Diagnosis of Diabetic Retinopathy using CBIR Method

Chaitali Desai
University of Mumbai
VIVA institute of technology
Shirgaon,Palghar,India

Shivani Gupta
University of Mumbai
VIVA institute of technology
Shirgaon,Palghar,India

Priyanka More
University of Mumbai
VIVA institute of technology
Shirgaon,Palghar,India

Prachee Singh
University of Mumbai
VIVA institute of technology
Shirgaon,Palghar,India

ABSTRACT
Here the process and knowledge of image processing is applied to diagnose Diabetic retinopathy from images of retina. Here Content Base Image Retrieval (CBIR) method is used. Content-based image retrieval method said physicians in the early Detection of diabetic retinopathy for preventing blindness. A content based image retrieval System allows the user to presents query image in order to retrieve images stored in the Database according to their similarity to the query image. A CBIR frame work will be Developed based on feature extraction method for diagnosis of diabetic retinopathy. Wavelet transform and dual tree complex wavelet transform is used for feature extraction of fundus image, for matching Euclidean distance will be calculated between the query image and the database and which will be having minimum Euclidean Distance will be the best match for query image and the retrieved images will be ranked.

Keywords
DWT, diabetic retinopathy, image database, image processing, Messidor.

1. INTRODUCTION
Diabetic retinopathy is a critical eye disease which can be regarded as manifestation of diabetes on the retina. The arteries in the retina become weakened and leak, forming small, dot like hemorrhages. These leaking vessels often lead to swelling or edema in the retina and decreased vision. New fragile, vessels develop as the circulatory system attempts to maintain adequate oxygen levels within the retina. This phenomenon is called neovascularization. Blood may leak into the retina and vitreous, causing spots or floaters, along with decreased vision. The screening of diabetic patients for the development of diabetic retinopathy can potentially reduce the risk of blindness in these patients. This work is one of the method of applying digital image processing to the field of medical diagnosis in order to lessen the time and stress undergone by the ophthalmologist and other members of the team in the screening, diagnosis and treatment of diabetic retinopathy. Content Based image retrieval (CBIR) is an automated system for a large database using query by image content. CBIR is found to be an efficient retrieval system for medial image database in diagnosis of disease. CBIR is an automatic retrieval of images generally based on some particular properties such as color composition, shape and

Texture. The main objective of this research work is to retrieve similar images matching the query image from medical databases by using feature extraction and similarity measurement techniques. Feature extraction is initial and important step in the design of content based image retrieval system. Feature extraction means extracting unique and valuable information from the image, these features are termed as signature of image. Wavelet transform is used to generate the feature vectors. The input image is compared with the images in database by extracting features from images and computing distance between them. Distance metric is the main tool for retrieving similar images from large medical databases. Euclidean distance is used for the purpose of similarity comparison. The images with minimum distance are displayed.

2. DESIGN METHODOLOGY

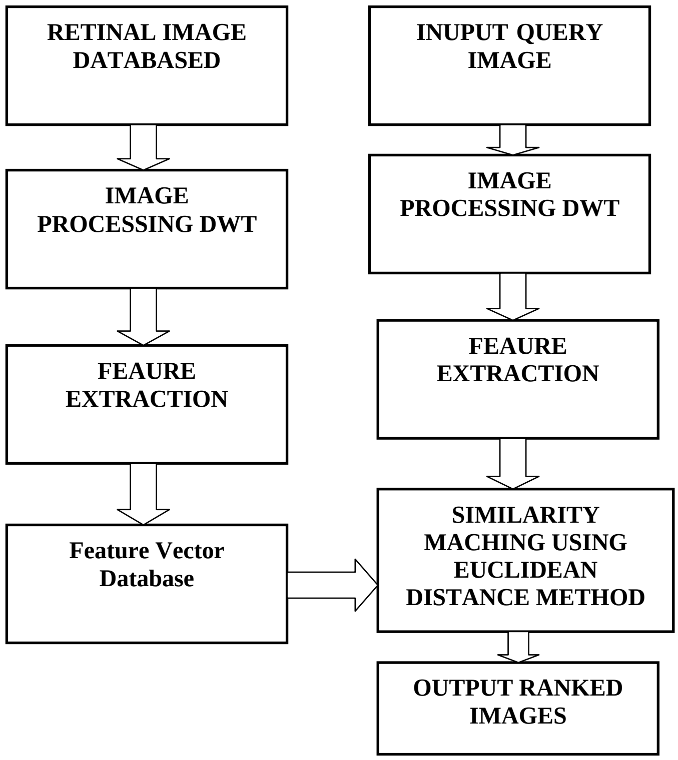

Fig 1: Flow chart of the design methodology

3. DATABASE

3.1 Messidor
The Messidor database, which contains hundreds of eye fundus images, has been publicly distributed since 2008. It was created by the Messidor project in order to evaluate automatic lesion segmentation and diabetic retinopathy grading methods. The MESSIDOR database has been established to facilitate studies on computer assisted diagnoses of diabetic retinopathy. The research community is invited to test its algorithms on this database.

