Thesis Overview

CONTENT BASED IMAGE RETRIEVAL THROUGH OBJECT FEATURES

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Digital images are an increasingly important class of data, especially as computers become more usable with greater memory and communication capacities. As the demand for digital images increases, the need to store and retrieve images in an intuitive and efficient manner arises. These approaches can roughly be classified into three categories such as text-based, content-based and semantic based.

Content based image retrieval(CBIR) is fairly a new method of image retrieval and is evolving continuosly. CBIR uses low-level features like colour, texture and shape that are inherent in the image can be used to describe and retrieve images. It involves two basic steps ,

- Feature Extraction
- Matching

The visual contents of the images in the database are extracted and described by multi-dimensional feature vectors. To retrieve images, the retrieval system is provided with example image. The system converts the image into its internal representation of feature vectors. The similarities/distances between the feature vectors of the input image and the images in the database are then calculated and retrieval is performed.

This in paper the object characteristics are captured through geometric features. the given image is segmented using the K-Means. For each cluster, the various geometric properties such as the Area(A), Radius(R), Perimeter(P), Equivdiameter(Eqd), Compactness(cn), Elongatedness (en) ,Thinness Ratio(Tr) are extracted. These seven feature vectors are used for the retrieval purpose or stored for future queries.

Using geometric features alone to match images is fairly efficient when compared to other methods like ARC-BC or convexity measures. The aim of this thesis to show that the rate of retrieval can be improved by combining various features than using a single characteristic. The proposed method combines colour, texture and geometric features to form a multidimension feature vector.

Colour is probably the most expressive of all visual features. Colour features are robust to translation, rotation and view angle and histogram is one of the simplest image features. We have used the HMMD color space as it takes into account the spatial information of pixels. The given RGB image is converted into HMMD colour space of 128 bins. The HMMD color model is defined by the hue, the shade (max), the tint (min), the tone (diff), and the brightness (sum). The max value controls the colour shade from black to white and a pure color, the min value controls the tint from black and a pure color to white, the diff value controls the tone from gray to a pure color, and the sum controls the brightness from a dark to a light color.
The steps involved in converting a image in RGB colour space to HMMD colour space using the following equations:

(Shade)max value = maximum value from input r, g, b values
(Tint)min value = minimum value from the input r, g, b values
(Tone) diff = max value − min value
(Brightness)sum = (max + min)/2

if (r=max ∩ (g − b)≧0) then Hue = (g−b)/(max−min)*60
if (r=max ∩ (g − b)<0) then Hue = (g−b)/(max−min)*60+360
if (g=max) then Hue = (2.0+(b−r))/(max−min)*60
if (b = max) then Hue = (4.0+(r-g)/(max-min))*60
if (diff = 0) then Hue = 0

These values are used to form the global histogram of the image and is stored as colour feature vector .

The texture of the image is measured using a statistical method that considers the spatial relationship of pixels , gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix.

The GLCM characterizes the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image. The statistical measures extracted are,

- Contrast - the local variations in the gray-level co-occurrence matrix.
- Correlation - the joint probability occurrence of the specified pixel pairs.
- Energy - the sum of squared elements in the GLCM, also known as uniformity.
- Homogeneity - the closeness of the distribution of elements in the GLCM to the GLCM diagonal.

The database is constructed by combining the geometric features , the texture features and the colour feature vector for all the given images. This is done separately before the retrieval process begins. This preprocessing reduces the retrieval time of the images. When a user inputs a image the feature vectors for the image are constructed. This is then compared with the features vectors stored in the database using dissimilarity methods. We have used Minkowski distance to calculate the dissimilarity measures. The images are then displayed with increasing dissimilarity.

The proposed method was tested using coral database images and the results were found promising. As a future work the shape descriptors and object indexing may be included to increase the rate and precision of retrieval.

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