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Identification of Stargardt Disease by Comparing with the Healthy Eye

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Abstract: ***Stargardt's disease / Fundus Flavimaculatus (STGD/FF) is a yellow-white spot forms on the outer layer of retina. Which affects RPE Cells (Retinal Pigment Epithelium). Photoreceptor digesion-when light falls on photoreceptor cells it convert light signal into bio-signals. During the conversion process chemical reaction takes places and release bi-product which is called as lipofuscin. The microscopic structure of fundus shows the accumulation of lipofuscin on RPE Cells. RPE Cells are basically vision cells present on the outer layer of the retina. FAF, OCT and AOSLO are the methods to evaluate cone and RPE cell structure in patients with STGD/FF. But using this techniques fundus can be identified only at advanced stage. At this stage the possibility of vision loss is high. So it's hard to rectify .But by comparing unaffected eye with affected eye using straight edge detection method. In Lab view Software, vision acquisition and vision development module used it is possible to find in initial stage. If the fundus are identified at early stage the patient can be easily rescued from vision loss. Advanced Cell Technology (ACT) is conducting human studies of a retinal degenerative disease treatment derived from human stem cells by placing healthy RPE cells in the retina, researchers believe that they can avoid vision loss at initial stage.***
Keywords: RPE cells, fundus photography, macular degeneration, lipso-fusion.

I. INTRODUCTION

Stargardt disease / Fundus Flavimaculatus (STGD/FF) is a yellow-white spot forms on the outer layer of retina which affects RPE Cells(Retinal Pigment Epithelium) RPE Cells are basically vision cells present on the outer layer of the retina. The microscopic structure of fundus shows the accumulation of lipofuscin on RPE Cells. Lipofuscin (lipid containing fluorophoric) is toxic in nature and it is the bi-product of photoreceptor digestion. Photoreceptor digestion when light falls on photoreceptor cells it convert light signal into bio-signals. During the conversion process chemical reaction takes places and release bi-product which is called as lipofuscin. Accumulation of lipofuscion increase vision loss. Fundus photography is a highly specialized form of medical imaging. Taken by fundus camera operated by ophthalmologists, retinal fundus images (retinal image hereafter) are important means to document the health of the optic nerve, vitreous, macula, retina and its blood vessels. Ophthalmologists can make use of the fundus photographs to diagnose eye diseases.

Figure 1 shows examples of retinal images of a healthy eye, a glaucomatous eye and an eye with age-related macular degeneration

II. STARGARDT DISEASE

Stargardt disease is characterized by progressive loss in central vision and bilateral atrophic- appearing changes surrounded by yellowish-white fundus lesions at the level of the retinal pigment epithelial layer. It has been suggested that the mutations in the ABCA4 gene coding for a retinal rod-specific ABC protein are responsible for Stargardt disease. It is the most common form of inherited juvenile macular degeneration.

Also involved in Stargardt disease is a region beneath the macula called the retinal pigment epithelium.. The symptom that brings

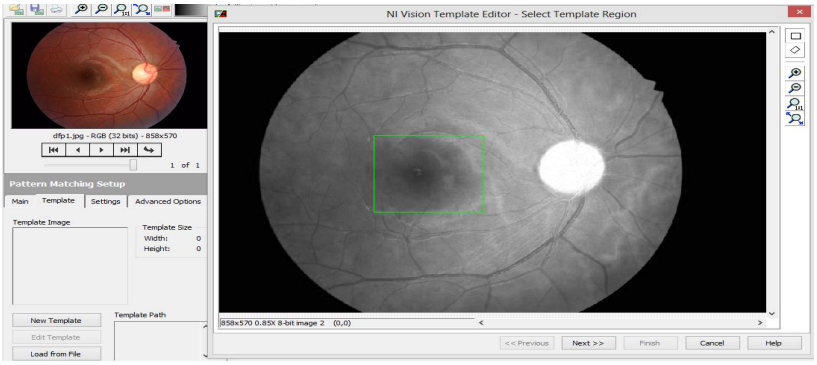
most people to an eye doctor is a change in central vision. The flecks might extend outward in a ring-like fashion. The flecks are deposits of lipofuscin, a fatty byproduct of normal cell activity. In Stargardt disease, lipofuscin accumulates abnormally. The progression of symptoms in Stargardt disease is variable. Visual acuity (the ability to distinguish details and shape) may decrease slowly at first, accelerate, and then level off. A study of 95 people with Stargardt disease showed that once a visual acuity of 20/40 is reached. Additional vision loss until it reaches 20/200. By age 50, approximately 50 percent of people in the study had visual acuities of 20/200 or worse. Eventually, almost everyone with Stargardt disease has a visual acuity in the range of 20/200 to 20/400. The vision loss is not correctable with prescription eyeglasses, contact lenses, or refractive surgery.

