# Cataract Eye Prediction using Machine Learning

Shruthi Bhat
Dept of Computer Engg
PCCOE, Pune

Som Mosalagi
Dept of Computer Engg
PCCOE, Pune

Tejal Bhalerao
Dept of Computer Engg
PCCOE, Pune

Pushpak Katkar
Dept of Computer Engg
PCCOE, Pune

Rahul Pitale
Dept of Computer Engg
PCCOE, Pune

## ABSTRACT

Humans, being visually oriented, witness the happenings in the surroundings with the help of eyes. In the current scenario, blindness, and visual impairment has become a major and ubiquitous health problem. Although new technologies are rapidly progressing, visual impairment remains a noteworthy problem for worldwide healthcare systems. One of such problems is Cataract. Cataracts causing poor vision may also result in an increased risk of falling and depression. Earlier, it was usual among old age people, but now childhood cataract has become an important cause of blindness and severe visual impairment in children. Existing studies have been done mostly on Fundus image datasets for automatic detection of cataract and grading using a predefined feature set. The challenge is to detect cataract using the normal lens images at an early stage thus allowing people to test for cataract themselves. This would rather ensure that people belonging to remote areas need not reach out to ophthalmologists, just to check whether the person is facing a cataract problem or not. This paper uses CNN models taking normal lens image input for detection of cataract problems.

## Keywords

Cataract detection, CNN, Fundus, Keras, Non-cataract, Normal lens image, TensorFlow.

## 1. INTRODUCTION

Humans, being visually familiarized, witness the happenings within the surroundings with the assistance of eyes. Within the current state of affairs, sightedness and handicap became major and omnipresent health issues. Though new technologies square measure apace progressing, handicap remains a motivating downside for worldwide attention systems. One among such issues is Cataract. A cataract could be a development of clouding up of the attention lens that ends up in a decrease in vision. Cataracts typically develop bit by bit that will have an effect on one or each eye. Symptoms could embrace pale colors, indistinct or visual disorder, halos around light-weight, bother with bright lights, and bother seeing in the dark. This might end in bother, Whereas, reading, driving, or recognizing faces. Poor vision because of cataracts may additionally end in Associate in Nursing hyperbolic risk of falling and depression. Cataracts cause half of all cases of sightedness, and thirty-third of handicap worldwide. Cataracts square sometimes measure because of ageing however may additionally occur because of radiation exposure, or trauma, or is also gift from birth, or occur following eye surgery for different issues. Risk factors of cataract embrace smoking, diabetes, tobacco prolonged exposure to daylight and alcohol. Earlier, it was usual among adulthood folks. However, currently childhood cataract has become one among the foremost vital causes of sightedness and severe handicap in youngsters. Thus, detection of cataract is the primary demand, and it will be done using exploitation varied strategies.

The branch of machine learning called Deep learning is a virtual representation of working of the human brain. Deep learning methods have created an impact of giving results better than human experts.Deep learning methods like Convolutional Neural Networks, Deep Neural Networks are used in various fields like medical imaging, search engine, gmail, computer vision, NLP, machine translation and many more. Deep learning models mostly depend on convolutional neural networks. Google's TensorFlow library can be used to build deep learning models with the help of dataflow graphs. This allows us to create many layers in a neural network. In order to build our Tensorflow model, Keras library can be used. Keras is simple that consists of an optimized interface for common use cases. Performance is an important measure to be considered in machine learning. Using high level APIs and fast debugging, TensorFlow gives good performance. Keras is the high level API used with TensorFlow to build the model. This can be used for classification, prediction, understanding, creation and discovery.[1]

## 2. RELATED WORK

Method of classification of cataract mainly comprises four parts namely preprocessing, feature extraction, feature selection and classifier or model.[5] The primary purpose of any classifier is achieved based on the input provided to it. Input for Cataract classification is a dataset of eye images of two different classes called cataract and non cataract. For many years, research on Fundus image analysis has been conducted. Fundus images are obtained by Fundus camera which clearly distinguishes cataract from normal eye.[2] The five convolution layer based on deep learning is used to separate the features in Fundus images.[4] Some of the features of retinal Fundus images have been extracted such as texture, sketch, color, wavelet, acoustical, spectral parameters and so on.[2] One of the other methods for cataract classification and detection is the Squeeze Net model. The dataset collected is first preprocessed in order to remove the noise in the images. To detect the circle part in the image, the Hough Circle algorithm is used. The training model is built using a convolutional neural network. Transfer Learning is used where a model developed for a task is reused as the beginning for another model.[3] In few other models, image preprocessing is done with the help of maximum entropy method. The features are extracted automatically using caffe. The extracted features must be identified and compared. In

this case, Softmax and support vector machines are used for classification. For the collected dataset, four different classifications are done. But Softmax gives better accuracy[4].

