CATARACT CLASSIFICATION

Machine Learning Project

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Contents

Introduction

Eye vision is an important sense to every human being. But unfortunately, many people across the world are suffering from vision impairments [1]. According to World Health Organization (WHO) [2], approximately 2.2 billion people are estimated to suffer from visual impairment. Cataracts account for about 33% of visual impairment and are the number one cause of blindness worldwide. The estimated prevalence of blindness in Pakistan varies from 2.0% to 4.3% [3]. Cataracts are the root cause of blindness in Pakistan also. According to the international agency for the prevention of blindness (IAPB) 2015 report, over 7.3 billion populations worldwide, 253 million people are suffering from vision impairments out of which 36 million are blind and 217 million are having MSVI [1].

Shortage of ophthalmologists in rural areas of the world, in which a lot of people suffering from cataracts are not diagnosed and treated timely. We develop an algorithm and platform to automatically diagnose and grade cataracts based on fundus images of patients. This method can help the government assist the poor population more accurately [4].

Problem Statement

Undiagnosed cataracts remain a huge challenge for many developing countries and rural populations due to a lack of accessibility [5]. In the whole world, cataract is the leading cause of visual deterioration, accounting for 65.2 million cases of vision impairment and blindness globally. Importantly, a substantial proportion of these cataract cases remain undiagnosed. Hence, cataract remains a major public health concern [6].

Methodology

We will be working on this project using Python on Google Collaboratory. Further, we intend to employ different techniques machine learning and deep learning on our dataset. The conventional machine learning algorithms are a combination of feature extraction and classification.

- In the feature extraction, the Principle Component Analysis technique will be employed.
- In the classification, The Support Vector Machine model will be used. It is a popular and efficient learning method for medical imaging applications. The SVM classifier is widely used in different ophthalmic images for the cataract classification task. Further, we also intend to employ a different set of classifiers such as Convolutional Neural Network (CNN), K Nearest Neighbors, and Random Forest.
- The evaluation metrics such as precision, recall, f1 score, and overall accuracy will be employed for model selection. Further, we also intend to include the

Receiver Operating Characteristic (ROC) curve with Area Under the curve (AUC) score.

- Flask framework is intended to be used for model deployment. The front end will be developed with HTML plus flask. The backend server will be decided later on either to choose Heroku or other free hosting servers.

Dataset Discussion

We have chosen the cataract image dataset publicly available on Kaggle [7]. It is a classification dataset consisting of four classes: normal, cataract, glaucoma, and retina disease. The size of the dataset is almost 4GB. So, we will be using the python package Kaggle to load the data into our code. Following is the general introduction to different classes of the dataset:

Normal

It refers to healthy cases. It comprises almost 300 cases of this class.

Cataract

It refers to those cases which have clouding of the normally clear lens of the eye. It comprises almost 100 cases of this class.

Glaucoma

It refers to those who have their optic nerve damaged. It comprises almost 101 cases.

Retina Disease

It refers to those who have a problem with the light-sensitive layer at the back of their eye. It comprises almost 100 cases.

Conclusion

Automatic and objective cataract classification is important for our model that is providing to reduce blindness ratio. ML technique has made huge progress in cataract classification, but there is still room for improvement. The development of ML methods provides the accurate and objective diagnosis of cataract, which is effective to help the people to improve their vision. Machine learning classifiers are used for different purposes, and these can also be used for cataract diagnosis. The classifier first trained with an image dataset called training data set. After that, these classifiers can automatically detect cataract screening problems. It is an excellent idea by developing lightweight machine-learning methods that solve the issue of cataract screening for developing countries with limited access to pricey ophthalmic tools.

Timeline

	Nov 11-17	Nov 17-25	Nov 25-Dec8	Dec 8 onwards
Proposal and idea				
Model development and testing				
Web implementation and deployment				
Project Demo				

References

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