III. ROLE OF IMAGING IN PREDICTING OUTCOME IN STARGARDT DISEASE

The image survey has been taken to collect the original fundus images of patients. ORIGA-light is available for online access upon request. Currently, ORIGA-light contains 650 retinal images annotated by trained professionals from Singapore Eye Research Institute. A wide collection of image signs, critical for glaucoma diagnosis, are annotated. Retinal fundus image is an important modality to document the health of the retina and is widely used to diagnose ocular diseases such as glaucoma, diabetic retinopathy and age-related macular degeneration. In this paper we present an online depository, ORIGA-light, which aims to share clinical ground truth retinal images with the public; provide open access for researchers to benchmark their computer-aided segmentation algorithms. An in-house image segmentation and grading tool is developed to facilitate the construction of ORIGA-light.

IV. ACQUIRING IMAGES USING IMAQ TOOLS

ROI or region of interest is used to select the important area of an image for processing. ROI can be used to greatly reduce image processing time. Recall that lab view currently supports rectangular images this means that image data must be stored in 2D array/matrix form. steps to implements the ROI constructor, the steps are open attached file then change the path to preset image in the block diagram and run VI .select ROI in the dialog shown with any of the tools click ok .Finally see the result in image control panel.



. Fig 2 Extraction of image using ROI descriptor

A. Overlay Points

The overlay VI is a simple shell to contain the actual commands which draw the smiley face onto the source image. Overlay.VI handles opening the source file, reading needed configuration information from it, writing the result, and then closing the file container. It also showcases a few simple design ideas for working with the overlay functions. Depending on the context of your program, it is often useful to use a sequence to properly order the processing. The VI also shows a critical step in working with overlay functions. Lab view stores Image data (actual pixels) and overlay data as separate entities within a program.

B. Edge Detection

Edge detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction. Use the Edge Tool to find edges or sharp transitions in the pixels values along a given line or ROI profile. The edges extracted from a two-dimensional image of a three-dimensional scene can be classified as either viewpoint dependent or viewpoint independent. A viewpoint independent

edge typically reflects inherent properties of the three-dimensional objects, such as surface markings and surface shape.

V. RESULTS AND DISCUSSIONS

The simulation output of lab view using edge detection technique is used to compare the intensity amplitude level of healthy eye with the eye affected by stargardt disease .Figure 4 shows the prediction of retinal behavior of healthy eye and Figure 5 shows the prediction of fundus flavimaculatus for affected eye . By comparing the graph of healthy eye with the different stages of affected eye we can able to predict the fundus at initial stage. Simultaneously the doctors can view the result in his pc with the help of web publishing tool in lab view. Similarly this feature can be enhanced with the additional GSM module so that patients can receive messages with the help of this module.

