Content Based Medical Image Retrieval System using Fourier Descriptors Feature for Nose Images

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Abstract

This paper aims to concentrate on a specific medical domain. In this work, retrieval of nose diseases images has been done by using Fourier descriptors feature. Fourier descriptors feature is a shape -based feature. Shape features are extracted from the given input images. Then these extracted features are stored in the database. Features which are stored in the database are compared with query feature. For similarity measurement, Euclidean distance method is used. Similar images are retrieved from the database. This system helps doctors in clinical care and research.

Keywords*: CBMIR, Fourier descriptor, Euclidean Method, Precision, Recall*

I. INTRODUCTION

Today's medical imaging is gaining more importance due to automated and efficient diagnosis in short period of time[1].Content based medical image retrieval(CBMIR) system is an automated computer aided technique. It retrieves the images on the basis of content .CBMIR helps doctors to diagnose the patient diseases. CBMIR improves the accuracy of images which are retrieved[2].CBMIR uses low level features like intensity ,texture ,color ,shape for feature vector construction[3].These feature vectors are compared with query feature for similarity comparison .CBMIR is very useful for many diseases such as brain tumor, lung cancer ,breast cancer ,spine disorder etc.

The main objective of this paper is to retrieve nose diseases image form the medical image database. In this paper shape-based feature is used for feature vector construction. Fourier descriptor is one of the examples of shape-based feature. Shape-based features can be boundary based or region based [4]. Fourier descriptors features are boundary based shape features. Fourier descriptors are computationally less complex and more robust compared with other feature descriptors.

II. RELATED WORK

There are many existing medical image retrieval systems related to specific medical diseases. They are discussed below

A. Content Based Medical Image Retrieval System Using Texture and Intensity for Dental Images

In this method, the author proposed retrieval of dental images using texture and intensity feature. Texture and intensity feature are combined to form single feature vector of the image by using fusion method. The resulting image is compared to the images in the database. The N top most similar images are then retrieved from the database. This approach is more robust and provides accurate results [2].

B. Content Based Medical Image Retrieval System Using Texture and Intensity for Eye Images

In this method, the author proposed retrieval of eye images using texture and Intensity feature. Both these features are combined to form a single feature vector of the image. Euclidean Distance method gives top images matching to our query images. The local binary pattern is used to extract texture feature. Precision and recall method are used for retrieval efficiency [3].

C. Unsupervised Feature Selection Applied to Content Based Retrieval of Lung Images

This method proposes the new hierarchical approach to content-based image retrieval called the "customized-Queries" Approach (CQA).In CQA search method and clustering algorithms are implemented. This method is implemented in two steps: step 1 (feature selection for classification) is used to classify the query images into one of the given disease group. In step 2 the best defined features similarity within a single disease group has been identified. This system retrieves images from only one main group at a time, it does not retrieve the images from the next most possible group to provide next best match in the group. This address the limitation of CQA [5].

D. Content Based Image Retrieval Based on Pyramid Structure Wavelet

In this method, the author proposed the result of image retrieval by using color, shape and texture and combination between them by using Receiver-operating characteristic curve (ROC).The hybrid technique is used with ROC technique to give

best results. In hybrid technique it compares HSV query with HSV database images and it provides sorted list with sorted images and their differences. The major drawback is that it takes the longer time for calculation and comparison with other technique [6].

E. Image Retrieval Based on Color and Texture Features of the Image Sub-blocks

In this method, the author proposed the image retrieval system based on color and texture feature. An image is partitioned into sub blocks; color of each sub block is taking out by measuring the HSV color space into the non-equal interval. The drawback of the system is the HSV color space. This method will concentrate only on the color images it does not favor for the specific medical domain. Because in specialized fields, namely in the medical domain the absolute color and gray level features are very limited [7].

III. PROPOSED METHOD

The proposed method is based on the shape of the images. The proposed CBMIR system is shown in fig.1. The CBMIR system is discussed below.

Step1: Create a database containing various nose images.
Step2: Do the image segmentation of each image in the database.
Step3: Extract the shape features of each segmented image in the database.
Step4: Construct feature vector for shape.
Step5: The new images formed are stored in another database called the Featured Databases.
Step6: Find the distance between feature vectors of query images and that of Featured database images.
Step7: Sort the distance and Retrieve the N-top most similar images.

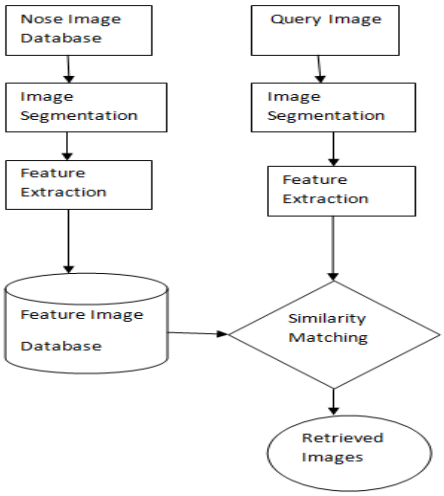

Fig.1 System Flow Diagram

The shape based Fourier descriptor performs better than another method for the process of shape extraction. Extracted feature vector are compared with query feature vector using Euclidean distance method to retrieve similar images from the database.

