

# Chapter 19

## Detection of Eye Diseases in Numerous Features Using Principle Component Analysis With Stacked Ensemble Method

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### ABSTRACT

*The function of the eyes, which assist humans in learning and gathering information from their natural environs, is crucial to existence. The prevalence of eye disease is increasing almost anywhere in the world, which necessitates a significant reaction. Prompt eye identification can be a great help in providing additional treatment to avert blindness. The main objective of this study is to create a broad architecture for better diagnosis of eye disease in a globally recognized structure to make it easier to use machine learning (ML) algorithms with an anticipated illness diagnosis using symptoms and available eye disease datasets. This leads to the proposal of an effective model that can diagnose eye illnesses employing principle component analysis (PCA) based light gradient boosting machine (LGBM) techniques. Moreover, the proposed method concentrates on evolving better self-learning.*

### INTRODUCTION

The refraction of light into the retina by the eye's lens, a transparent, circular part of the eye that extends beyond the iris (Hu et al., 2020). A condition known as a cataract causes the eye's lens to become clouded (Abbassy & Mohamed, 2016). The World Health Organization estimates that 65.2 million individuals worldwide have cataracts, which is a considerable rise compared to the total number of persons with

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glaucoma, corneal opacities, trachoma, and diabetic retinopathy who have the same degree of visual loss or blindness (Abbassy, 2020). In 2025, there will be more than 40 million blind individuals globally, with cataracts accounting for more than 50% of all occurrences of blindness (Song et al., 2019).

The causes of cataracts include smoking, alcoholism, inheritance, medications, nutritional or metabolic problems, and excessive sun exposure (Sigit et al., 2018; Agarwal et al., 2019). It's connected to a lot of other diseases as well. Unfortunately, a large number of people, both in rural and urban regions, have visual problems caused by eye disorders such as bulgy or cloudy vision, glaucoma, ocular hypertension, cataracts, etc. (Abdelazim et al., 2020). This can be due to a number of factors, including ageing, diabetes, genetics, and heredity. The growing usage of digital gadget displays as a result of modern lives is another issue that has an impact on eyesight (Ghozali, 2023a). Many South Asian nations have a disproportionately high incidence of these eye issues (Aditya Komperla, 2023). According to a survey that was provided, 21.6% of the population in Bangladesh has impaired eyesight, and 1.5% of adult Bangladeshis are blind. This is due to a number of factors, such as excessive use of digital gadgets, pollution, and poor eye care practices (Sutradhar et al., 2019).

Exophthalmos is the medical word for Bulging Eyes (BE), also referred to as BE. It is a symptom of several disorders rather than an individual condition (Bala Kuta & Bin Sulaiman, 2023). Excessive dryness, apparent whiteness, double vision, and a throbbing feeling in the eyes are all signs of BE (Boina, 2022). BE can affect one or both of a patient's eyes and when it does, it may result in issues with blinking. Damage to the nerves or a lack of eye muscle synchronization are the two main causes of crossed eyes (Ghozali, 2023b). Weaker visual signals are ignored by the brain when other signals are provided to it. Patients with strabismus struggle to regulate their eye movement and are unable to keep their eyes aligned normally (Ghozali & Urrohmah, 2023).

Damage to the nerves or a lack of eye muscle synchronization are the two main causes of crossed eyes. Weaker visual signals are ignored by the brain when other signals are provided to it. A cataract is a thick, hazy region that often develops on the eye's lens. The cataract is a protein clump that has accumulated in the eye and prevents normal light from passing through the lens and onto the retina. Deterioration of night vision, hazy vision, fading colours, and double vision are some of the key symptoms brought on by cataracts. Cataracts can be classified into cortical, congenital, nuclear, traumatic, posterior, bilateral, senile, and other subtypes (Sengupta et al., 2023).

In order to make associating the cataract with a particular subtype as simple as possible for this study, these subtypes are combined into a single disease category. The primary risk factors for cataracts include smoking, elevated blood pressure, having a family history of the illness, being obese, having diabetes, cancer treatments, becoming older, and being exposed to radiation from X-rays. Cataracts are one of the most frequent eye conditions in low- and middle-income nations (Vashishtha & Kapoor, 2023). Taking adequate care of the eyes may lower the risk of losing vision and going blind while also keeping an eye on any potential eye conditions, such as cataracts and glaucoma, that might develop (Hasan Talukder et al., 2023).

An ML technique called ensemble learning combines predictions from various models in an effort to increase the accuracy of predictions. Ensemble models are used to decrease prediction generalization errors (Ali et al., 2019). When the basis models are varied and independent, the ensemble approach reduces model prediction error. The method uses the sum of individual outputs to create a prediction (Bose et al., 2023b). The ensemble method functions and acts like a single model, although having many basic models (Hasan & Hasan, 2019). The majority of actual data mining systems use ensemble modelling

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