ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 2, Issue 2, February 2015

Detection of Fundus Flavimaculatus using Fisher's linear discriminant method

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Abstract: Age-related macular degeneration occurs in "dry" and "wet" forms. It is a major cause of blindness and visual impairment in older adults.In the dry (non exudative) form, cellular debris called drusen accumulate between the retina and the choroid, and the retina can become detached. In the wet (exudative) form, which is more severe, blood vessels grow up from the choroid behind the retina, and the retina can also become detached. It can be Stargardt disease also known as fundus flavimaculatusand Stargardt macular dystrophy is the most common form of inherited juvenile macular degeneration. Inherited as an autosomal recessive trait, it is a severe form of MD that begins in late childhood, leading to legal blindness.Stargardt disease is usually diagnosed in individuals under the age of twenty, when decreased central vision is first noticed. It causes a progressive loss of central vision and, in the early stages, patients may have good visual acuity, but they may experience difficulty with reading and seeing in dim lighting. Other common symptoms of Stargardt disease include blurriness and distortion.

Index Terms: AMD, Stargardt's, Mathematical model, Eye fundus, Macula

I. INTRODUCTION

The human eye has been called the most complex organ in our body. It's amazing that something so small can have so many working parts. But when you consider how difficult the task of providing vision really is, perhaps it's no wonder after all. The eye is often compared to a camera. Each gathers light and then transforms that light into a "picture." Both also have lenses to focus the incoming light. A camera uses the film to create a picture, whereas the eye uses a specialized layer of cells, called the retina, to produce an image.

STARGARDT DISEASE, or fundus flavimaculatus, is an inherited juvenile macular degeneration that causes progressive vision loss usually to the point of legal blindness. The progression usually starts between the ages of six and twelve years old and plateaus shortly after rapid reduction in visual acuity.

The simplest method of image segmentation is called the thresholding method. This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image. The key of this method is to select the threshold value (or values when multiple-levels are selected). Several popular methods are used in industry including the maximum entropy method, Otsu's method (maximum variance), and et al. k-means clustering can also be used.

II. RELATED METHODS

[1] deals with the concept of how to differentiate the fluid filled region boundaries in optical coherence tomography images in the retina. The Optical coherence tomography (OCT) is an optical signal acquisition and processing method. It captures micrometer-resolution, three-dimensional images from within optical scattering media. Once the contours of the fluid filled regions were outlined, the quantative analysis of the surface area and volume of the fluid filled regions were performed. Therefore by increasing the segmentation method the performance can be improved and the images can be detected automatically.

In [2], the red detection of red lesion method is presented based on a hybrid approach, combining prior works by Spencer and Frame with two important new contributions. The first contribution is a new red lesion candidate detection system based on pixel classification. Using this technique, vasculature and red lesions are separated from the background of the image. After removal of the connected vasculature the remaining objects are considered possible red lesions. Second, an extensive number of new features are added to those proposed by Spencer–Frame. The purpose of the candidate classification system is to classify each of these objects as either a red lesion or a non-red lesion. And thus we can able to detect the red lesions automatically than other various other methods.

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[3] aims in detecting any changes that happens in the blood vessel and patterns that are present in the macula of the eye. This also helps in the diagnosis of retinal disease such as Age related macular degeneration and to classify its types in an efficient way. The advantage of this is to detect automatically and segment the disease age related macular degeneration in the macula without any human supervision and interaction stored in the database.

In [4], hybrid segmentation method is described for Geographic Atrophy (GA) quantification by identifying hypo-fluorescent GA regions from other interfering retinal vessel structures. Since the manual quantification of GA is time consuming and prone to inter- and intra-observer variability. Automatic quantification is important for determining disease progression and facilitating clinical diagnosis of AMD.

Ordinary histogram equalization simply uses a single histogram for an entire image. Here we are using the method called local adaptive thresholding method. Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images. This is used for denoising and compression purpose. By means of this accurate yellow deposit can be identified. But here we cannot able to differentiate the drusen which is the initial stage of the age related macular degeneration and the fundus- flavimaclatus which is the very first sign of stargardt's.

III. PROPOSED SYSTEM

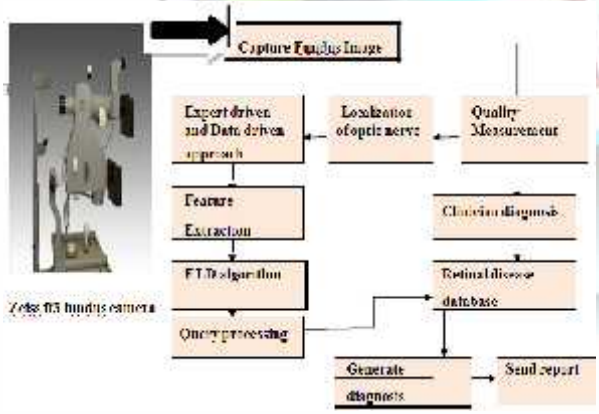

Fig.1. System view of the proposed system

The major objective of this project is to found and detect the target lesion in an instantaneous way, her we are considering the target lesions as the drusen deposit which is the initial stage of the age related macular degeneration and the Stargardt's, and to differentiate them in an unique method. The proposed method tells about the strategies by which and how the present technique is better than the previous method in the processing and the determination of the image. Some of the techniques are here which makes better improvement in our project.

