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# Diagnosis of Cataract using a Robust Algorithm for Telemedicine Applications

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***Abstract: This project proposes and evaluates an algorithm to automatically detect cataract from colored images of adult human subjects. The methods currently available make use of DSLR (Digital Single Lens Reflex) cameras which are very expensive thereby, making the whole process expensive. The main objective of this project is to provide a robust and affordable alternative to the classic treatment method which adopts the above methods. In this project via an algorithm we aim to diagnose the presence of cataract from the true colour images of an eye. The algorithm proposed makes use of OpenCV for cataract screening based on textural features such as uniformity, intensity and standard deviation. These features are first computed and mapped using Data Mining techniques after consultation with an eye expert to define the basic threshold of screening system and later tested on real subjects in an eye clinic. Pre-processing includes conservative smoothing followed by image de-noising. The isotropic Gaussian filter is widely used as a low pass filter for image de-noising.Feature extraction is done after pre-processing to extract all the information for cataract detection from the eye's pupil region. The extracted parameters were compared with the values obtained from an ophthalmologist to determine the presence of Cataract in the eye of the patient. Finally, a tele-ophthalmology model using our proposed system has been suggested, which confirms the telemedicine application of the proposed system.***

***Keywords: DSLR camera, OpenCV, de-noising, reprocessing.***

## I. INTRODUCTION

Waterfall is one of the most common reasons for visual impairment in the industrialized world, representing over half of visual impairment. In the present situation, instances of waterfalls prompting visual impairment are probably going to progress because of a maturing populace and lack of required human services framework in low and central pay nations. Computerized picture preparing (DIP) strategies are the promising methodology, which procedure a picture and delivers certain yields as indicated by the client's code. Utilizing picture handling strategies one can perform picture improvement, division, examination and analysis and so forth.

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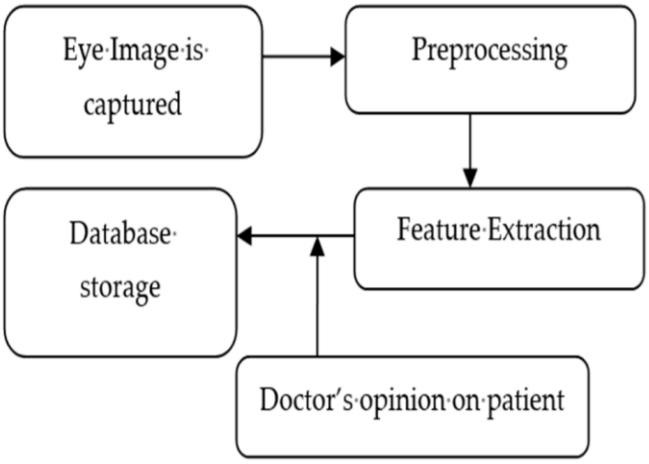
Medicinal picture preparing is the way toward breaking down restorative pictures, for example, mind sweep pictures, skin pictures for skin sickness discovery, retinal pictures, Computer Tomography (CT) pictures to identify and analyze illnesses and variations from the norm in the piece of the body.

### Problem Statement

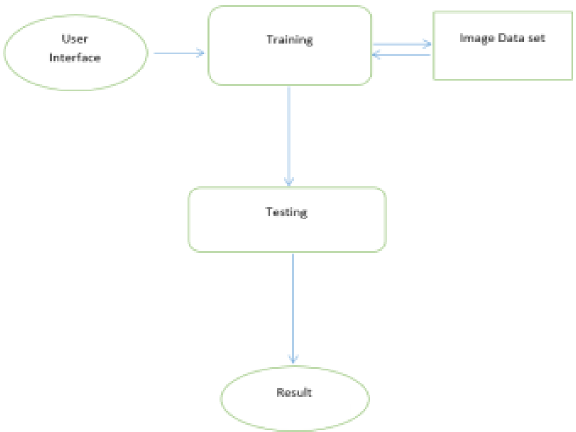
The point of convergence of a human eye is optically clear, involving generally of water and protein. It is arranged behind the iris and before vitreous body and retina in the eye. On account of its shape, clarity and refractive document, the point of convergence can think light onto the retina. Any muddling or loss of clarity of the point of convergence is known as a cascade. Cascades deter the transmission of light to the retina and thusly achieve weakened vision or even visual disability [1]. They are the primary wellspring of visual inability around the globe, speaking to over portion of visual inadequacy in making countries. Most cascades are age-related, anyway they can in like manner be credited to sickness, damage and inherent parts. With the overall example of developing masses, the inescapability of cascades is depended upon to increase.

