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Content Based Image Retrieval with Texture and Colour

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Abstract

Content based image retrieval system is used to retrieve images which are very close to the image that is given as input by user.User can give any image in the database for which texture and colour calculations are performed using euclidean distance and quadratic distances respectively.This system is efficient when the database is very large and manual retrieval of images consume long time.Database is divided into parts ,which belongs to same category for decreasing the computational time.Main objective of this paper is to retrieve an images using both the texture and colour features of an image and display optimum number of outputs

Keywords: Database, Euclidean distance, Quadratic distance, Texture, Colour.

Introduction

Images now play a crucial role in fields as diverse as medicine, journalism, advertising, design, education and entertainment. The number of images available on the Web was recently estimated to be between 30 and 50 million– a figure in which some observers consider to be a significant underestimate. While it is perfectly feasible to identify a desired image from a small collection simply by browsing, more effective techniques are needed with collections containing thousands of items. Journalists requesting photographs of a particular type of event, designers looking for materials with a particular color or texture, and engineers looking for drawings of a particular type of part, all need a system for retrieving these images in minimum time wih great accuracy.In this project we convert images into vectors and calculate euclidean distance and quadratic distance between query image and all the images in the database and retrieve the images from database which are having the least values in sorted order and display those images.In this we use both texture and colour feature extraction and indexing in database.The major advantage of this will be computational time will be decreased and accuracy will be increased because we are considering both texture and colour features.Databse here taken contains images divided into some categories like planes,mountains,buildings ,balls etc

Methodology

The below architecture explains the architecture of an image retrieval system. The user uses the query interface to submit the query which is processed and browses the image collection to extract euclidean distances and quadratic distances. It calculates the euclicdean distance,quadratic distances between the query image and other images in database.The euclidean distances,quadratic distances are sorted in ascending order and the euclidean distance with least values are stored in file.For color based system same system is followed but in place of euclidean distance we use quadtratic distance.Quadratic distances are also sorted and least values are stored in file .

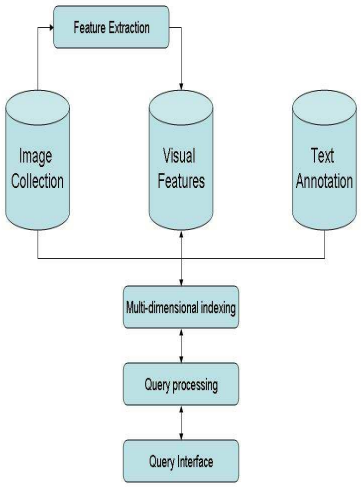

Fig 1 System architecture

For extracting texture features we divide the input four subimages lol-low,low-high,high-low,high-high sub bands.This is done recursively upto third level .Energy levels are calculates using energy formula.These energy results will be used in calculating euclidean distance between query image and other images in the database and there by the closer images to query image are saved ina file.Similarly clour features are extracted using quadratic distance.The images that are having close colours to query image are stored in the file io sorted order.

Colour Extraction

For colour feature extraction we calculate quadratic distance between the query image and all other images in database.For calculating quadratic distance between two images we need rgb colour model to hsv colour model.We get the hsv map model for both query image and image in database with which we are calculating quadratic distance.Now quadratic distance is calculated using below series of formulae.

```
quadratic(X1, map1, X2, map2)
[rHist1 gHist1 bHist1] = rgbhist(X1);
[rHist2 gHist2 bHist2] = rgbhist(X2);
q1 = rHist1 - rHist2;
s1 = abs(q1);  d = s1.'*A*s1;   d = d^1/2;     d= d /
1e8;
```

d contains the value of quadratic distance.
Here in the above forumla A stands for value of similarity matrix.
Similarity matrix value is calculated between two images let be I,J.It is given by

```
similarityMatrix(I,J)
[r, c] = size(I); where r is number of rows and c is
number of columns of I
Algorithm for calculating similarity matrix
for i = 1:r
  for j = 1:r
    M1 = (I(i, 2) * sin(I(i, 1)) - J(j, 2) * sin(J(j, 1)))^2;
      M2 = (I(i, 2) * cos(I(i, 1)) - J(j, 2) * cos(J(j,
1)))^2;
      M3 = (I(i, 3) - J(j, 3))^2;
      M0 = sqrt(M1 + M2 + M3);
      A(i, j) = 1 - (M0/sqrt(5));
  end
end
```

Texture Extraction

As mentioned in methodology we use energy algorithmm .

A.*Energy level algorithm*

1.Decompose the image into four sub images.

2.Calculate the energies of the decomposed imges using the formula given below

$$\frac{1}{MN}\sum_{i=1}^{m}\sum_{j=1}^{n}|X(i,j)| \qquad \text{……..(1)}$$

Where M and N are dimensions of image and X is intensity of pixel located at i th row and j th cloumn in the image map.

Euclidean distance D between two vectors X and Y is given by the below formula

D^2= ((X-Y) ^2)).....(2)

Now using this formula euclidean distances are calculated and the resulting set of euclidean values between the query image and images in database are sorted and the least values are stored in the file .This file used to displaying the images in output.It contains the image and respected euclidean value of the image with respective to query image.

Indexing Database

For better performance of the system in terms of time database is divided into some parts which belongs to some category like aeroplanes,birds,animals ,buildings,balls,food items,mountains etc.Here the computational time can be decresed by searching image only from the category it belongs to rather searching the whole database.

Performance Results

Performance of our system can be decided on two factors precision and recall .Precision rate is given by the formula

Precision= No. of relevant images retrievel/Total number of images retrieved

Recall is given by formula

Recall= No. of relevant images retrieved /Number of relevant images in the database

These are the values of precision rate for some images in different categories of database**.**

TABLE. I Precision table

Image no	No:of relavent images retrieved	Total no:of images retrieved	precision
4	24	42	.571
29	23	42	.547
47	24	42	.547
53	26	42	.619
95	21	42	.5
96	23	42	.547
168	24	42	.571
139	22	42	.523
197	25	42	.595
195	30	42	.714
226	25	42	.595
234	24	42	.571

TABLE. II Recall table

Image no	No:of relavent images retrieved	Total no:of images retrieved	precision
4	24	42	.571
29	23	42	.547
47	24	42	.547
53	26	42	.619
95	21	42	.5
96	23	42	.547
168	24	42	.571
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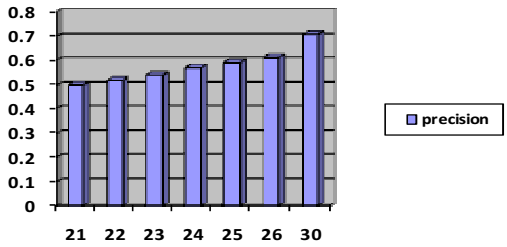

Fig.2 precision vs image retrieval

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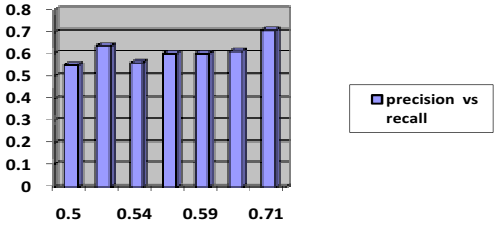

Fig.3 precision vs recall

Conclusion

Frame work is designed for content based image retrieval using texture and colour feature.As database is indexed we have reduced the computational time when compared to the database without indexing.Combination of texture and colour based retrieval will reduce the number of image output and accuracy is increased when compared to their execution individually. Precision rate is around 57 percentage and recall rate around 61 percentage.As the balance is right between recall and precision rate this system is optimal and best for taken problem.

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