Chapter 10
A Study on the Examination of RGB Scale Retinal Pictures Using Recent Methodologies

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ABSTRACT

Retinal disease/condition examination is one of the significant areas of the medical field. A variety of retinal abnormality assessments based on fundus image-assisted trials are widely proposed by the researchers to examine the parts of the retina. Recently, traditional and soft computing-based approaches are executed to inspect the optic disc and the blood vessels of the retina to discover disease/damages. This work implements (i) A two-phase methodology based on Jaya Algorithm (JA) and Kapur's Entropy (KE) thresholding and level-set segmentation for the optic disc evaluation and (ii) JA-based Multi-scale Matched Filter (MMF) for the blood vessel assessment. During this analysis, various benchmark datasets such as RIM-ONE, DRIVE, and STARE are considered. The experimental study substantiates that JA-assisted retinal picture examination offers better results than other related existing methodologies.

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INTRODUCTION

Eyes are the vital organs in human body which play a crucial role in human sensory arrangement. It translates the light signals into understandable picture and transmits it to the brain through optic-nerve in the form of electro-chemical pulses. A shortcoming or injury in eyes may affects translation of light signals into pictures, which may cause momentary or permanent loss of vision. Hence, a pre-screening procedure is always suggested by the ophthalmologist to ensure the safe functioning of eyes. During this screening practice, various regions of eyes are examined using a visual check and also using the imaging procedures (Rabbani et al., 2015; Mahmudi et al., 2014; Golabbakhsh & Rabbani, 2013).

Retina is an inmost deposit in eye and automatic assessment of fundamental retinal parts are very significant to discover a range of retinal diseases (Mahmudi et al., 2013). If the cause and the nature of retinal-infection is discovered, then the doctor will suggest a well-organized treatment to cure or minimize the infection. In literature, retinal pictures recorded with ocular fundus image (Golabbakhsh & Rabbani, 2013), fluorescein angiography (Rabbani et al., 2015), and optical coherence tomography (Mahmudi et al., 2014) are extensively used to examine different elements in retina.

Earlier works confirms that, retinal examination is essential in identification and handling of Ocular-Hypertension (OHT), Diabetic-Retinopathy, Macular-Edema, glaucoma, Retinal-Vasculature (RV), Optic-Nerve Disorder (OND), malaria, papilloedema and Cardiovascular-Diseases (CD) (Jahromi et al., 2014; Wilkinson et al., 2003; Hajeb et al., 2012; 2014; Esmaeili et al., 2012; Sivakamasundari et al., 2015; Raja et al., 2012). These works also confirms the need of assessing the geometrical and physical disparity in Retinal-Optic-Disc (ROD) and Retinal-Blood-Vessel (RBV) to identify a range of illnesses.

This paper proposes two semi-automated procedures to examine the Fundus-Retinal-Pictures (FRP). Initially, the examination of Optic-Disc (OD) is implemented using the Jaya Algorithm (Rao, 2016; Rao & More, 2017) and Kapur's Entropy (Anitha et al., 2017) (JA+KE) based pre-processing and the Level-Set Segmentation (LSS) as the post-processing section. This technique is implemented to extract the OD from the RGB scale FRP obtained from normal (255 pictures) and Glaucoma (200 pictures) cases existing in RIM-ONE database. This work also examines the OD of other images, such as Normal (118 pictures), Early (12 pictures), Moderate (14 pictures), Deep (14 pictures) and OHT (11) available in the RIM-ONE database. The above said pictures are associated with five numbers of the expert's annotations called the Ground-Truth (GT). A relative assessment among the extracted OD and GT is executed to confirm the superiority of proposed procedure based on the computed values of picture likeliness measure (PLM). The higher values of PLM