Region Based Classification Algorithm for Medical Image Databases

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Abstract

In this paper presents the region based classification algorithm for medical image database. It provides better results and efficient retrieval of medical images. The proposed method follows three steps. Firstly, segment the medical images into regions based on edge following technique. This technique is more accurate and efficiency compare to existing contour methods. Secondly, calculate the feature vectors of each region using signature. Thirdly, calculate the distance between query feature and database image features. The efficiency and performance of the presented method has been evaluated using a dataset of about 500 simulated. The experimental results show that the proposed method has more efficiently and effectively for medical applications in CBIR systems.

Index Term: - Content-based image retrieval, medical image databases, region matching

I. INTRODUCTION

The explosive growth of the internet and the wide use of digital content necessitate the development of effective ways of managing the visual information by its content and have increased the need for efficient image retrieval procedure [1]. Due to the rapid development of computing hardware, digital acquisition of information has become one popular method in recent years. Every day, G-bytes of images are generated by both military and civilian equipment. Large set of medical images, architectural and engineering designs, journalism and advertising, are worth mentioning. Consequently, how to make use of this huge amount of images effectively becomes a highly challenging problem [2]. As a result, studies on Content Based Image Retrieval (CBIR) have emerged and have been an active research from the past decade.

In most of the image retrieval systems, a query is specified by an image to be matched. We refer to this as an overall search, as similarity is based on the overall properties of images. By contrast, there are also partial search querying systems that retrieve based on a particular region in an image. A content-based image retrieval method named CBDIR, segmenting the teeth of dental study models (plaster casts of the dentition), exhibits varieties of malocclusions [3]. Medical and general purpose image retrieval (MGIR) method is used for retrieving medical and general purpose images from databases, robust to scaling and translation of objects within an image [4]. The Colorimetric-Based Retardation Measurement Method (CBRM) is a method in which each image is first decomposed into regions [5]. A measure for the overall similarity between images is developed using a region-matching scheme that integrates the properties of all the regions in the images [6].

The CBMIR system is interactive and the user is allowed to correct the results of the segmented images. The user can identify and extract interesting images or regions from all segmented images. The user can even specify the class to which an image belongs. Based on the properties of individual regions and spatial relationships between such regions, the CBMIR system takes the responsibility of efficient storage, representation, and retrieval of images.

In this paper is organized as follows. Proposed method in section II. The simulation results are presented in Section III. Concluding remarks are made in Section IV.

II. PROPOSED METHOD

The proposed method has better retrieval accuracy and efficient method. In this work, retrieval the medical image based on region based segmentation. To segment the image into regions or dominant objects based edge following technique. After that apply the label of each region. The block diagram of proposed method as shown in figure.1.
Fig. 1. block diagram of proposed method

The algorithm of proposed method is given by

\[
\text{for } k=1: \text{DBIMAGES } \\
\text{read image } k; \text{ } \\
\text{SEG=segment the image using edge following contour} \text{ } \\
[B,pk]=Bwlabel(seg); \text{ } \\
\text{for } i=1: Pk \% pk is number of components in kth image } \\
k=B(i) \% read the ith component of kth image } \\
\text{find } Si; \% Si is the signature of component i } \\
\text{calculate } Fi1, Fi2, \ldots, Fi8 \text{ } \\
\text{save } k, i, Fi1, Fi2, \ldots, Fi8 \% \text{save ten values for component i, in database } Dv \\
\text{end;} \text{ } \\
\text{end } \\
\text{end }
\]

**query matching**

\[
\text{input } Q; \% Q is the query image, SOM segmented } \\
\text{find } Fq; \% \text{calculate the feature vector of query image } Q \text{ } \\
\text{for } J=1: N \% N is the number of images in database } Dd \\
\text{compare } Q; \% \text{search for the most similar images in database } Dy \\
\% (compare number of components and feature vectors) \\
\text{report similarities; } \% \text{report partially or completely similar cases. } \\
\text{end; }
\]

**A. Edge following technique**

It is Law’s texture and Canny edge detection. Edge following technique can be divided into the two steps. They are edge map and average vector field. In law’s texture, calculate a convolving an input image with each of the masks. In average vector field, the edge vector field is calculated according to the following equations:

\[
E=1/k(M_x+M_y)
\]

Where

\[
K=\max(\sqrt{M_x+M_y})
\]

Each component is the convolution between the image and the corresponding difference mask, i.e.

\[
M_x=-G_y*f \%
\]
\[
M_y=G_x+f
\]

where \(G_x\) and \(G_y\) are the difference masks of the Gaussian weighted image moment vector operator in the x and y directions.

At the pixel position \((i, j)\) of an image, the successive positions of the edges are then calculated by a 3 × 3 matrix

\[
L(r,c) = \alpha M(r,c) + \beta D(r,c) + \varepsilon E(r,c)
\]

where \(\alpha\), \(\beta\), and \(\varepsilon\) are the weight parameters that control the edge to flow around an object.

The algorithm of edge following technique as shown below

1. Read the image
2. Generate the Gaussian mask
3. Convolution between image and Gaussian mask
4. Apply gradient %initial gradient
5. \([u \, n]\)=Initializing the contour position
6. For 1: no_of contours
7. \([nx, ny]\)=gradient(u);
8. %law texture here we donot calculate convolution between image and mask.Because convolution applied in step 3
9. \(Mx=\sqrt{Nx^2+Ny^2}\);
10. Ang=angle(u);
11. \([N]=\text{gradient}(nx,ny);\%\text{law texture .here we donot calculate convolution between image and mask. Because convolution applied in step 3}
12. \(P=\text{gradient}(nx,ny);\%\text{edge detection}
13. \(E=N+p;\%\text{edge map=texture+ edge detection}
14. \%\text{end of edge map}\%\%
15. \(u=u+\Omega *Mx + \alpha*E+\beta*ang);\%\text{edge following technique or contour update}

End of contour
B. Feature selection

In this work, we take the signature as a feature vector. Features are extracting from database images and query image. In signature feature calculated based on three ratios. They are 1) Signature Height Width Ratio 2) Signature Occupancy Ratio.

The signature height width is ratio obtained by dividing signature height to signature width. The height is the maximum length of the object obtained from the segmented region from medical image. Similarly the width is also calculated considering the row of maximum length.

The signature occupancy ratio is the ratio of number of pixels which belong to the signature to the total pixels in the signature image and is given by

\[ D_i = \frac{N_i}{N} \]

C. Distance calculation

Euclidean distance is the distance between energy of images from database and energy of query image. The formula of Euclidean distance is given by

\[ distance = \sqrt{query^2 + dbimages^2} \]

Here

Query is the energy of query image and db images is the energy of database images.

III. EXPERIMENTAL RESULTS

A dataset of about 500 simulated, but realistic computed tomography and magnetic resonance images (MRI) is used. These work simulated using MATLAB TOOL.

IV. CONCLUSION

In this paper employs novel technique in which each image is first decomposed into regions and then calculate the signatures and computing feature vectors. It is more accuracy and retrieval effiency. The results show the retrieval images more relevant to query image.
Fig. 5. Retrieve images for a sample query of 401 in the database using proposed method

Fig. 6. Query image number 251

Fig. 7. Retrieve images for a sample query of 401 in the database using proposed method

REFERENCES


