Retinal Color Fundus Data Base Evaluation for Various Eye Diseases

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Abstract: The design and development of computer-aided diagnosis for eye deceases are becoming very vital and necessary and is an active research area in biomedical image processing. The quality as well as performance analysis of fundus depends on testing image by the application of predefined techniques. For this reason a deep knowledge of various database and its construction for different eye deceases are necessary and will facilitate to develop pre processing methods. This paper is intended to provide an over view of various retinal fundus image databases. Since number of researchers uses different databases for eye deceases to execute their ideas, however, there are no unique databases available to evaluate the program for different eye deceases on fundus image. This paper, presents the details and collective discussion on ten fundus data base for types of deceases and images particularly for certain image processing techniques. This paper will provide insight view of quality, camera used to capture images, based on particular eye diseases

Keywords; Fundus database; A/V Ratio; Moderate glaucoma; Ocular hypertension OHT

I. INTRODUCTION

Eye is the most important and very sensitive organ in the human body. Several diseases suffers eye of all age group from infant to old age, as age increases these diseases are becoming very common and difficult to diagnose and requires more analysis and resources to solve the problem. People with diabetes and any other serious diseases will suffer from eye related problems more quickly. The retinal eye diseases become easy to handle if it is treated in the initial stage. In modern day treatment applies new technique and methods to diagnose the problem, for this a data base is to be maintained which contains information about the eye diseases and color or gray scale images called as fundus image. Fundus image are captured by the special camera called as fundus camera, which is specially designed to capture the rear side of the eye ball, means it provides complete eye ball image. The captured images are of different qualities which depend on the quality of the camera used. These captured images forms a group on images called as data base. In general the data base contains the image of same or different quality and size. Also the data bases are divided by the certain eye diseases. The data base can also contain retinal eye images of the healthy eye so it can be compared with the diseased eye images. There are many data base or also called as data set which is specially built for fundus images.