Generating optimal filters is used to normalize the image samples from maximally representative image samples. The reference samples can be normalized by using this method. The optimal compression framework can be analyzed inorder to get compressed image from the normalized samples for feature extraction. Finally the Principle Component Analysis is done to the filtered images. The PCA is orthogonal linear transformation that transforms the set of reference samples into a coordinate system.

The plug-in losslessly decomposes a layer of an image into layers of wavelet scales. This means that you can edit the image on different detail scales frequencies. The trivial recomposition of the image can be done by the manipulation programming layer modes so that we can see the results of our modifications instantly. Among the applications are retouching, noise reduction, and enhancing global contrast.

An image can be transformed into a set of wavelet scales. There are detail scales and one residual. The detail scales contain the image details of a scale size. This means that scale 1 contains only image details of the smallest scale. Scale 2 details are larger and scale 3 details even larger. With wavelets we can decompose the image into scales of different detail size. To state it simply, one scale will contain the skin details like pores, other scales contain spots. This will used to reduce noise and local contrast of the image will also be done. The haar wavelet transform is applied to the image for the decomposition purpose and for analyzing the presence of the target lesions in an image in an efficient way.

IV. RESULTS AND DISCUSSION

The analysis does not include static ways of analyzing the source code of developed software and relationships between the software's building blocks. Rather, it provides valuable information about how the developed component or the whole application behaves when it runs, either in the test environment or in the final deployment environment. And this activity is designed to provide explanations for various exposed or potential misbehaviors.

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TABLE I
ANALYSING THE PERFORMANCE

Disease	No of Samples	Algorithm			
		Mathemat-ical Model	%	Fast Lesion Detection	%
Age Related MD	30	22	73.33	25	83.333
Stargardt's	25	-	0.000	22	88.000

The above table shows the performance analyzed for detecting the fundus disease, based on two approach such as, Mathematical modeling and Fast Lesion Detection Algorithm, Here we processed a total of 55 image samples (30 for AMD and 25 for Stargardt's). and after processing we get highest performance percentage by means of Fast Lesion Detection Algorithm.

Profiling is a way to measure where a program spends time. To assist you in profiling, MATLAB provides a graphical user interface, called the Profiler, which is based on the results returned by the profile function. Once you identify which functions are consuming the most time, you can determine why you are calling them and look for ways to minimize their use and thus improve performance. It is often helpful to decide whether the number of times a particular function is called is reasonable. Because programs often have several layers, your code may not explicitly call the most time-consuming functions. Rather, functions within your code might be calling other time-consuming functions that can be several layers down in the code. In this case it is important to determine which of your functions are responsible for such calls.

Profiling helps to uncover performance problems that you can solve by

- Avoiding unnecessary computation, which can arise from oversight
- Changing your algorithm to avoid costly functions
- Avoiding recomputation by storing results for future use

The profiler analysis for our project is shown as follows, Fig.2. shows the profiler analysis for the implemented code, and here the Profile Summary report presents statistics about the overall execution of the function

Function Name — A list of all the functions and subfunctions called by the profiled function. When first displayed, the functions are listed in order by the amount of time they took to process.

Calls — The number of times the function was called while profiling was on.

Total Time — The total time spent in a function, including all child functions called, in seconds. The time for a function includes time spent on child functions. Note that the Profiler itself uses some time, which is included in the results. Also note that total time can be zero for files whose running time was inconsequential.

Self Time — The total time spent in a function, not including time for any child functions called, in seconds.

Total Time Plot — Graphic display showing self time compared to total time.

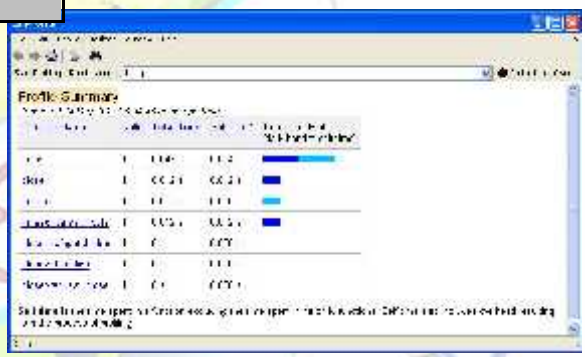

Fig.2.The profiler analysis for implemented code

V. CONCLUSION

Age-related macular degeneration occurs in "dry" and "wet" forms. It is a major cause of blindness and visual impairment in older adults.In the dry (non exudative) form, cellular debris called drusen accumulate between the retina and the choroid, and the retina can become detached. In the wet (exudative) form, which is more severe, blood vessels grow up from the choroid behind the retina, and the retina can also become detached. It can be Stargardt disease also known as fundus flavimaculatusand Stargardt macular dystrophy is the most common form of inherited juvenile macular degeneration. Inherited as an autosomal recessive trait, it is a severe form of MD that begins in late childhood, leading to legal blindness.

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