Automated diagnosis of ARMD

S.Sivasankari, K.Narasimhan, S.Ramya
School of Electrical and Electronics Engineering
SASTRA university, Thanjavur, Tamilnadu, India
siva.ece.ds@gmail.com
knr@ece.sastra.edu
ramya.ece.sk@gmail.com

***Abstract*— Retinal Image analysis plays the important role in identifying retinal diseases and acts as aid for ophthalmologist. One of the retinal pathology which mainly affects the elder persons is Age Related Macular Degeneration. In retinal fundus images detection and segmentation of drusen, which helps to diagnose and grade the level of the Age related macular degeneration plays the major role. In this paper, we proposed the novel approach in which we used wavelet based sub band energy as a feature vector to discriminate normal and abnormal images. We used DB3, Symlet, RBio(3.3,3.5,3.7) and we extracted the energy signature of various sub bands. Feature ranking and selection is done by using chi square test and consistency subset evaluation method. Thirteen features we used to classify the image using Support Vector Machine Classifer. We have collected the images from Vasan Eye Care Hospital, Thanjavur, Tamilnadu, India and with the guidance of ophthalmologist we have bifurcated normal and abnormal images for testing the proposed method. We obtained the accuracy of 93% with the combination of RBIO and SVM. Among the sub band energies we got high discriminatory power for diagonal and vertical sub band energies.**

Keyword- ARMD, Drusen, Features, Feature ranking, SVM classifier

I. Introduction

ARMD harms the macular area. The central vision will be lost due to macular degeneration. It is known to develop in people aged over 60.

ARMD furtherly separated,

i) Dry Macular Degeneration

ii) Wet Macular Degeneration

The causes of drusen are

i) Heredity

ii) UV light exposure

iii) Malnutrition

Drusens are classified into two types:

i) Hard drusen

ii) Soft drusen

i) Hard drusen

It does not show the way to macular degeneration. Hard drusen are yellow in color with rigidly formed borders. It is known to develop in people aged over 40.

ii) Soft drusen

Soft drusens are pale yellow in color and do not possess a rigid border. It is known to develop in people aged over 45.

In[1] texture features and higher order spectra features helps to diagnose the disease glaucoma. In[2] we get information on computational analysis of the human eye and its application points. In [3] we can get idea about fourier analysis. In [4] we could get clear view about feature selection using wavelet transforms. In[5] feature classification using wavelet transform was described. In[6] we can get mathematical idea about features and its calculation.

