Chapter 73
An Artificial Intelligence-Based Smart System for Early Glaucoma Recognition Using OCT Images

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ABSTRACT

Glaucoma is a progressive and constant eye disease that leads to a deficiency of peripheral vision and, at last, leads to irrevocable loss of vision. Detection and identification of glaucoma are essential for earlier treatment and to reduce vision loss. This motivates us to present a study on intelligent diagnosis system based on machine learning algorithm(s) for glaucoma identification using three-dimensional optical coherence tomography (OCT) data. This experimental work is attempted on 70 glaucomatous and 70 healthy eyes from combination of public (Mendeley) dataset and private dataset. Forty-five vital features were extracted using two approaches from the OCT images. K-nearest neighbor (KNN), linear

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discriminant analysis (LDA), decision tree, random forest, support vector machine (SVM) were applied for the categorization of OCT images among the glaucomatous and non-glaucomatous class. The largest AUC is achieved by KNN (0.97). The accuracy is obtained on fivefold cross-validation techniques. This study will facilitate to reach high standards in glaucoma diagnosis.

1. INTRODUCTION

Glaucoma is the second most crucial optic 'eye' disease in this world. As per sources in 2010, approximately 60 million populations cross-sectional to be disease infected, and this count is increasing above 20 million in the period 2020. It does no repairable damage to the central part of the optic nerves that can lead to making the person blind. Hence, sensing Glaucoma during the initial stage is very imperative. Generally, doctors focus on the area of the optic disc & optic cup and find the edges though optic nerve examination. They assure the glaucoma presence they identify the increased size of the optic cup. One of the essential features is to identify the ratio of the height of the Cup to the disc; this is the crucial indicator for identifying Glaucoma. Among the patients, if the Cup-to-Disc ratio (CDR) value is at least 0.5, it may be considered as the glaucomatous eye.

Human eye mainly has three layers. The outer layer: Sclera, which is used to protect the eyeball; Second layer: Choroid and the innermost layer: Retina."Retina" is liable in vision because of the presence of photoreceptors. Researchers have invented many techniques which are used for detecting retinal disorder. These techniques include fundus photography, fluorescein angiography, and the OCT.

Figure 1. OCT image with macular edema