Retinal Vessel Segmentation of Non-Proliferative Diabetic Retinopathy

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ABSTRACT

Diabetic retinopathy is a disease in diabetic patients that affects the eye. It happens due to damage in the blood vessels of the light-sensitive tissues at the retina. In non-proliferative diabetic retinopathy, tiny changes occur in the blood vessels of the eye. Non-proliferative diabetic retinopathy can trigger macular edema or macular ischemia. In this study proposes the retinal vessel segmentation and vessel quantization on the DRIVE database which is publicly available. The experimental results express the retinal vessel can be effectively detected and segmented.

KEYWORDS
Blood Vessels, Diabetic Retinopathy, Eye, Vessel Segmentation

1. INTRODUCTION

Diabetic retinopathy is an advanced disease, and it may advance from mild retinopathy to severe proliferative retinopathy. It is broadly categorized as nonproliferative diabetic retinopathy (NPDR) and proliferative retinopathy (PDR) (Kahai et al., 2005). Segmentation and Recognition of Retina images and blood vessels in retina images play a significant role in a variety of medical diagnoses. Measurements of blood vessel width, color, reflectivity, tortuosity, abnormal branching, or the occurrence of vessels of a certain thickness provide the most useful information for diagnosis. When the number of blood vessels in an image is large, or when a large number of images is acquired, manual description of the vessels is tedious or even impossible.

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Segmentation of microaneurysms and hard exudates is also important for the more accurate diagnosis of diabetic retinopathy, and which need to be effectively performed (Antal & Hajdu, 2012). The common symptoms of diabetic retinopathy are blurred vision (this is linked often to blood sugar levels), floaters and flashes, and sudden loss of vision (Fong et al., 2004). Diabetic Retinopathy is mainly because of the damage of retinal blood vessels in diabetic patients. So the early detection of Diabetic Retinopathy is required to protect or to save the diabetic patient from vision loss, and for that, it is necessary to detect and segment the retinal image and retinal blood vessels. Diabetic retinopathy is caused mainly due to changes in the retinal blood vessels, the thin, light-sensitive inner lining in the back of your eye. These changes are called diabetic retinopathy (Antal & Hajdu, 2012). To determine if a person suffers from diabetic retinopathy, retinal images are used. Retinal images show changes in the retinal blood vessels. When these retinal blood vessels are damaged, they may leak blood and grow delicate new vessels. When the nerve cells are damaged, vision is impaired. These changes can result in blurring of your vision, hemorrhage into your eye, or, if untreated, retinal detachment. Diabetic retinopathy is the most common diabetic eye disease and a leading cause of blindness in the United States (Desmond, 1999; Diabetic Retinopathy, 2018). Following are some symptoms of Diabetic retinopathy:

- Blurred vision;
- Sudden loss of vision in one eye;
- Seeing in rings around lights;
- Dark spots or flashing lights.

2. RELATED WORK

J. Soares et al. had presented a method for automated segmentation of the vasculature in retinal images. It produces segmentations by classifying each image pixel as a vessel or nonvessel, based on the pixel’s feature vector. Where feature vectors are composed of the pixel’s intensity and continuous two-dimensional and Morlet wavelet transform responses taken at multiple scales for classification Gaussian mixture model (Joa et al., 2006). Carmen Alina Lupascu et al. (2010) mentioned feature based AdaBoost classifier for retinal vessel extraction on DRIVE dataset (Lupascu et al., 2010). It is a supervised mode, which trains a classifier with manually labeled images. Shu-Chen Cheng et al. introduced a fractal feature to measure lacunarity, which states the characteristics of fractals that have the same fractal dimension but different appearances. For those vascular distributions in the same fractal dimension, further classification can be made using the degree of lacunarity (Cheng & Huang, 2003). And the further classification is performed by using the degree of lacunarity. Muhammad Moazam Fraz et al. proposed the new method for segmentation on retinal images it uses an ensemble system of bagged and boosted decision trees and utilizes a feature vector based on the orientation analysis of gradient vector field, morphological transformation, line strength measures, and Gabor filter responses (Fraz et al., 2012).
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