Figure1: Normal or Healthy fundus images

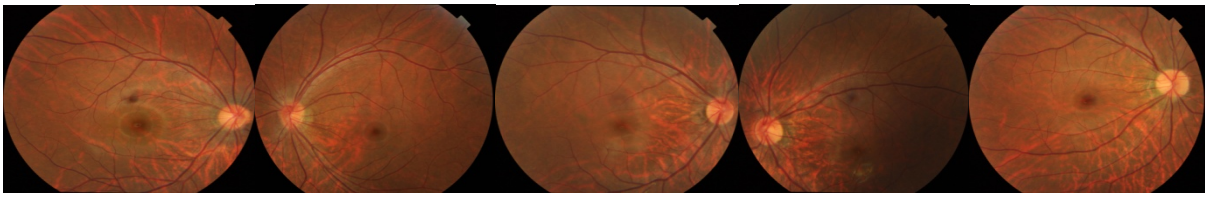


Figure 2: Tessellated fundus images

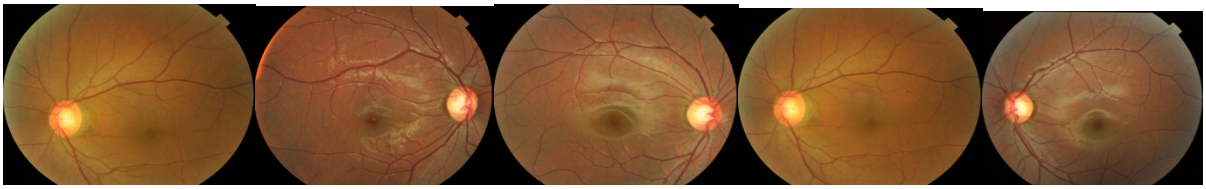


Figure 3: Large optic cup fundus images

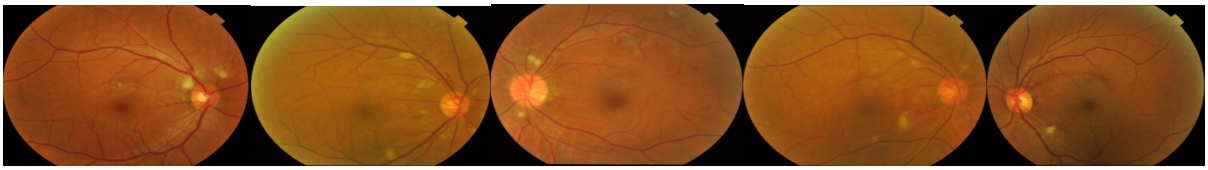


Figure 4: Cotton-wool spots fundus images

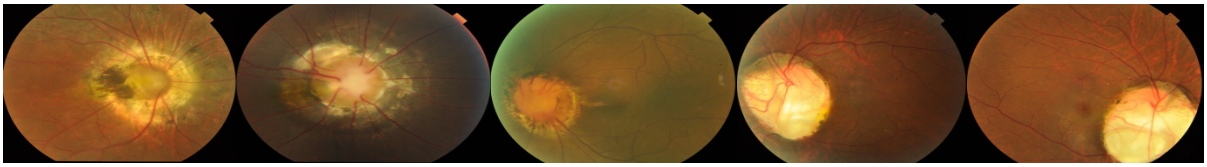


Figure 5: Congenital disc abnormality images

II. EVALUATION OF DATA BASE

2.1 RIM-ONE data base: Glaucoma Image Database: The RIM-ONE is the retinal fundus images data base which is developed for segmentation of optic nerve head using algorithms. RIM-ONE focus only on ONH segmentation, the data set contains high-density 169 photographs also 5 pairs of reference segment images. Gold standard dataset is of 169 ONH photographs acquired by 169 photographs from full retinal of different subjects and classified as: - 11 Ocular hypertension OHT, 118 Normal eye, 14 Moderate glaucoma, 14 Deep glaucoma, 12 Early glaucoma pictures

2.2 FIRE: "Fundus Image Registration Dataset" Totally 134 pairs photographs also with 129 fundus pictures forms the data base. Next divided into three types depends on image properties. Nidek AFC-210 series fundus camera is used , with pixel density 2912 x 2912 picture element with fov 45° in x axis and y axis, captured from 39 subjects. Further images arranged in pairs.

2.3 STARE- **"**Structured Analysis of the Retina" The complete data set consist approximately 400 raw images. These images are set to view 100 images at a time. For Optic nerve detection the Artery/vein labeling is done for 10 pictures and ground truth of 80 pictures. Further the dataset contains 20 eye fundus images with 700 x 605 pixels with two sets of ground-truth vessel. 35-deg FOV is used with Topcon TRV-50 fundus camera

2.4 VICAVR database: if in an analysis A/V Ratio is needed then VICAVR database is used. It provides data to calculate or to compute A/V Ratio. The DB is of 58 raw photographs. TopCon non-mydriatic camera is applied for capturing images with model NW-100.Optic disc centered with 768x584pixels resolution. major analysis is for type (artery/vein) labeling also caliber of the blood vessels measuring from angular radius of optic disc and vessel

2.5 OCTAGON dataset: Angiography by Optical Coherence Tomography OCT-A is the technique mainly applied for segmentation of Fovea (FAZ). 144 healthy OCT-A images of first dataset and second data set of 69 diabetic OCT-A pictures, further allocated into 4 groups of 36 and 17 pictures. Different age groups are considered for collection of data as six ranges, each with 3 subjects of left and right eye: 10-19 age group, 20-29 age, 30-39 age,

40-49 age, 50-59 age and 60-69 age group. 3x3 deep image, 6x6 superficial image, 3x3 superficial image, 6x6 deep of one each with selecting at least one eye

2.6 CLOUD dataset: is for automated identify and represent data set for cornea-contact lens relationship using optical coherence tomography anterior segment images (AS-OCT). 112 AS-OCT photographs took from 16 subjects. An scanner model OCT Cirrus 500 series Carl Zeiss Meditec is applied to get photos, anterior segment module were used to obtain sclera contact lens (SCL) images .

2.7 DRISHTI-GS: Is a optic nerve head (ONH) segmentation data base totally of 101 images. further divided as 51 testing images, 50 training, Ground truth, with center upon OD with 30^0 fov with resolution 2896 _ 1944 pels with uncompressed PNG format.

*2.8 Chase data base***:** 28 retinal fundus photographs of HD resolution 1280 x 960 picture element are available. 2 pair's ground-truth vessel annotations are included in data base, Training and testing allowing one set pair. "Human" baseline for second set, 8 fundus images are for training and 20 for testing.

