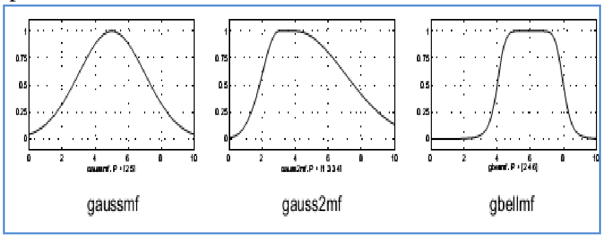

Fig. 3: Degree Function Gaussf Gauss2mf And Gbell Curve

Although the Gaussian membership functions and bell membership functions achieve smoothness, they are unable to specify asymmetric membership functions, which are important in certain applications. Next, you define the sigmoidal membership function, which is either open left or right. Asymmetric and closed (i.e. not open to the left or right) membership functions can be synthesized using two sigmoidal functions, so in addition to the basic sigmf,also have the difference between two sigmoidal functions, dsigmf, and the product of two sigmoidal functions psigmf.

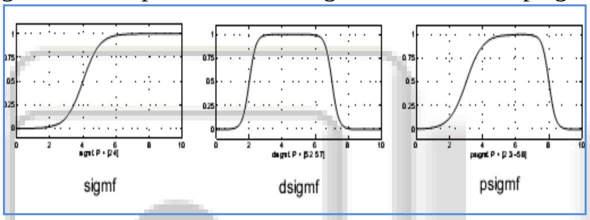

Fig. 4. Degree Function Sigmf Dsigmf And Psigmf curve

Polynomial based curves account for several of the membership functions in the toolbox. Three related membership functions are the Z, S, and Pi curves, all named because of their shape. The function zmf is the asymmetrical polynomial curve open to the left, smf is the mirror-image function that opens to the right, and pimf is zero on both extremes with a rise in the middle.

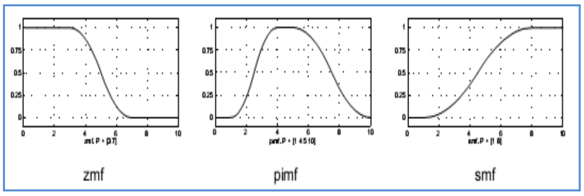

Fig. 5: Degree Function Zmf Pimf And Smf Curve

There is a very wides election to choose from when you reselecting a membership function. You can also create your own membership functions with the toolbox. However, if a list based on expanded membership function sseems too complicated, just remember that you could probably get along very well with just one or two types of membership functions, for example the triangle and trapezoid functions. The selection is wide for those who want to explore the possibilities, but expansive membership functions are not necessary for good fuzzy inference systems summary of Membership Functions:

Fuzzy sets describe value concepts (e.g., fast runner, hot weather, weekend days).

A fuzzy set admits the possibility of partial membership in it. (e.g., Friday is sort of a weekend day, the weather is rather hot).

The degree an object belongs to a fuzzy set is denoted by a membership value between 0 and 1. (e.g., Friday is a weekend day to the degree 0.8).

A membership function associated with a given fuzzy set maps an input value to its appropriate membership value.

II. Result And Analysis

In fuzzy logic image can be retrieved by determining the size of the object use membership functions and fuzzy logics. There are member function Trimf and Trapmf which is used to determine the size of object .There are some sample which can be trained and compare with the images of database. It can be seen in the following figure.

