Field Layer Extraction of Cataract using Image Processing Technique

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Abstract: In current technological world, treatment and disease detection has seen a high range of improvement through telemedicine. Cataract is one among those diseases which need its diagnosis in early stages with an immediate treatment. In this paper, we propose a unique adoptive image processing technique for extraction the symptoms of cataract and the affect field. The technique includes image smoothing and preprocessing followed by appending the algorithm. The results are demonstrative and are archived in the paper.

I. INTRODUCTION

Human eye sight is considered to be one of the precious gifts in nature, a normal functional human eye has a capacity to detect and segregate 2.5million color combinations. Apart from this, it has the adjustable natural lens with sight of taught and understanding, if we could say in one manner, Human eye is an organ which cannot be artificially designed.

As known, in today's world the human eyes are exposed to many harmful radiations and stress lights of emitting devices such as smart phone screens and laptops. In such a case, the lenses are diminished and gradually lose the power of recognition, which shall intern lead in the development of cataract layer on the circumference of the eye. Cataract is a thin extra layer growth on the natural lens of human eyes mainly caused due to stress and hereditary diseases such as diabetes mellitus (Sugar). [2][3]

In this paper, we propose a unique image processing technique for extracting the cataract layer and its surrounding which are affected in almost accurate manner. [1] This technique basically includes, image smoothing and tuning to fetch a quality image and then it is followed with noise removal process. Once these steps are performed, we append our proposed technique to extract the cataract and its affected regions. This paper consists of methodology in section II and implementation results and conclusion followed in section III and IV.

II. METHODOLOGY

Computer assisted diagnosis for various diseases are very common now a days and medical imaging is playing a vital role in such diagnosis incorporating with new technology as telemedicine. In modern world, we are well equipped with high-end technological tools and devices which narrow down the complicated process and conclude with an efficient results and parameters. The proposed algorithm has four stages in extracting the cataract as shown in figure 1.
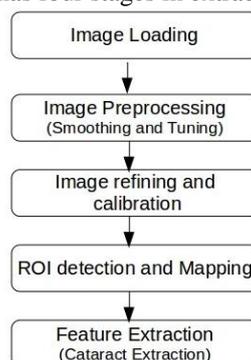

Fig 1: Algorithm flow diagram

Step1: Image Loading or Exporting: In this step, the X ray color image of eye is exported from the medical capturing devices such as MRI or typical X ray machine under doctor or technician supervision. Floating these images from one domain to another is not a major challenge in current scenario, but typically in our paper we use JPEG, PNG and BMP format images for processing with independent dimension and ratios.

Step 2: Image Preprocessing: Images acquired from external sources is made compatible with the design experimental environment for easy processing. Hence in this paper we smooth the image to a fixed threshold value to higher optimizations and tuning is done for removal of unwanted noise signals and thereby enhances the simulated image model for future processing. Fig 2 shows the original image and Fig 3 shows the image after appending preprocessing techniques.

Fig 2: Original Image (Color X ray)

The above shown image is accompanied with noise, dark shades and a proment background. This is a original image loaded for the processing which are obtained from high-end medical image aquasition machines. These images also incoperate dull features of cataract through the blurness and blood nerve shades path (which are obtained after processing). Hence we append step 2 for preporocessing and ehancing the image. Fig 3 shows the image after preprocesing in an clear and more aquirate manner which is suitable for processing.

Fig 3: Preprocessed image of original image

Step 3: Image Refining and Calibration
This is an most improtant step under processing which is performed soon after preprocessing. Image edge smoothing and detection technique is appended for contract inversing and feature multiplying in an most appropraite fashion. Figure 4 shows the refined and calibrated image of the preprocessed image from step 2. In calibration it reverses the contrast and diliburates the featured.
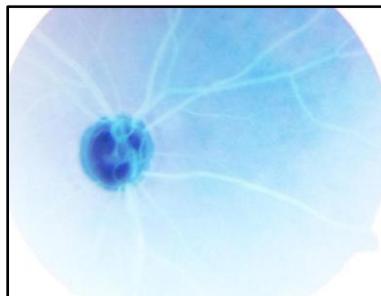