*2.9 Kaggle data base***:** The data set consists of 1000 fundus images which belong to 39 groups belongs to Joint Shantou International Eye Centre (JSIEC). These images are the part of total 209,494 fundus images which are used for training and testing.

*2.10 The RITE "Retinal Images vessel Tree Extraction***"** is of 40 set images a vessel reference standard, and Arteries/Veins (A/V) reference standard, The two sets training and test gives two subsets each set consists of fundus photograph and labeled using four colour based vessel reference standard, red for Arteries labeling, blue fro veins labeling, green for labeling overlapping of arteries and veins, white for uncertain areas and formatted as tiff for fundus photograph, png for vessel reference as well as A/V reference standard.

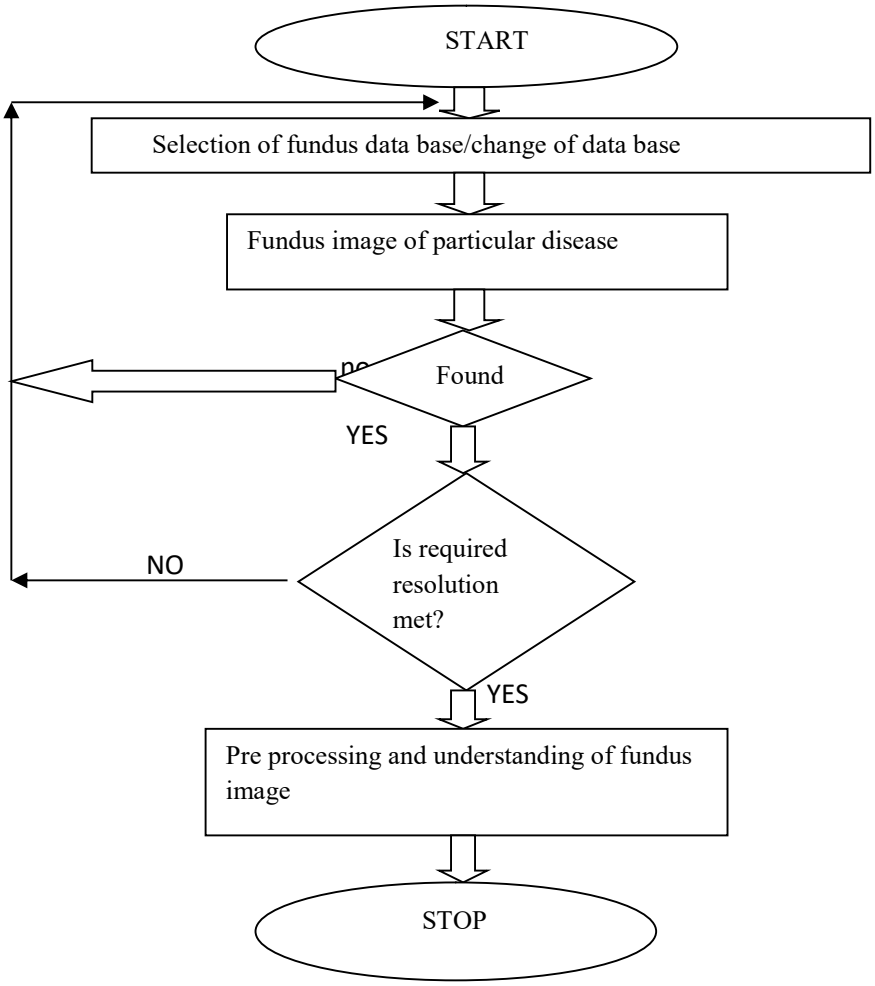
III. DATA BASE SELECTION METHOD

Flow chart for selection of fundus data base

The selection of data base plays a major role in retinal fundus image processing. Most of the data base which are publically available are of open source, means it's of free cost and downloadable. And some of the data base will have access to only registered users and some data base will charge to download. The data base contains fundus image of the retina in two forms, it may be of gray scale or color fundus images. These images are captured using special camera called as fundus camera. Many manufactures supplies fundus camera with various resolution and characteristics.

Fundus generally refers to the complete picture of the eye ball, which includes the front position as well as the rear position of the eye ball. The fundus are captured with pre defined angle called FOV-field of view, once the image is captured it will be stored in digital form in the computer memory.

