Chapter 10

A New EYENET Model for Diagnosis of Age–Related Macular Degeneration:
Diagnosis of Age–Related Macular Degeneration

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ABSTRACT

Age-related macular degeneration is an eye disease, that gradually degrades the macula, a part of the retina, which is responsible for central vision. It occurs in one of the two types, DRY and WET age-related macular degeneration. In this chapter, to diagnose Age-related macular degeneration, the authors have proposed a new EYENET model which was obtained by combining the modified PNN and modified RBFNN and hence it poses the advantages of both the models. The amount of the disease spread in the retina can be identified by extracting the features of the retina. A total of 250 fundus images were used, out of which 150 were used for training and 100 images were used for testing. Experimental results show that PNN has an accuracy of 87%, modified PNN has an accuracy of 90% RBFNN has an accuracy of 80%, modified RBFNN has an accuracy of 85% and the proposed EYENET Model has an accuracy of 94%. This infers that the proposed EYENET model outperforms all other models.

INTRODUCTION

Age-related macular degeneration [ARMD] is defined as an ocular disease leading to loss of central vision in the elderly stage. Therefore, regular Screening of ARMD affected patients retina is very important. With the advent of computing techniques, the automated segmentation and analysis is expected to support...
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the ophthalmologist in the clinical decision making process. Automated or computer-assisted analysis of ARMD affected patients retina can help eye care specialist to screen larger populations of patients. Dry ARMD is characterized by thinning of the retina and drusen, small yellowish-white deposits that form within the retina. It results in slow, gradual progressive “dimming” of the central vision. Wet ARMD is characterized by abnormal growth of new blood vessel under the retina called “Neovascularization”. Blood vessels are unusually weak in their structure and prone to leaky and be easily break and bleed. During the recent years, there have been many studies on automatic diagnosis of ARMD using several features and techniques.

Hoover, A., et al. (2000) described an automated method to locate the optic nerve in images of the ocular fundus. Zakaria Ben Sheh et al. (2001) proposed a new segmentation method based on new transformations, they introduced in mathematical morphology. It is based on the search for a new class of regional maxima components of the image. These maxima correspond to the regions inside the drusen. Rapantzikos, K et al. 2003 developed a novel segmentation technique for the detection of drusen in retina images. They introduced and tested a histogram-based enhancement technique, which uses histogram equalization as its core operator and a histogram-based segmentation technique (HALT) to segment areas that differ slightly from their background regions. Zhu Hong Qing, (2004) presented a novel automated method for the segmentation of blood vessels in retinal images based upon the enhancement and maximum entropy thresholding. Ingrid E. Zimmer-Galler and Ran Zeimer, (2005) detected the presence of age-related macular degeneration (AMD) at a level requiring referral to an ophthalmologist for further evaluation and possible treatment. Nageswara Rao Pv et al. (2005-2009), proposed a new approach for protein classification based on a PNN and feature selection. Ana Maria Mendonca and Aurelio Campilho, (2006) presented an automated method for the segmentation of the vascular network in retinal images. The outputs of four directional differential operators are processed in order to select connected sets of candidate points to be further classified as centerline pixels using vessel derived features. Niall Patton et al. 2006 described current techniques used to automatically detect landmark features of the fundus, such as the optic disc, fovea and blood vessels.

W. Kenneth et al. 2007 proposed optic nerve and localization of the macula using digital red-free fundus photography. Maria Garcia et al. 2007 extracted a set of features from image regions and selected the subset which best discriminates between Hard Exudates and the retinal background. The selected features were then used as inputs to a multilayer perceptron classifier to obtain a final segmentation of Hard Exudates in the image. Saurabh Garg et al. 2008 explained two methods namely texture-based detection and model based approach that they have developed to reliably detect and count drusens. O Sheba et al. 2008 developed an automated method using the principle of mathematical morphology for finding the drusen exudates using retinal image analysis. Jie Tian et al. 2009 used PNN as a classifier for the automated classification of underwater objects. Lili Xu and Shuqian Luo, 2009 presented a novel method to identify hard exudates from digital retinal images. A feature combination based on stationary wavelet transform and gray level co-occurrence matrix was used to characterize hard exudates candidates. Maria Garcia et al. 2009 automatically detected one of these lesions, hard exudates, in order to help ophthalmologists in the diagnosis and follow-up of the disease. Three NN classifiers were investigated: multilayer perceptron, RBFNN and support vector machine (SVM). Alireza Osareh & Bita Shadgar, 2010 proposed an automated method for identification of blood vessels in color images of the retina. For every image pixel, a feature vector is computed that utilizes properties of scale and orientation selective Gabor filters. The extracted features are then classified using generative Gaussian mixture model and discriminative support vector machine classifiers. D. Jayanthi et al. 2010 gave only the frame work.