3.2 Data description
The 300 eye fundus color numerical images of the posterior pole for the MESSIDOR database were acquired by 3 ophthalmologic departments using a color video 3CCD

camera on a Topcon TRC NW6 non-mydriaticretinograph with a 45 degree field of view. The images were captured using 8 bits per color plane at 1440*960, 2240*1488 or 2304*1536 pixels.800 images were acquired with pupil dilation (one drop of Tropicamide at 0.5%) and 400 without dilation.The 300 images are packaged in 3 sets, one per ophthalmologic department. Each set is divided into 3 zipped sub sets containing each 100 images in TIFF format and an

Excel file with medical diagnoses for each image.

3.3 Medical diagnoses

Two diagnoses have been provided by the medical experts for each image:

- Retinopathy grade
- Risk of macular edema

Retinopathy grade

- Grade 0 (Normal): (µA = 0) AND (H = 0

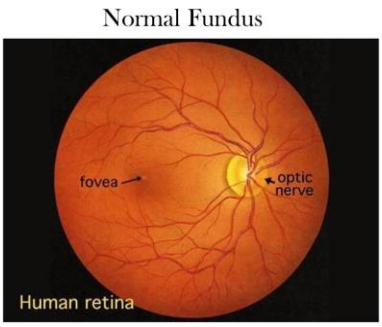

Figure no. 4.1 Grade 0

- Grade 1 : (0 < µA <= 5) AND (H = 0)

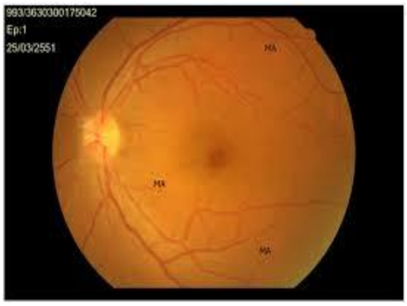

Figure no. 4.2 Grade 1

- Grade 2 : ((5 < µA < 15) OR (0 < H < 5)) AND (NV = 0)

Figure no. 4.4 Grade 2

- Grade 3 : (µA >= 15) OR (H >=5) OR (NV = 1)

Figure no. 4.4 Grade 3

4. IMAGE PRE-PROCESSING

This is the process of preparing the acquire images for image enhancement. Image resizing is the major process to carry out. This will reduces the size of the image to enable digital image processing to carry out. It enables the MATLAB application to display the full image instead of a reduce size of the image i.e. before resizing the image was shown at 67% instead of the normal 100%.

4.1.1 D-DWT

The concepts of one-dimensional DWT and its implementation through sub band coding can be easily extended to two-dimensional signals for digital images. In case of sub band analysis of images, we require extraction of its approximate forms in both horizontal and vertical directions, details in horizontal direction alone (detection of horizontal edges), details in vertical direction alone (detection of vertical edges) and details in both horizontal and vertical directions (detection of diagonal edges).

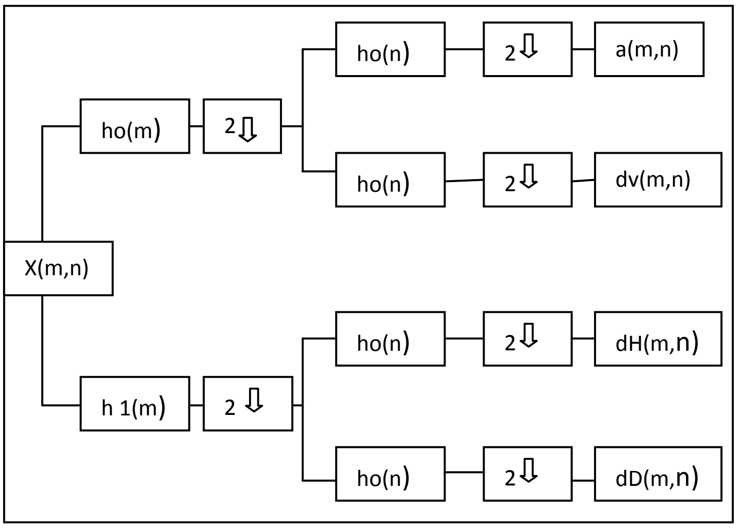

Fig 2 : 2D DWT

The filtering in each direction follows sub sampling by a factor of two, so that each of the sub bands corresponding to the filter outputs contain one-fourth of the number of samples, as compared to the original 2-D signal.