## II. PROPOSED WORK

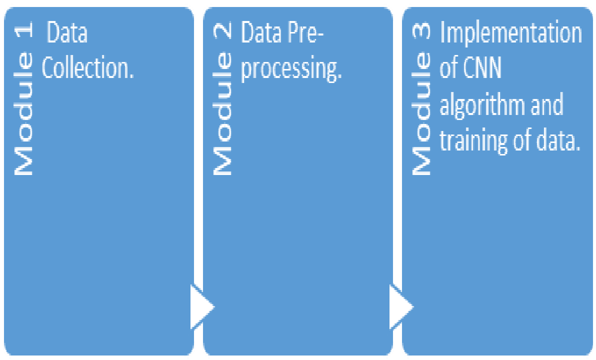
This project proposes a novel alternative to the existing system for digital detection of cataract using various algorithms. The main problem area in the existing system is the use of DSLR cameras and advanced lenses, which in turn make the process expensive. With this project we aim to replace the expensive cameras with smaller cameras and inexpensive cameras the likes of which are even available on above average smartphones. The smartphones can be used as a part of an elaborate setup in conjugation with external stands or tripods while taking pictures of the human eye. A stand or tripod is necessary in order to maintain stability and ensure that the image captured is not blurred. Once the image is captured, it is fed as an input to the system that processes it and compares it with the predefined threshold value for cataract infected eye. Based on this comparison the system either confirms or denies the presence of cataract. We then advise the concerned subject to consult an ophthalmologist in order to validate our diagnosis and proceed with treatment.




**System Architecture:**



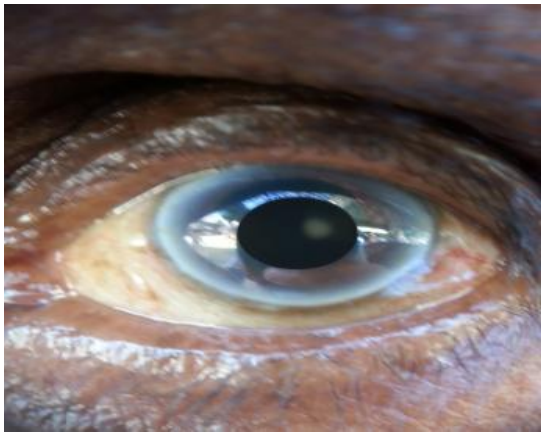

**Modules:**




*Module 1:*

- Firstly, the data is collected from different resources.
- Data is put through various preprocessing stages.
- Data is prepared for feature extraction.
- Training of datasets is performed.
- Data Collection
- Resources used: - Civil Hospital Aliganj,Lucknow.

**Input image:**



*Module 2:*

- Data Preprocessing.
- The data is passed through a series of steps of preprocessing.
- Steps are as follows :
  1. Grayscale conversion.
  2. 2D filtering.
  3. Thresholding
  4. Morphological Opening
  5. Finding circles

**Image after grayscale conversion:**

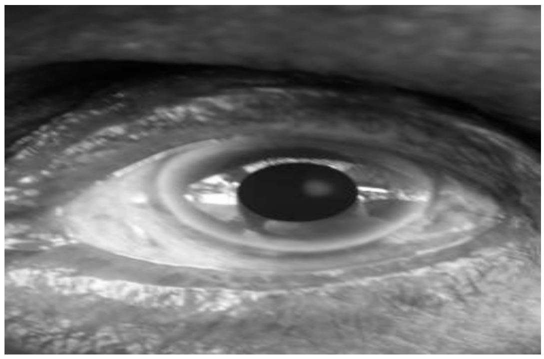
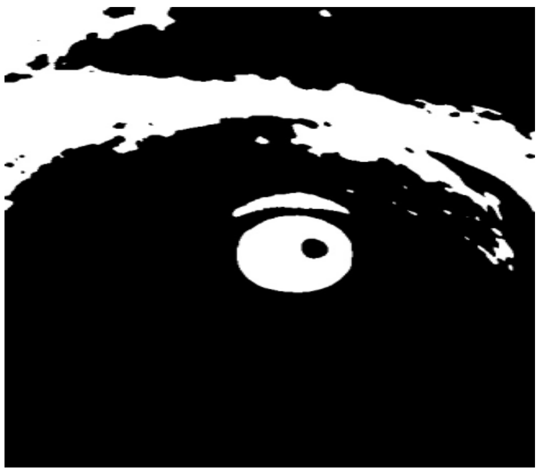