A Convolutional neural network works well for object recognition. This system uses a pre-trained model with the image set for diabetic retinopathy. The trained models that are already available provide class objects which take an image as input.[1] Pool 5 layer feature mapping is used to classify and extract features. This feature extraction is cross-checked by using another method giving two conclusions. The first one provides the G-filter method that is used to overcome the reflection and interference of uneven illumination. The second one is used to increase the number of images available to improve accuracy.[6] Cataract must be detected as soon as possible so that it will be easy to prevent it by getting more and turning the person blind. The aim of this paper is to efficiently use a deep convolutional neural network to detect and classify cataracts. Existing automatic methods for cataract grading, such as [7-12], usually utilize a predefined set of image features that provides a redundant, or maybe noisy, incomplete representation. Moreover, all the predefined features were artificially extracted, a heuristic (need professional knowledge) method that depends on experience and luck. Also, its regulation takes a lot of time.
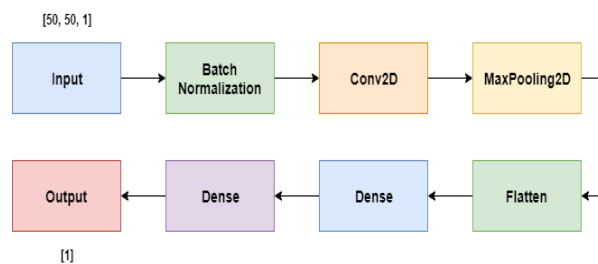
## 3. SYSTEM ARCHITECTURE



**Fig 1: CNN model**

The model takes an eye image dataset as input that is processed by subsequent layers of convolutional neural networks. Batch Normalization technique trains neural networks that standardize the input images to a layer batch wise thus stabilizing the process of learning. This decreases the number of training epochs that are required to train networks. 2D Convolutional Layer creates a convolution kernel that coevolves with the layer input and produces a tensor of outputs. Max Pooling down-samples an input image to reduce its dimensions. It allows making assumptions about features contained in the binned sub-regions. The featured map obtained is pooled and then flattened. The pooled feature map matrix is transformed into a single column by flattening which is further fed to the neural network for processing. Dense layer is responsible for adding the fully connected layer to the neural network.

The implementation methodology begins from a collection of good image dataset for both the classes namely cataract and normal eye. Image preprocessing is done involving 2 steps-resizing the images to a specific size and cropping the image borders. Due to a very high fluctuation in the size of images, all images need to be downsized to a common size of width 50 pixels and height 50 pixels. A model or a binary classifier is created in order to make predictions. This model is trained by feeding a training dataset to the model. The model is supposed to predict whether the image belongs to class cataract or non-cataract. The images of the data set used for testing is not the same as that used for training as the model

may memorize the unimportant features of the training images. This issue is known as over fitting, and to avoid it we keep a portion of our dataset out of the training procedure. After the testing phase, the model is ready to predict for new images.(fig.2.)
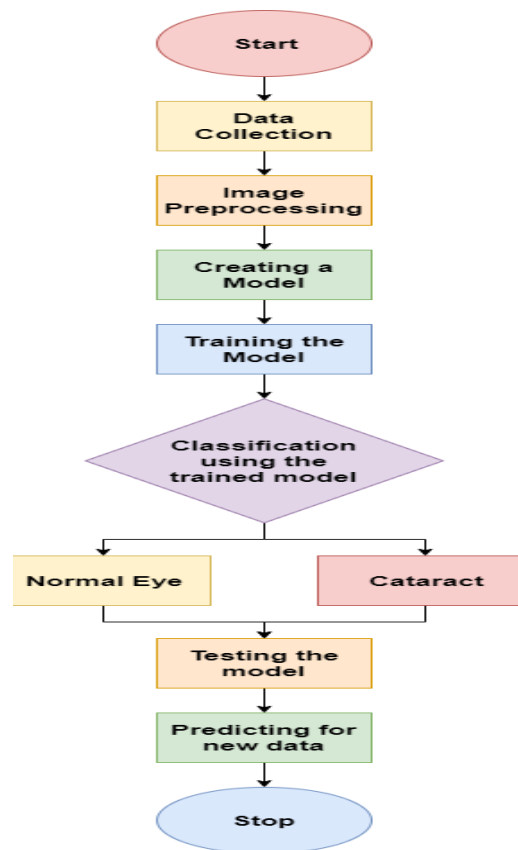


**Fig 2: Implementation methodology**

## 4. PROPOSED SOLUTION

The proposed solution takes input image that crops the eye part in order to obtain a valid image for classification. This image is available in binary format. Using flask middleware, image is converted into hexadecimal format and fed to the ML model. The model predicts the result in text format and it is sent to the user as output.
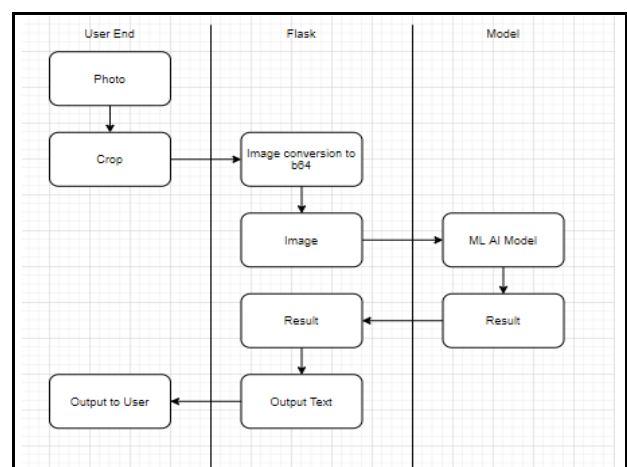


**Fig 3: Proposed Solution**

## 5. CONCLUSION

In this paper, we proposed Convolutional neural network method to classify images into two classes namely cataract and non-cataract. The dataset has been collected and classified as cataract and non-cataract eye. Out of all the images, some are kept for training and some for testing. The model is trained with the training dataset and tested with the testing dataset to identify and classify the cataract in the new input image successfully.

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