

# Chapter 1

## Detection of Ocular Pathologies From Iris Images Using Blind De-Convolution and Fuzzy C-Means Clustering: Detection of Ocular Pathologies

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### **ABSTRACT**

*The images of disease-affected and normal eyes collected from high-resolution fundus (HRF) image database are analyzed, and the influence of ocular diseases on iris using a reliable fuzzy recognition scheme is proposed. Nearly 45 samples of iris images are acquired using Canon CR-1 fundus camera with a field of view of 45° when subjected to routine ophthalmology visits, and the samples of eye images include healthy eyes, eyes affected by glaucoma, cataract, and diabetic retinopathy. These*

DOI: 10.4018/978-1-7998-3092-4.ch001

*images are then subjected to various image processing techniques like pre-processing for de-noising using blind de-convolution, wavelet-based feature extraction, principal component analysis (PCA) for dimension reductionality, followed by fuzzy c-means clustering inference scheme to categorize the normal and diseased eyes. It is inferred that the proposed method takes only two minutes with an accuracy, specificity, and sensitivity varying in the range of 94% to 98%, respectively.*

## **INTRODUCTION**

The most accurate method for biometric authentication is iris recognition and is most impressive worldwide, which results in creation of the distinctive identification numbers for the people in India using ADHAAR (Dhooge & de Laey, 1989), or Canadian border control system CANPASS (Roizenblatt et al., 2004). Like any other organ in the human body, the eyes and iris may suffer from various diseases like cataract, acute glaucoma, posterior and anterior synechiae, retinal detachment, rubeosis iridis, corneal vascularization, corneal grafting, iris damage and atrophy and corneal ulcers, haze or opacities. The eye pathologies are separated into five groups based on the impact on iris recognition: 1) healthy without impact), 2) illness detected but still clear and unaffected iris unaffected 3) geometric distortion 4) distortion in iris tissue and 5) obstruction in iris tissue (Aslam et al., 2009; Borgen et al., 2009; Dhir et al., 2010; ISO/IEC 19794-6:2011, 2011; Monro et al., 2009; Rajendra Acharya, 2011; Yuan et al., 2007).

MIRLIN, VeriEye and OSIRIS are the three methods used for iris recognition which is used to find the difference in the average value of the comparison scores inferred between the healthy and disease affected eyes. The comparison scores generated for the disease infected eyes as compared with healthy eyes is not within the tolerable limit when these conventional schemes are used. Variation in the comparison score may mislead in false non-match rate (Budai et al., 2013; McConnon et al., 2012; Neurotechnology, 2012; Odstrcilik et al., 2013; Seyeddain et al., 2014; Smart Sensors Ltd, 2013).

The various ocular diseases were detected using the database. The symptoms and the effects of various ophthalmic disorders are discussed here. Cataract is the common ophthalmic disorder indentified worldwide. The effect of this disease includes blurring of the eye lens causing reduced vision, Figure 1A. This eye disease occurs due to thickening of cornea which prevents the light from entering the lens thereby inhibiting the vision (Aggarwal & Khare, 2015; Canadian Border Services Agency, 2015; Haleem et al., 2015; Sutra et al., 2013; Trokielewicz et al., 2014; Unique Identification Authority of India, n.d.).

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