Chapter 26
Automatic Localization of the Optic Disc Center in Retinal Images Based on Angle Detection in Curvature Scale Space

A. Elbalaoui
Université Sultan Moulay Slimane, Morocco

M. Boutaounte
Université Sultan Moulay Slimane, Morocco

Mohamed Fakir
Université Sultan Moulay Slimane, Morocco

A. Merbouha
Université Sultan Moulay Slimane, Morocco

ABSTRACT

Digital images of the retina is widely used for screening of patients suffering from sight threatening diseases such as Diabetic retinopathy and Glaucoma. The localization of the Optic Disc (OD) center is the first and necessary step identification and segmentation of anatomical structures and in pathological retinal images. From the center of the optic disc spreads the major blood vessels of the retina. Therefore, by considering the high number of vessels and the high number of the angles resulted from the vessels crossing, the authors propose a new method based on the number of angles in the vicinity of optic disc for localization of the center of optic disc. The first step is pre-processing of retinal image for separate the fundus from its background and increase the contrast between contours. In the second step, the authors use the Curvature Scale Space (CSS) for angle detection. In the next step, they move a window about the size of optic disc to count the number of corners. In the final step, they use the center of windows which has the most number of corners for localizing the optic disc center. The proposed method is evaluated on DRIVE, CHASE_DB1 and STARE databases and the success rate is 100, 100 and 96.3%, respectively.

1. INTRODUCTION

Retinal imaging is increasingly used in large scale, to studies for detection of glaucoma, diabetic retinopathy age-related macular degeneration and cardiovascular disease.When an ophthalmologist uses an ophthalmoscope to look into the eye, he sees the viewof the retina represented in (Figure 1). Retina is the innermost layer of the eye and composed of many important anatomical features. The main structures of a fundus retinal image were defined as the OD, fovea, and blood vessels. The optic nerve is one of the most important organs in the human retina. The localization of the ODis the first step of most identification, segmentation, diagnosing some diseases on retinal images such as diabetic retinopathy (A. Dehghani, 2012) and retinal recognition (M Ortega1, 2009). Detection of the optic nerve is a key preprocessing component for the automatic extraction of the anatomical structures of the retina (X. Zhu, 2010).

Identification of the OD disc is an important step in the detection and analysis of the anatomical structures and pathological features in the retina. A crucial preliminary step in computer-aided analysis of retinal images is localization of the OD center, several researchers have proposed methods for these purposes (RM Rangayyan, 2010). Zhuet al. (X. Zhu, 2010) proposed a method based on edge detection using the Sobel operators and detection of circles using the Hough transform were employed to localize OD.RM Rangayyan et al. uses a method based on the detection of the vessels using Gabor filters, detection of peaks in the node map obtained via phase portrait analysis and an intensity-based condition. Tobin et al. (K.W. Tobin, 2007) proposed a method relies on the accurate segmentation of the vasculature of the retina followed by the determination of spatial features describing the density, average thickness, and average orientation of the vasculature in relation to the position of the optic nerve. H. Ying et al. (H. Ying, 2007) proposed an algorithm to differentiate the OD from other bright regions such as hard exudates and artifacts, based on the fractal dimension related of blood vessel. The OD was segmented by local histogram analysis. The scheme was tested with the DRIVE dataset and identified the OD in 39 from 40 images. Mendonça (A.M. Mendonça, 2013) proposed a method for automatic location of

Figure 1. Retina as seen through an opthalmoscope
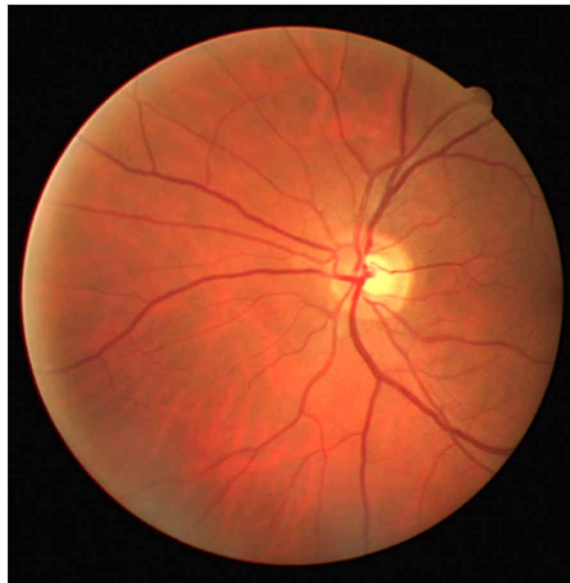
Related Content

A survey of unsupervised learning in medical image registration
 (2022). *International Journal of Health Systems and Translational Medicine (pp. 0-0).*
www.irma-international.org/article//282679

COVID-19 in India: Emergence, Implications, and Possible Precautionary Measure for Disease Transmission in Indian Healthcare Workers
Prashant Johri, Vivek Sen Saxena, Ahmad T. Al-Taani, Pallavi Murghai Goeland Nitin Kumar Gaur (2022). *International Journal of Health Systems and Translational Medicine (pp. 1-13).*
www.irma-international.org/article/covid-19-in-india/282704

Identification of Preoperative Clinical Factors Associated With Perioperative Blood Transfusions: An Artificial Neural Network Approach
Steven Walczakand Vic Velanovich (2021). *International Journal of Health Systems and Translational Medicine (pp. 62-75).*
www.irma-international.org/article/identification-of-preoperative-clinical-factors-associated-with-perioperative-blood-transfusions/270954

Research Tools and Methods for the Analysis of Microbiota in Dairy Products
Sylvia Klaubaufand Frank J. J. Segers (2018). *Microbial Cultures and Enzymes in Dairy Technology (pp. 23-53).*
www.irma-international.org/chapter/research-tools-and-methods-for-the-analysis-of-microbiota-in-dairy-products/202800

Information and Communication Technology for Mental Health: A Systematic Literature Review
Shrutika Namle, Amir Hossein Ghapanchiand Alireza Amrollahi (2016). *Encyclopedia of E-Health and Telemedicine (pp. 606-618).*
www.irma-international.org/chapter/information-and-communication-technology-for-mental-health/151989