A. Image Segmentation

In this stage, undesired tissues like eye, ear, and skull are removed. Segmentation can be used for object detection. Segmented objects differ greatly in contrast from the background image. Changes, in contrast, can be detected by operators that calculate the gradient of an image. Sobel operator can be used to calculate the threshold value. Threshold value is used to create a binary mask that contains a segmented cell. Lines of high contrast in the image are represented by the binary gradient mask. By using imdilate function these masks are dilated. But still, some holes are present in the interior of the cell after getting dilated binary gradient mask. By using imfill functions these holes are filled. After this step, cell is successfully segmented. By using imclearborder function any object which is connected to the border of the image is removed. To smoothen the object, we do eroding twice with a diamond structuring element. By using strel function diamond structuring element is created.

B. Feature Extraction

Shape based features are extracted by fourier Descriptors [8].Features extracted by fourier descriptor are dominant features for boundaries and object representation [9].By using fft function discrete Fourier transform of the image is computed.DFT of an is given by the below formula.

$$b(k) = \frac{1}{M}\sum_{m=0}^{M-1} q(m)\, e^{-j2\pi km/M}$$

$$k = 0,1,2,\ldots M-1$$

$$q(m) = x(m) + j\,y(m),$$
$$m = 0, 1, 2 \ldots M-1$$

Fourier descriptors of the boundary are represented by complex coefficients b(k).

IV. RESULT ANALYSIS

Experimental results present the working of the retrieval of the image from the database.

Fig.4.1 Sample Image

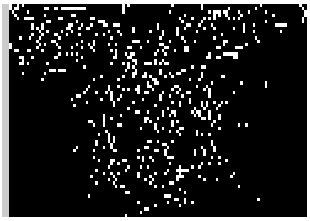

Fig.4.2 Binary Gradient Mask of the Image

Fig.4.3Dilated Gradient Mask of the Image

Fig.4.4 Binary Image with Holes

Fig4.5 Cleared Border Image

Fig.4.6 FFT of the Cleared border Image

Fig4.7 Query image

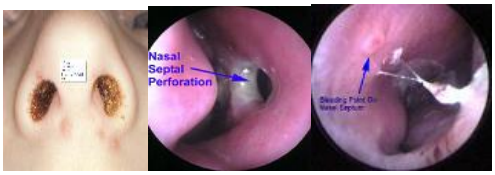

Fig.4.8 Images in the Database

A. Image Retrieval using Euclidean Method

Euclidean distance method is calculated between query and database images. Images which having minimum Euclidean distance are considered as a most similar image [10].The formula for

the Euclidean method is given below.

$$d\left(A^{I},A^{Q}\right)=\sqrt{\sum_{i=1}^{n}\left(A_i^{I}-A_i^{Q}\right)^2}$$

Where,

AI-is the Images in the database
AQ-is the query image for retrieval

B. Retrieval Efficiency

By selecting some query images from MATLAB Workspace datbase ,the system was tested and results are shwon in th follwloing Tabel.1.Retrieval Efficiency is measured with Precision and recall. Formulas for Precision and recall are given below.

PRECISION = NO.OF RELEVENT IMAGES RETRIEVED/ TOTAL NO. OF IMAGES RETRIEVED

RECALL=NO.OF RELEVENT IMAGES RETRIEVED/ TOTAL NO.OF RELEVENT IMAGES IN THE DATABASE

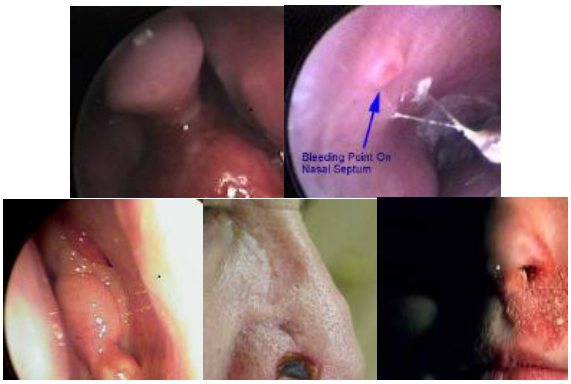

Fig.4.8 Retrieved Images form the datbase

Table.1. Precision and Recall Values in %

Query Image	Precision	Recall
1	97%	88%
2	98%	90%

V. CONCLUSION

In this work, an effective nose image retrieval system based on shape based feature is presented. Fourier Descriptors is used to find shape based features. Retrieval Efficiency is measured with precision and recall, methods.

ACKNOWLEDGMENT

I would like to take this opportunity to express my gratitude to the people whose assistance has been invaluable in this paper. I would like to thank the Director of National Institute of Technology, Manipur for providing financial and infrastructure support for making this work possible.

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