

Early detection of eye disease in humans using Random Forest & HOG concepts

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Received Date: 09 March 2020

Revised Date: 18 April 2020

Accepted Date: 20 April 2020

Abstract: In this paper, a brief introduction to early detection of eye disease in humans using Random Forest & HOG concepts. The result is the outcome of the Post-Graduate project work of the student that will be carried out in the second year of the course & this work is just the synopsis that is being framed for the carrying out of the detection of glaucoma disease. A glaucoma is a group of eye diseases that cause damage to the optic nerve, causing the successive narrowing of the visual field in affected patients due to increased intraocular pressure, which can lead the patient, at an advanced stage, to blindness without clinical reversal. As we have heard and seen from generations across, glaucoma has been and is still one of the leading diseases that permanently damage if untreated. As per the current research, it says that 79Million are affected BY 2020, which are untreated. To make it easy for us humans, early detection is one of the best ways to create awareness and treat the diseased. After having gone through the majority of the literature, have seen that when LBP is given to HOG has accurate results for better feature extraction than other methods; also application of Cuckoo search (CS) algorithm, Random forest (for classifying), and Conventional Neural Network (for segmentation) have better outcome compared to the previously used hybrid algorithm methods to detect the diseased from the normal eye. So, to achieve this, I will be using the Matlab tool to produce more accurate results than any other platform. In one of the papers, the LBP algorithm has been extensively used to obtain the desired results, but when learned about HOG, it looked as if it has better properties to enhance the required results when combined with LBP. CS is another unique method to analyze an aggregation of the image texture.

Keywords — Glaucoma, HOG, Random Forest, Matlab, Simulation

I. INTRODUCTION

Many factors cause glaucoma; some of them are unknown, the biggest factor is intraocular pressure in

the eye. This single factor can be treated and controlled. It is one of the most severe eye diseases according to the number of blindness causes in India and western countries. Therefore, the early detection, long-term monitoring of the patients, and the appropriate therapy decision at the correct time are serious tasks for the ophthalmologist. This earlier detection of deadly diseases has been proposed using advanced image processing, analysis, and recognition techniques.



Figure 1. Progressive visual loss caused by glaucoma. (a) Normal vision. (b) As glaucoma advances, the field of vision of a patient slowly narrows. (c) Advanced glaucoma without proper treatment leads to substantial vision loss and blindness if left untreated.

II. THE DEVELOPED METHODOLOGY

The proposed methodology that is going to be used in our project work is presented in this section. The proposed methodology adopted in the present project work is depicted in Fig. 4 in a very highly abstracted manner with various blocks numbered as 1 through 7, which are explained as follows.

1. Block 1 gives the data samples collected from various hospitals, including normal and diseased eye image samples.
2. Block 2 gives the information about pre-processing where the image involves normalizing the image where the purpose of analysis and increasing the overall performance of the system have used general procedure, which helps emphasize removing the irrelevant sections from the images.



3. Block 3 gives the information about segmentation as it is a process of partitioning a digital image into multiple individual segments to ease the analysis of the image, which is done using Convolutional Neural Networks (CNN). Here the objects and the image boundaries can be located easily. CNN segmentation is a task to remove the effects of eyelids to get a better view of ROI.
4. Block 4 gives the information about image normalization and enhancement where, after all the previous processes, we have to remove noises and again enhance the image texture, quality, and clarity for further blocks.
5. Block 5 gives the information about feature extraction Random Forest (RF); here, the forest of trees splitting with oblique hyperplanes can gain accuracy as they grow without suffering from overtraining, as long as the forests are randomly restricted to be sensitive to only selected feature dimensions.
6. Block 6 gives the information about the concept used to classify and optimize the retina part's extracted features into normal & diseased cases. In our proposed methodology of classification & optimization, the Cuckoo Search (CS) type of classifiers have been used to obtain a better accuracy of the diseased retina (Glaucoma) recognition system.

III. TYPES OF GLAUCOMAS

Normal-Tension Glaucoma: It is also called low tension or normal-pressure glaucoma. It is a form of glaucoma in which damage occurs to the optic nerve without eye pressure exceeding the normal range (10-20mmHg).

Congenital Glaucoma: This type of glaucoma occurs in babies when there is an incorrect or incomplete development of the eye's drainage canals during the parental period. This is a rare condition that may be inherited. It is also referred to as childhood glaucoma, pediatric or infantile glaucoma. It is usually diagnosed within the first year of a baby's life.

Primary Glaucoma: Primary glaucoma is mainly due to an increase in Intra Ocular Pressure (IOP). The regions affected are the Optic cup, Optic Nerve Head, Neuro retinal Rim, and Retinal Nerve Fiber Layer.