Figure 1: Drusen

II. PROPOSED SCHEME

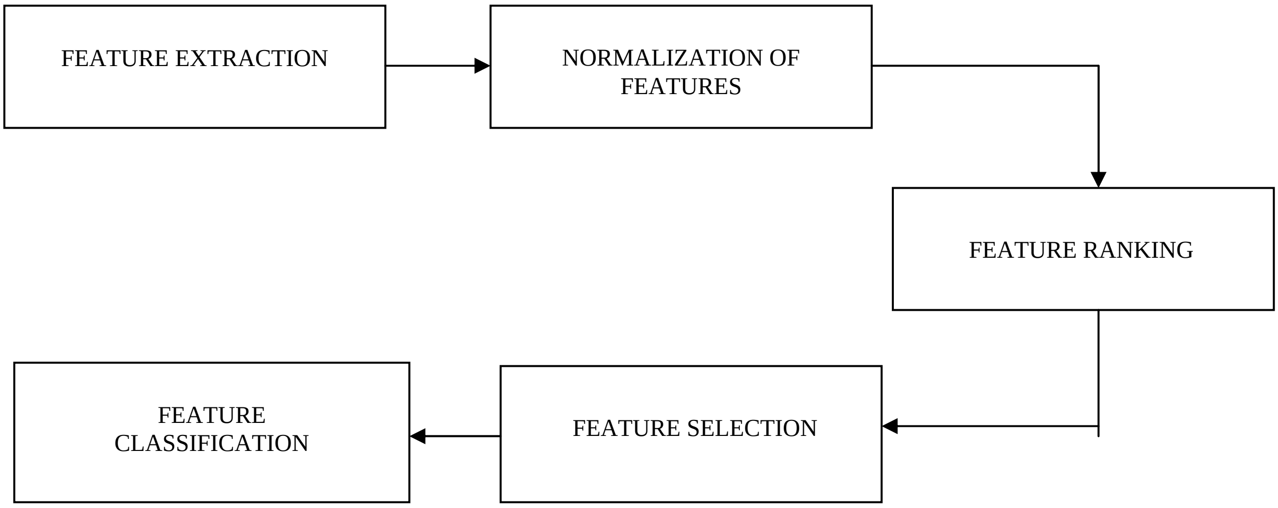

Figure 2: Flow diagram of proposed scheme

III. METHODOLOGY

A.Feature extraction

Discrete Wavelet Transform

Here we use three Discrete Wavelet Transforms. We extract energy feature values using Daubechies, Symmlets and Biorthogonal (3.3,3.5,3.7) Wavelet transform. We do get all get horizontal, vertical and diagonal co efficients of all three wavelets. After applying wavelet decomposition, we extract 13 features from these three wavelet filters. The feature equation contains all horizontal, vertical and diagonal energy values.

B. Normalization of features

Normalization is an operation which modifies the range of pixel intensity values. It is also known as Contrast sretching. In normalization of features block, intensity values of gray scale image is converted into new image which has new intensity value range.

C. Feature ranking

We rank the features by using Chi-Squared test method. In graphical representation of chi squared test x-axis indicates chi square value and y-axis indicates the number of individual experiment that got the chi-square value. We are assigning unique class and making the size of the features in rows and dimensions. Here we use degrees of freedom which is simply the number of classes of size minus 1.

D.Feature selection

We select features by using Consistency Subset Evaluation(CSE). We divide features into two subsets. In first subset we consider horizontal, vertical and average energy values of Daubechies, Symmelts and Biorthogonal(3.3) wavelet filters. In second subset we take average and energy feature values of Biorthogonal wavelet filters(3.5,3.7). We make only average values for horizontal co efficient and energy values for vertical co efficient. We neglect diagonal co efficient. Finally we select only energy features from the two subsets.

E.Feature classification

In training stage 100 images are examined and made the training matrix values. This training databases contain both drusen affected images and normal images. We assign one group which contains the values 0 and 1, where 0 indicates the drusen images and 1 indicates normal images. In testing phase, SVM classifier which compares the test images with trained data set. The compared result says whether the given image is drusen image or normal image. The value 0 is assigned for the class. If the class is 0, the message box will open and says that it is drusen image otherwise the image is normal image when the class does not belong to 0.

IV. EXPERIMENTAL RESULTS

TABLE I

Table 1 shows the energy features of three wavelet transforms

Wavelet transforms	Energy features	Normal image	Drusen image
Daubechies 3	Average	$5.3245e^{-9}$	$6.9209e^{-10}$
	Energy	1.0789	0.3478
Symmlet 2	Average	$2.7315e^{-13}$	$1.4211e^{-14}$
	Energy	2.7469	1.0093
RBio 3.3	Horizontal energy	$6.7318e^{-13}$	$5.4378e^{-17}$
	Vertical Energy	1.3469	0.4462
RBio 3.5	Horizontal Energy	$7.658e^{-12}$	$2.4586e^{-17}$
	Vertical energy	1.7348	0.2351
RBio 3.7	Horizontal energy	$2.7461e^{-15}$	$1.6149e^{-17}$
	Vertical energy	1.4876	0.1426

TABLE II

Table II shows 13 selected features using Consistency Subset Evaluation method

Energy features	9.123	1.512	1.705	3.566	8.881	1.334	2.220	2.583	0.517	2.936	4.567	0.305	2.966

V. CONCLUSION

We extracted 13 energy features from 3 wavelet filters. we also determine sum and average values for horizontal and vertical coefficients.Using these numerical values of energy features We compare tested images with the training set data using SVM classifier and give the exact nature of the given image.

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