The first and foremost step in fundus image selection is to check whether the data base contains the required image of the problem under consideration like images belongs to particular disease like Age-Related-Macular-Degeneration, Cataract, DR, types of Glaucoma, Conjunctivitis (Pink-Eye), Uveitis, Eye Allergies, Keratoconus, Corneal Ulcer etc. if not, change the data base.



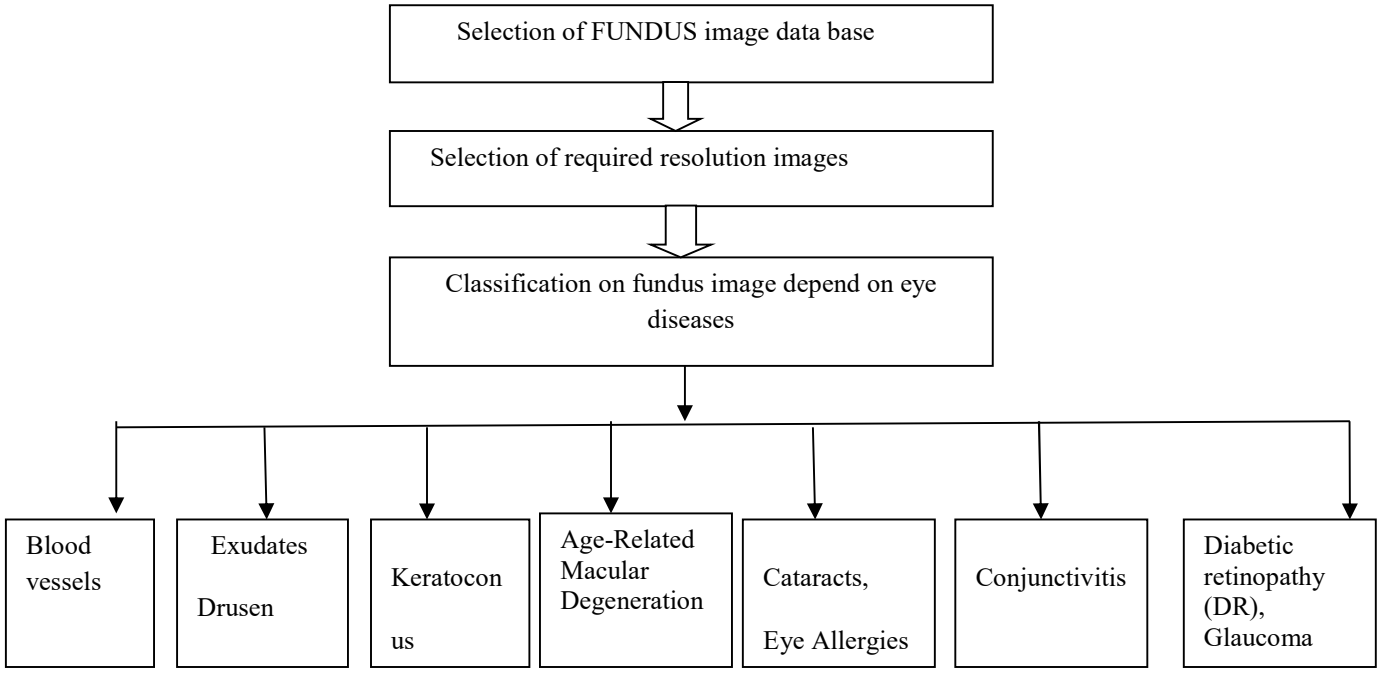
IV. DETAILS OF VARIOUS DATA BASE

SL. NO	Data Base	Camera	Total Images	Image Resolution	Diseases
01	RIM-ONE data base	----------	169 ONH images	high-resolution	Glaucoma
02	FIRE: Fundus Image Registration Dataset	using Nidek AFC-210 fundus camera	129 fundus images and totally 134 pairs of images	2912x2912 pixels	Image registration
03	STARE DB	Top-Con series TRV-50 fov 35^0 fundus camera	400 raw photographs	700 x 605 pixles	Optic nerve detection

