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TELEMEDICINE APPLICATION BASED AUTOMATIC EYE CATARACT DETECTION ALGORITHM USING MATLAB

Ms. Prafulla P S*, Kavyashree K T**, Arpitha P***, Sowmya T S****, Nireeksha M Y*****

*(Electronics & Communication Engineering, BGS Institute of Technology, Karnataka, India,)

**(Electronics & Communication Engineering, BGS Institute of Technology, Karnataka, India,)

***(Electronics & Communication Engineering, BGS Institute of Technology, Karnataka, India,)

****(Electronics & Communication Engineering, BGS Institute of Technology, Karnataka, India,)

*****(Electronics & Communication Engineering, BGS Institute of Technology, Karnataka, India,)

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Abstract:

This paper proposes and evaluates an algorithm to automatically detect the cataracts from color images in adult human subjects. Currently, methods available for cataract detection are based on the use of either fundus camera or Digital Single-Lens Reflex (DSLR) camera; both are very expensive. The main motive behind this work is to develop an inexpensive, robust and convenient algorithm which in conjugation with suitable devices will be able to diagnose the presence of cataract from the true color images of an eye. An algorithm is proposed for cataract screening based on texture features: uniformity, intensity and standard deviation. These features are first computed and mapped with diagnostic opinion by the eye expert to define the basic threshold of screening system and later tested on real subjects in an eye clinic. Finally, a tele-ophthalmology model using our proposed system has been suggested, which confirms the telemedicine application of the proposed system.

Keywords **— tele-ophthalmology, Digital Single-Lens Reflex (DSLR) camera, SVM Classifier**

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I. INTRODUCTION

Eye related disorders and subsequent vision loss affects individuals severely through on-going medical expenses during treatment of disorders and through the high economic and mental trauma of degrading vision. The World Health Report regarding cataracts, updated in 2014, says that285 million people are estimated to be visually impaired worldwide, out of those 39 million are blind and 246 have low vision. In the current scenario, cases of cataracts leading to blindness are likely to advance due to an ageing population and shortage of required healthcare infrastructure in low and middle-income countries. World Health Organization (WHO) defines a cataract as clouding of the lens of the eye, which impedes the passage of light. Normally, the lens is a completely clear image. The proteins which form the lens are normally very precisely layered and arranged and it is this feature which allows the proteins to be completely transparent. If this internal structure is degraded and the proteins become disorganized or damaged, the lens itself starts to become whitish or

cloudy and this prevents the transmission of light back onto the retina.

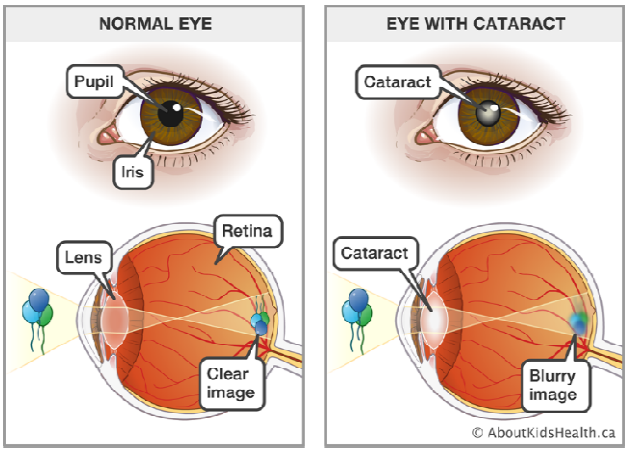

Figure 1: Normal eye & eye with cataract

II. METHODOLOGY

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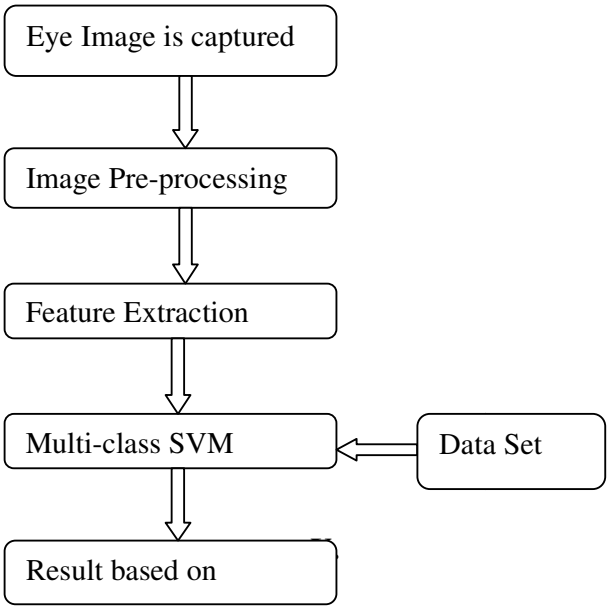

Figure 2: Block diagram

Explanation :

- Preprocessing includes conservative smoothing followed by image denoising. The isotropic Gaussian filter is widely used as a low-pass filter for image de-noising
- Feature extraction is done after preprocessing to extract all the information for cataract detection and grading from the circular pupil region. The proposed detection algorithm is based on finding the accurate thresholds of texture feature parameters such as image intensity (I), uniformity (U) standard deviation (s), to distinguish between healthy and abnormal eyes. In cataract eyes, the whitish color originates from the lens region so it can be easily concluded that cataract eyes have higher intensities than normal eyes.
- Extracted feature of eye is compared with data set using SVM multi-class classifier.
- Result is based on the feature matched with which class of image.

III. Objective:

- Eye is an important part of our body. It reacts towards light. Cataract is a disease that affects our eyes badly. Cataract is the clouding of the eye lens, which leads to the decrease in vision. It can single or both eyes. The symptoms may include cloudy or

blurred vision, colors that may not appear as bright as they once did, glare, poor night vision. Our main objective of this paper is that is successfully detecting the Eye Cataract in any stage such that preventive measure can be taken.

V. ADVANTAGES

- Less complexity and better result
- Reduce computational cost
- User friendly GUI compared with other platform implementation.
- Works well with even unstructured and semi structured data like text, Images and trees.
- SVM is always compared with ANN. When compared to ANN models, SVMs give better results.

VI. APPLICATIONS

- It can be used in Tele ophthalmology.
- Huge demand in medical field.
- Detecting Steganography in digital images
- Protein Structure Prediction.

VII. CONCLUSIONS

This paper presented a texture information based automated algorithm for detection of cataracts from a digital eye image of adult human subjects.

The proposed algorithm detects presence of cataract by reading texture information from circular pupil of adult human subjects. It is not tested on child subjects, also it cannot detect cataract in the child subjects with those suffering from coloboma, i.e., the child subjects who have noncircular pupils. A GUI has been created in MATLAB for adding simplicity to the operation of proposed system and a network architecture has been proposed for its implementation in telemedicine application. Future work includes fine tuning of the threshold parameters for cataract detection by considering a large number of patients and corresponding ophthalmologists' decisions. Intelligent computing methods such as SVM or machine learning can be used for improved results. Efforts are being made to remove the flash spot of the camera during preprocessing and evaluate its effect. The algorithm can further be extended for predicting severity information in terms of cataract grading. Different wireless networks will be evaluated for the required quality of service parameter requirements at different layers for the proposed tele-ophthalmology architecture.

VIII. ACKNOWLEGEMENT

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