Fig 4: Refined and Calibrated Image

Step 4: ROI Detection and Mapping
This step is a combination of ROI (Region of Interest) and Mapping. ROI in this paper is the affected area of eye with cataract under low and average density. Many previous algorithms have been proposed to extract cataract only in high density region. In our proposed algorithm we extract the thin layer under low density. A modularity of image is studied from Fig 4 and Step 4 is thereby computed [4].
In ROI Detection process, the algorithm detects the regions of nerves paths under continues blurriness and disjunctions of the same under dark region (Can be seen in Fig 4). These nerves under dark or overlapped region are marked as ROI for our given image. From Fig 5, ROI could be shown after processing. And rebuilding the structural densities of the image leads in mapping the entire eye.
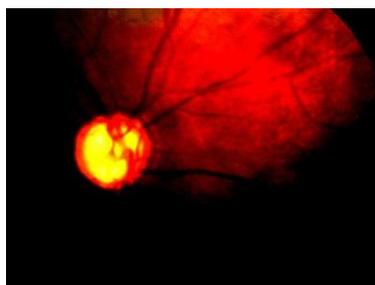

Fig 5: ROI Detection and Mapping of Cataract

Step 5: Cataract Extraction (Feature Extraction)
From the previous steps we have achieved ROI of an eye which is either completely affected or partially affected by cataract. In this step we concentrate on extracting the cataract overall structure from the eye's circumference. Figure 6, shows the cataract extraction [5].
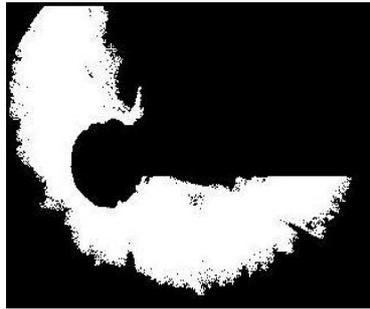

Fig 6: Cataract extraction

III.   CONCLUSION

In this paper we concentrate on extracting cataract from the low and average density region and reconstruct it. During the processes we append smoothing, tuning and ROI mapping for extracting the output. In our paper we try to focus on the region which shall be affected and also a study on different approaches of the cataract spreading. We have successfully extracted the cataract region and the possibility region of spreading. Figure 7 and Figure 8 demonstrates the GUI for the experimental setup with contrasting outputs and behaviors.
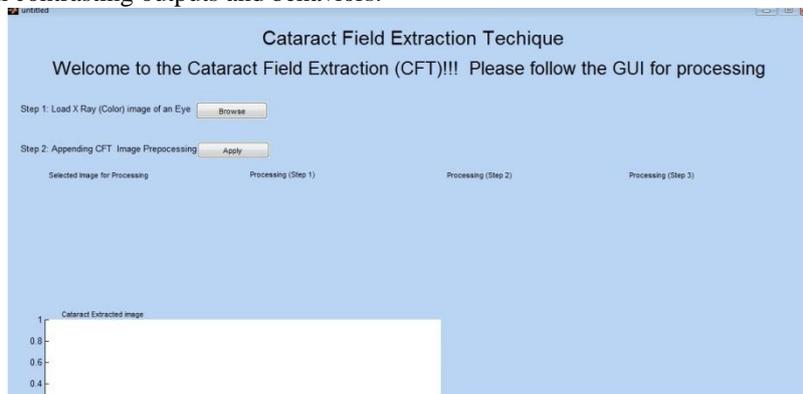

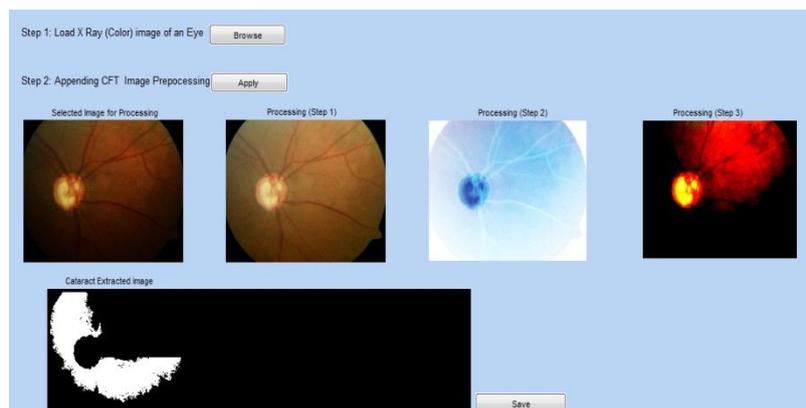Fig 7: GUI for CFE (Cataract Field Extraction)

Fig 8: GUI with all possible outputs and Cataract Extraction Image

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