**Image after thresholding:**



*Module 3:*

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- **Training and testing: -** The data is split into training and testing set. After the training, the system is trained and ready to check the system by giving the inputs as image .To find the accuracy of output, testing is performed and it can be done by either user or admin. In the testing part, 20% data has been provided to test the system whether it predicts correctly or not and it also the final step of the process.
- Steps involved:
  1.Image Inversion
  2.Iris Detection
  3.Cataract Detection

**Image after inversion:**

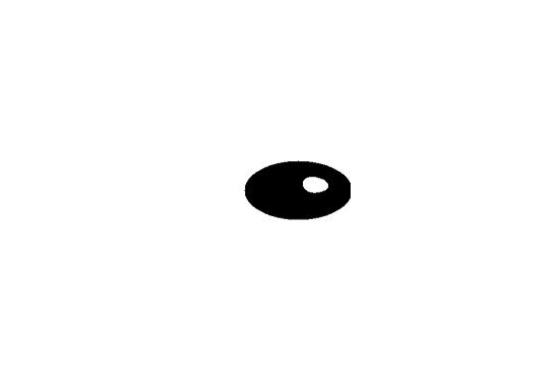
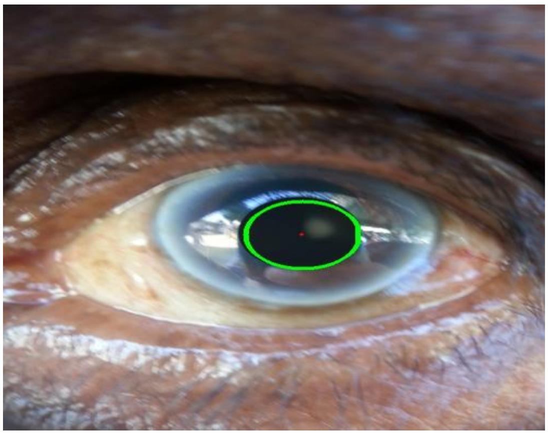


**Image after Iris detection:**

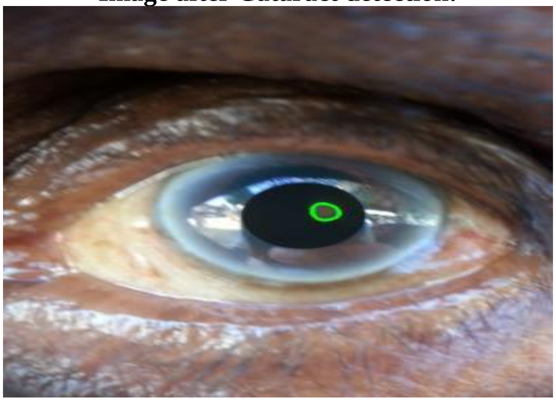


## III. CONCLUSION

Thus, through this project we have are aiming to provide a robust solution to the problem of detection of cataract through our algorithm. Through this algorithm we aim to provide a better accuracy at detection of cataract in the people thereby reducing the overall cost and efforts that are required to be done in the process. This will allow the people from underprivileged/remote areas to also get access to the medical facilities which can be quite difficult to attend to in these conditions. Thus, our algorithm will provide an improved accuracy in detection of cataract and due to its robustness, it is effective and portable and also reduces the amount of effort that medical practitioners will have to put in this work. Through this project we aim to reduce the cost of detecting of cataract using images from high end expensive cameras and thereby reducing the overall working cost of the project by providing it with low cost average size images from the camera of a regular smartphone which provides a photo of an average size of 16 megapixels. We also get the help of medical practitioners at the end of the detection of cataract by our software thereby our verdict is furthermore authenticate by the experienced eye surgeon; while the other methods use the inputs of medical practitioners at regular intervals while working on the image samples. Thus, through our software; we aim to assist the medical practitioners in providing medical assistance more effectively and in less time as compared to other software solutions available.

**OUTPUT**

**Image after Cataract detection:**



Pupil area: 8637.0
Cataract area: 529.0
Centre of cataract: (292,349)
Cataract is (17,-10) away from pupil centre
5.77 percent cataract

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**Sarthak Khanna** is pursuing his UG degree in Computer Science and Engineering from SRM Institute of Science and Technology, Kattankulathur. Currently a 4th year student. He has an aptitude for research and has attended workshops in the field of Artificial Intelligence . His interest lies in the field of Machine learning , Data Science and Augmented Reality.

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