4.2 Feature Extraction

As we know that raw image data that cannot used straightly in most computer vision tasks. Mainly two reason behind this first of all, the high dimensionality of the image makes it hard to use the whole image. Further reason is a lot of the information embedded in the image is redundant. Therefore instead of using the whole image, only an expressive representation of the most significant information should extract. The process of finding the expressive representation is known as feature extraction Feature extraction can be defined as the act of mapping the image from image space to the feature space.

The main point for choosing the features to be extracted should be guided by the following concerns. The features should carry sufficient information about the image and should not require any domain specific knowledge and it should be easy to compute in order for the approach to be feasible for a large image collection and rapid retrieval. Another thing is that it should relate well with the human perceptual characteristics since users will finally determine the suitability of the retrieved images

4.2.1 Color

Color is the one mostly used visual feature in Image retrieval. It is relatively robust to background complication and independent of image size and orientations. Color Histogram is commonly based on the intensity of three channels. It represent represents the number of pixels that have colors in each of a fixed list of color ranges. Color Moment is based used to overcome quantization effect in color histogram. It represents to calculate the color similarity by weighted Euclidean distance. Color set is used for fast search over large collection of image. It is based on the selection of color from quantized color space. A histogram is the distribution of the number of pixels for an image. The color histogram represents the color content of an image. It is robust to translation and rotation. Color histogram is a global property of an image. The number of elements in a histogramdepends on the number of bits in each pixel in an image.

4.2.2 Shape

In image retrieval, depending on the applications, some require the shape representation to be invariant to translation, rotation, and scaling, while others do not. Shape descriptor is some set of numbers that are produced to describe a given shape feature. A descriptor attempts to quantify shape in ways that agree with human intuition (or task-specific requirements). Good retrieval accuracy requires a shape descriptor to be able to effectively find perceptually similar shapes from a database.

4.2.3 Texture

Texture refers to visual patterns with properties of homogeneity that do not result from the presence of only a single color such as clouds and water. Texture features typically consist of contrast, uniformity, coarseness, and density. There are two basic classes of texture descriptors, namely, statistical model-based and transform-based. The former one explores the grey-level spatial dependence of textures and then extracts some statistical features as texture representation.

4.3 CBIR

The role of CBIR starts when a query image and a large data base of images are available, then CBIR extracts visual contents (features) of the query image and compares these with the visual contents of each image in the data bank. Those images in the data bank, whose visual contents closely match those of the query image, are then retrieved. These retrieved images are supposed to be looking "similar" to the query image. However, in practice, only a few retrieved images will look similar, because the extracted visual features from any image will not fully characterize represent that image. Images that are close in feature space are, in general, not close semantically.

Two main functionalities are supported:

- Data insertion
- Query processing.

The data insertion subsystem is responsible for extracting appropriate features from images and storing them into the image database.

The query processing, in turn, is organized as follows:

The interface allows a user to specify a query by means of a query pattern and to visualize the retrieved similar images. The query-processing module extracts a feature vector from a query pattern and applies a metric (such as the Euclidean distance) to evaluate the similarity between the query image and the database images. Next, it ranks the database images in a decreasing order of similarity to the query image and forwards the most similar images to the interface module. Note that database images are often indexed according to their feature vectors by using structures.

5. SIMILARITY MATCHING TECHNIQUES

After feature extraction we calculate the mean and standard deviation of these vectors.

Mean:

To find mean of N numbers add N numbers and divide it by N

If the numbers are ,X1,X2,X3….,Xn the total is:

X1+ X2+ X3+….+,Xn

The total is divided by N to make the average

X1+ X2+ X3+….+,Xn/N

For multidimensional array we calculate mean along rows and columns

Standard Deviation:

The standard deviation (represented by the Greek letter sigma, σ) is a measure that is used to quantify the amount of variation or dispersion of a set of data values. A standard deviation close to 0 indicates that the data points tend to be very close to the mean of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values.There are two common definitions for the standard devicoation s of a data vector X.

$$(1)\, s = \left(\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2 \right)^{\frac{1}{2}}$$

$$(2)\, s = \left(\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2 \right)^{\frac{1}{2}},$$

where

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

and n is the number of elements in the sample. The two forms of the equation differ only in n – 1 versus n in the divisor. We save these values as feature vector for all the images in the database and at run time we calculate the feature vector of the query image, then these feature vectors are compared using different matching technique.