Secondary Glaucoma: Secondary glaucoma (SG) arises due to certain complicated conditions like serious eye injury, tumor, diabetes. Neo-vascular glaucoma is a type of secondary glaucoma which is a resultant of Diabetic Retinopathy.

Neo-vascular glaucoma: Neo-vascular glaucoma is caused by the abnormal formation of new blood vessels on the iris and over the eye's drainage

channels. Neo-vascular glaucoma is always associated with diabetes. It never occurs on its own. The new blood vessels block the eye's fluid from exiting through the trabecular meshwork, causing an increase in eye pressure.

IV. DATA FLOW DIAGRAM FOR GLAUCOMA DETECTION IN HUMAN EYES

The data flow diagram shown in the figure is used to detect glaucoma in the human eyes.

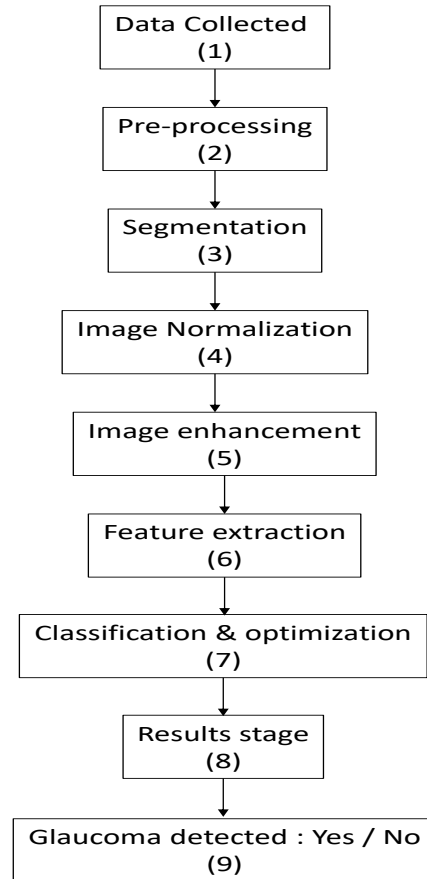


Figure 2. Block-diagram of the proposed methodology

V. POSSIBLE OUTCOME OF THE EXPECTED RESULTS OF SIMULATION

The possible outcome of this project work has to be presented in this section. The expected results or the outcome of the project work could be summarized as follows -

- To detect Glaucomatic eyes in their early stages for better treatment.
- Also, it can be used shortly for creating an automatic system for better identification of the diseased eyes.

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He has got teaching (academic), research & administrative experience of nearly **32⁺ years** in various engineering colleges countrywide (Karnataka, Gujarat, Maharashtra) and spent his entire career after graduation in the field of academics only. He has worked in the levels of **Lecturer-Asst. Prof.** (≈19⁺ yrs), **PG Coordinator**, **Prof-i/c HOD-Prof. & Head** (≈6⁺ yrs), **Director-Research**, i/c **Principal & as Full-time Principal** (≈7 yrs) in various institutions where he has worked so far across the country. Currently, he is working as **Professor & Head of the Dept. of Electronics & Communication Engineering** of the renowned 40-year-old Dayananda Sagar Group's '**Dayananda Sagar College of Engineering** Bengaluru, Karnataka, India, for **4 years** (approx). He has also worked as a **Project Assistant** and as a **Research Engineer in Systems and Control Engineering (IIT Bombay, India)** and worked on vibration control of space launch vehicles in **IITB** during his research tenure for nearly one year of central government assistantship program.

He has published a large number of papers in various National, International Journals and Conferences in India & abroad and published more than a **dozen textbooks** with editions, notable among them being ('**Introduction to robotics**' - 1st edition, '**Fast Track to Robotics**' - 4th Edn., '**Fundamentals of Robotics**' in 2 volumes, Vol-1 and Vol-2 along with a CD which contains about 200 C / C++ programs for performing various simulations on robotics – 5th edition, '**Examination Security System - Design & Development of Examination Mechanism Using Electronic Box**' from Germany costing around **49 Euros**, '**Microcontroller & Applications Theory**'-1st Edn, '**Basic Electronics**'-1st Edn). He has also published a number of **book chapters** in various edited books from renowned publishers (20 nos). He has also published a **research monograph** in the International level from the Springer-Verlag publishers (Europe) on the topic titled, '**Modeling, Control & Implementation of Smart Structures**', Vol. 350, LNCIS, costing €114.39 Euros, which was a collaborative work done in IIT Bombay.