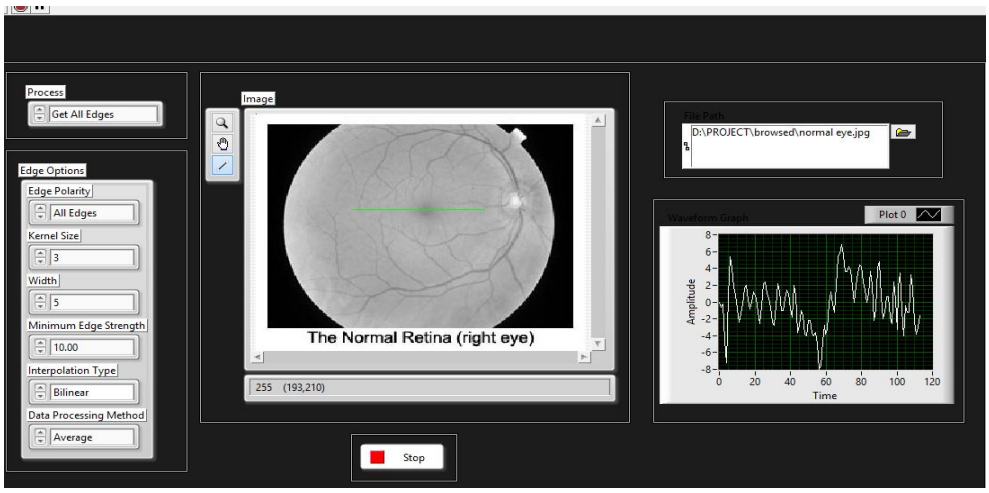


Figure 4 Prediction of retinal behavior for healthy eye

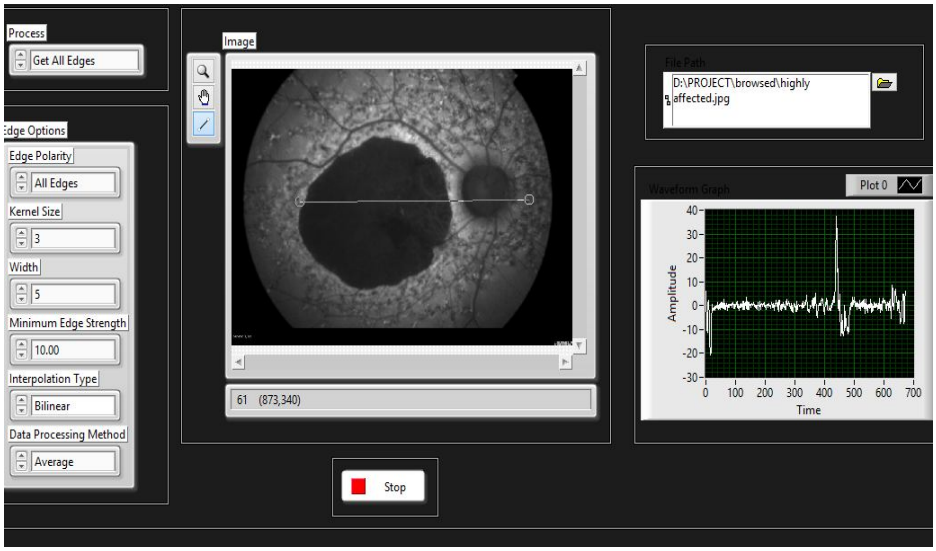


Figure 5 Prediction of fundus flavimaculatus for affected eye

Researchers has been found that by finding stargardt's disease at initial stage would provide huge scope for halting the causes. The finding process described in this paper. Even at far cases, Fundus fluorescence method is very much welcomed by researchers. The treatment is being developed by Oxford Biomedical, a biopharmaceutical company in the U.K. which also has gene therapy products for wet age-related macular degeneration (AMD) and Usher syndrome in clinical development. Advanced Cell Technology (ACT) is conducting human studies of a retinal degenerative disease treatment derived from human stem cells. The Phase I/ II clinical trials are evaluating the treatment in people with Stargardt disease and dry AMD. Early results are encouraging thus far;

vision improvements have been reported for some participants. The studies are taking place at multiple sites in the U.S. By placing healthy RPE cells in the retina, researchers believe they can save photoreceptors and slow or halt vision loss. The Foundation Fighting Blindness Clinical Research Institute is launching a natural history study of people affected by Stargardt disease. Known as ProgSTAR, this study has three primary goals: 1) Determine the best outcome measures to accelerate evaluation of emerging treatments, 2) Better understand disease progression for selecting future clinical trial participants, and 3) Identify potential participants for forthcoming clinical trials. It is giving $2 million to MitoChem Therapeutics, a start-up company which, thanks to prior Foundation support, has identified compounds that appear to boost mitochondrial function and show potential for significantly slowing vision loss caused by a variety of retinal degenerations.

. VI. CONCLUSION

Vision Development module is a useful tool for the identification and follow-up of lesions associated with lipofuscin accumulation or RPE cell loss. As such, imaging the advanced or initial stage fundus may yield important additional information in a diagnostic setting in relatively frequent retinal dystrophies such as STGD1, BVMD and in retinal dystrophies associated with periphery/RDS mutations. It may visualize more lesions compared to ophthalmoscopy. Comparison of intensity to initial and advanced stage of stargardt's disease:

Normal stage	Initial stage	Second stage	Advanced stage
2.4	-14.6	-6.8	10
1.8	-26.8	-6.8	13.6
0.8	-10	-6.8	11
-0.2	18.8	-6.8	6.8
- 0.6	-5.2	-6.8	0.4
-0.6	-29	-6.8	-4.8
0	-12.4	-6.8	-7
0.4	1.8	-6.8	-10.2

The parameters which are exported from plot to numbers will signify the variation and determines the affected eye. Last stages with RPE cell loss may look similar in various retinal dystrophies and in other retinal disorders such as age-related macular degeneration. In this respect, FAF may be of limited use in the differential diagnosis between different forms of retinal dystrophy. Molecular genetic testing may be very helpful in these cases. Compared to fluorescein angiography, this process is reliable, as a non-invasive imaging modality, is a straightforward and relatively patient-friendly means to get an overview of the accumulation of fluorophores like lipofuscin and atrophic changes within the RPE-photoreceptor complex. Therefore, comparison process may constitute a convenient tool for cross-sectional and family studies, as well as in the follow-up of various retinal dystrophies. In addition, it may also play a role as a parameter for the evaluation of therapeutic effects in future clinical treatment trials.