5.1 Euclidean Distance Algorithm

This distance metric is most commonly used for similarity measurement in image retrieval because of its efficiency and effectiveness. It measures the distance between two vectors of Images by calculating the square root of the sum of the squared absolute differences. The Euclidean distance between point p and q is the length of the line segment connecting them ( ). In Cartesian co-ordinates, if p = (p1, p2,..., pn) and q = (q1, q2,..., qn) are two points in Euclidean n-space , then the distance (d) from p to q, or from q to p is given by formula

$$d(p,q)=d(q,p)=\sqrt{(q1-p1)^2+(q2-p2)^2+...+(qn-pn)^2}$$

6. CONCLUSION

Techniques that effectively use most of the information from image are backbone of an efficient content based image retrieval system for medical diagnosis. In this project we will develop an image retrieval system based on various techniques for feature extraction and similarity measurement. An algorithm for Content Based Image Retrieval (CBIR) using Discrete Wavelet Transform (DWT) and Dual Tree Complex Wavelet Transform (DT-CWT) will be implemented in this project images containing any evidence of retinopathy. Here texture features will be extracted which will be later on compared with entire database to perform classification of

Retinopathy grades. We will assess the algorithm performance using Messidor database containing 300 retinal images with grades of each image marked in an excel sheet.

7. ACKNOWLEDGMENTS

First and foremost, we would like to thank our guide prof.ASHWINI KOTHAVALE for they guidance, advice, information and ideas which has help us for completing this Froth Year Project.We deeply indebted to individuals who directly or indirectly,are responsible for this project. Secondly, we are grateful to Prof. Archana Patil, HOD[EXTC] and our principal Prof. Arun kumar for giving us inspiration, timely guidance and valuable suggestions during the course of the project. Besides, we would like to thanks our other faculties' teachers of our branch electronic and telecommunication.

8. REFRENCE

[1] Gwenol´eQuellec, Mathieu Lamard, Lynda Bekri, Guy Cazuguel,´Member, IEEE, Christian Roux, Fellow member, IEEE, Beatrice Cochener: Medical case retrieval from a committee of decision trees

[2] Swati V. Sakhare&Vrushali G. Nasre .: Design of Feature Extraction in ContentBased Image Retrieval (CBIR) using Color and Texture

[3] G. Quelleca,c, M. Lamardb,c,*, G. Cazuguela,c, B. Cochenerb,c,d, C. Rouxa,caInstitut Telecom, Telecom Bretagne, UEB, Dpt ITI, Brest F-29200, France bUnivBretagne Occidentale, Brest F-29200, France cInserm, U650, IFR 148 ScInBioS,Brest F-29200, France dCHU Brest,Service d'Ophtalmologie, Brest F-29200,France.: Wavelet optimization for content-based image retrieval in medical databases.

[4] Ivan W. Selesnick, Richard G. Baraniuk, and Nick G. Kingsbury.: The Dual-TreeComplex Wavelet Transform

[5] Mathieu Lamard, Guy Cazuguel, Gw´enol´eQuellec, Lynda Bekri, Christian Roux,B´eatriceCochener.: Content Based Image Retrieval based on Wavelet Transformcoefficients distribution

[6] V.Shaj1 , K.P kaliyamurthie.2 P.G Scholar1 , Assistant Professor2 Bharath University, Chennai, Tamil nadu. Modified Qef For Diabetic Retinopathy Diagnosis--

[7] Nastar, C., March 1997. Indexation d'images par le contenu: unetat de l'art. In: CORESA'97.

[8] Rajendra Acharya U & Chua Kuang Chua & E. Y. K. Ng & Wenwei Yu & Caroline Chee "Application of Higher Order Spectra for the Identification of Diabetes Retinopathy Stages"; J Med Syst (2008) 32:481–488.

[9] AlGarni, G., Hamiane, M., October 2008. A novel technique for automatic shoeprint image retrieval. Forensic Science International 181 (1).

[10] Ryszard S. Chora´s,"Image Feature Extraction Techniques and Their Applications for CBIR and Biometrics Systems", International ,Journal of biology and biomedical engineering, Issue 1, Vol. 1, 2007

[11] 'Image processing with complex wavelets' By Nick Kingsbury Signal Processing Group, Department of Engineering, University of Cambridge, Cambridge CB2 1PZ, UK (ngk@eng.cam.ac.uk)