04	VICAVR database	Top Con series NW-100 FC	58 raw images	768x584	blood vessels
05	OCTAGON dataset	----------	144-OCT-A normal healthy and 69 DR OCT-A images	high-resolution	Fovea Avascular Zone (FAZ)
06	CLOUD dataset:	OCT 500 Cirrus scanner	112 AS-OCT images	high-resolution	cornea-contact lens relationship
07	DRISHTI-GS		101 images	2896 _ 1944 pixels	optic nerve head
08	Chase data base:	----------	28 retinal fundus images	1280 x 960 pixels	Training and testing
09	Kaggle data base	----------	1000 fundus images which belong to 39 groups, 209,494 fundus images	high-resolution	All diseases
10	The RITE (Retinal Images vessel Tree Extraction)	----------	40 sets of fundus images	high-resolution	Blood vessel

All most all data base will have separate categories for different types of fundus images. Once the image is found the next step is to check for the required resolution, some data base will contain high resolution images and some will have low resolution images. According to the requirement these images are selected.

V. CLASSIFICATION OF FUNDUS IMAGE DEPENDING ON VARIOUS DISEASES



The various data base provides fundus images for image processing techniques; the different data base contains fundus images for different resolution and depending on other image characteristics. The data bases contains random amount of images.

VI. CONCLUSION

It has been examined that the data base with more fundus images provides more information and it is easier to select the images, since data base contains more images the researcher can select more images for analysis and process. Many of the data base contains images for more than one disease. It is strongly recommended that the researcher to select the data base which contains more number of images like Messidor data set, STARE data set, Kaggle etc. as possible.

VII. FUTURE SCOPE

For the purpose of combined and collective data to be available in a single plat form, different data base is to combine based on the characteristics of the fundus images like size, resolution, camera applied, FOV and other parameter, we strongly defend to construct single data set for advancement of bio medical image processing .and it is required to be free and in open source. Further an efficient tool can be built for sorting of fundus images depending on the image characteristics

REFERENCES

[1] **RIM-ONE: An Open Retinal Image Database for Optic Nerve Evaluation** F. Fumero1, S. Alayon1, J.L. Sanchez1, J. Sigut1, M. Gonzalez-Hernandez2 *1Dept. of Systems Engineering, University of La Laguna 2Dept. of Ophthalmology, Hospital Universitario de Canarias,http;//* rimone.isaatc.ull.es *franfumero@isaatc.ull.es*

[2] FIRE:Fundus Image Registration Dataset C. Hernandez-Matas, X. Zabulis, A. Triantafyllou, P. Anyfanti, S. Douma,A. A.Argyros Journal for Modeling in Ophthalmology, vol. 1, no. 4, pp. 16-28, Jul. 2017. https://projects.ics.forth.gr/cvrl/rempe/ https://carlos.hernandez.im

[3] A. Hoover,et.al paper title "Locating Blood Vessels in Retinal Images by Piece-wise Threhsold Probing of a Matched Filter Response", *IEEE Transactions on Medical Imaging* , vol. 19 no. 3, pp. 203-210, March 2000.

[4] M. Ortega, N. Barreira, J. Novo, et.al, "SIRIUS: A Web-based system for retinal image analysis", International Journal of Medical Informatics , 79(10), 722-732, 2010. macarena.diaz1@udc.es

[5] Cabaleiro, P.; and others --Automatic Identification and Representation of the Cornea–Contact Lens Relationship Using AS-OCT Images, Sensors, 19, 5087, 2019.

[6] DRISHTI-GS:retinal image data set for optic nerve head –ONH Segmentation Jayanthi Sivaswamyy S.R. Krishnadas, Gopal Dutt Joshiy Madhulika Jainy Ujjwaly Syed Tabish A.y y IIIT, Hyderabad, India, Arvind Eye Hospital, Madurai, India

[7] Zhang, J., Dashtbozorg, B. et.al (2016)" Robust retinal vessel segmentation via locally adaptive derivative frames in orientation scores". IEEE Transactions on Medical Imaging, 35(12), pp.2631-2644.

[8] https://www.kaggle.com/linchundan/fundusimage1000

[9] Hu Q, Abràmoff MD, Garvin MK. paper title "Automated separation of binary overlapping trees in low-contrast color retinal images". Med Image Comput Comput Assist Interv. 2013;16(Pt 2):436-43. PubMed PMID: 24579170

[10] S. G. Vázquez, N. B and others--Improvements in Retinal Vessel Clustering Techniques:Towards the Automatic Computation of the Arterio Venous Ratio", Computing, Archives for Scientific Computing", 90 (3), 197-217, 2010. [12] https://projects.ics.forth.gr/cvrl/fire/