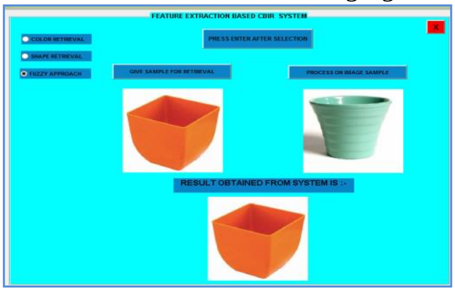

Fig. 6: Show Image Retrieval on the basis of size of the Object

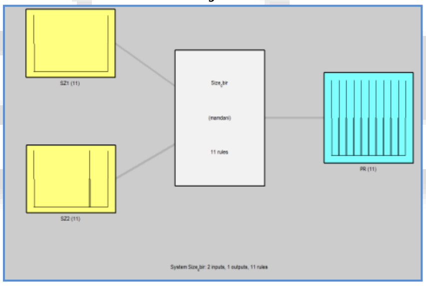

Fig.7: Output from Fuzzy logic toolbox

There are two input like AND logic gate with one output at the end .it describe system size with 2 input 1 output, 11 rules of the fuzzy logic. There are used Trimf member function to determine the size of the object in the image. Then query image compare with rest of the image in the database.

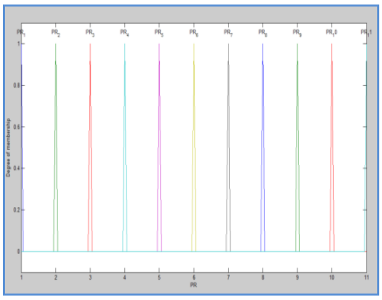

Fig.8: Plotting grapg of membership function of 11 samples

Then Output from the fuzzy logic tool box in the form of this degree of membership graph with the value always lie between 0 or 1. It can be say true or false a discrete value as can be seen in the gragh. A membership function is a curve that defines how each point in the input space is mapped to a membership value. (or degree of membership) between 0 and 1.The input space is sometimes referred to as the universe of discourse, a fancy name for a simple concept.

III. CONCLUSION

The purpose of this paper was to improve the accuracy (precision) of a CBIR application by allowing the system to retrieve more images similar to the source image. The proposed methodology adds a new color features to the already implemented HSV color features and GLCM texture features. The new color features is the Average Color Dominance value (ACD) which represents the average of the top dominating colors.The proposed methodology was tested and experimented on a benchmark database of images. The proposed methodology had increased the average precision from an average of 40.4% (Kavithamethodology) to an average of 45.7% for precision. However, there are still some drawbacks in the image matching algorithm that could be improved to provide better results in general and prevent the precision to decrease when increase the number of output images.

IV. FUTURE WORK

This CBIR application has some drawbacks and weaknesses that could be improved. Some of these drawbacks that could be improved in the future are the as in the following:

A. One of the main and core improvements is the Image Matching Algorithm. The system gets all images and sorts them by how close they are to the source image. However, the sorting algorithm (image matching algorithm) could be further improved to obtain better precision.

B. It was found better to scale down images from 384x256 to 160x240. However images with sizes smaller than 160x240 would be scaled up and so would not obtain similar results. In addition, very large images would lose lots of visual information when scaled down to 160x240. Therefore it would be better to preprocess images in a certain way so that it will provide the same effect as scaling images down.

REFERENCES

[1] Dr.Fuhuri Long,Dr.Hongjiang and Prof.David Dagan Feng, 2003.Fundamental of content based ImageRetrieval;
[2] http://www.cse.iitd.ernet.in/~pkalra/siv864/Projects/ch01_Long_v40-proof.pdf.
[3] P.S.Suhasini, Dr. K.Sri Rama Krishna, Dr. I. V. Murali Krishna CBIR using Color Histogram processing, Journal of Theoretical and Applied Information Technology
[4] Onur Kucuktunc, Daniya Zamalieva, Fuzzy Color Histogram-based CBIR System
[5] Wu Kai-xing, Xu Qiang, Image retrieval based on fuzzy color histogram 978-0-7695-3278-3/08,2008 IEEE DOI 10.1109/IIH-MSP.2008.57
[6] K. Konstantinidis, A. Gasteratos , I. Andreadis Image retrieval based on fuzzy color histogram processing
[7] Ruofei Zhang, · Zhongfei (Mark) Zhang, FAST: Toward more effective and efficient image retrieval
[8] Kashif Iqbal ∗, Michael O. Odetayo, Anne James, Content-based image retrieval approach for biometric security using colour, texture and shape features controlled by fuzzy heuristics.