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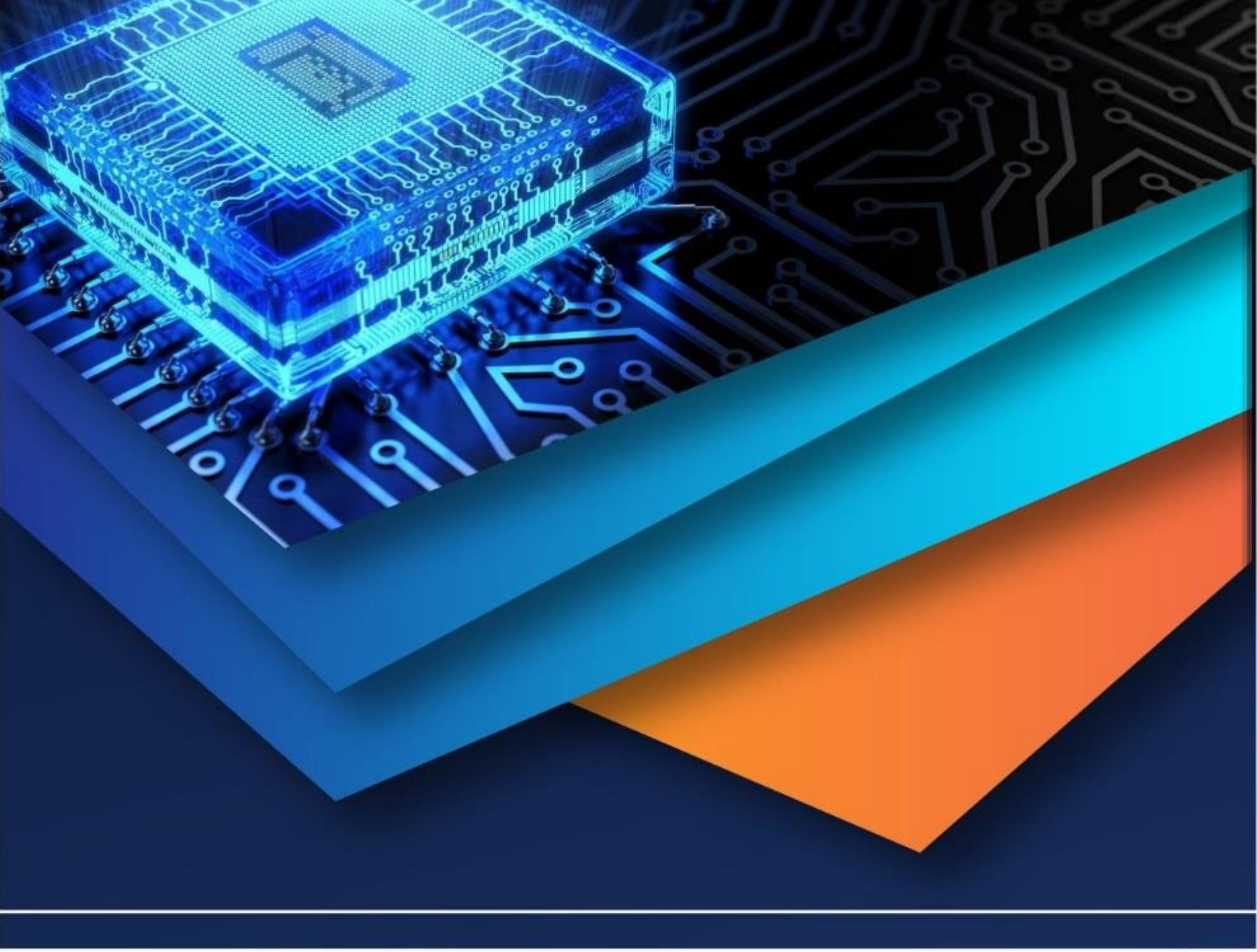

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