Chapter 24
Segmentation of Optic Disc From Fundus Image Based on Morphology and SVM Classifier

Jiamin Luo
Shantou University, China

Alex Noel Joseph Raj
https://orcid.org/0000-0003-1505-3159
Shantou University, China

Nersisson Ruban
https://orcid.org/0000-0003-1695-3618
Vellore Institute of Technology, India

Vijayalakshmi G. V. Mahesh
https://orcid.org/0000-0002-1917-7506
BMS Institute of Technology and Management, India

ABSTRACT

Color fundus image is the most basic way to diagnose diabetic retinopathy, papillary edema, and glaucoma. In particular, since observing the morphological changes of the optic disc is conducive to the diagnosis of related diseases, accurate and effective positioning and segmentation of the optic disc is an important process. Optic disc segmentation algorithms are mainly based on template matching, deformable model and learning. According to the character that the shape of the optic disc is approximately circular, this proposed research work uses Kirsch operator to get the edge of the green channel fundus image through morphological operation, and then detects the optic disc by HOUGH circle transformation. In addition, supervised learning in machine learning is also applied in this chapter. First, the vascular mask is obtained by morphological operation for vascular erasure, and then the SVM classifier is segmented by HU moment invariant feature and gray level feature. The test results on the DRIONS fundus image database with expert-labeled optic disc contour show that the two methods have good results and high accuracy in optic disc segmentation. Even though seven different assessment parameters (sensitivity [Se], specificity [Sp], accuracy [Acc], positive predicted value [Ppv], and negative predicted value [Npv]) are used for performance assessment of the algorithm. Accuracy is considered as the criterion of judgment in this chapter. The average accuracy achieved for the nine random test set is 97.7%, which is better than any other classifiers used for segmenting Optical Disc from Fundus Images.

1. INTRODUCTION

1.1 Research Background and Significance

Diabetic retinopathy, hypertension, glaucoma and macular degeneration are the most common causes of visual impairment and blindness (Mariotti,S.P. and Pascolini,D. 2012). The basis for diagnosis of ophthalmic diseases is color fundus image. Through fundus images, experts can directly observe the structure and direction of arteriovenous vessels, the proportion and change of optic disc and cup. This can help doctors to detect the above-mentioned ophthalmic diseases as early as possible, and provide more accurate diagnostic results for patients (Beiji. Z. et al, 2015). Usually, more than 80% of global visual impairment cases can be avoided in advance.

The optic disc is a basic anatomical structure in the fundus of the eye. In color fundus images, it is usually light yellow bright spots similar to circular or elliptic shapes. The gray level of the pixels is higher than other structures. The retinal vessels converge in the center of the optic disc and enter the optic nerve. Hypertension, glaucoma and other diseases can cause optic disc depression and then pathological changes. Analysis of the morphological changes of the optic disc is helpful to the diagnosis of related diseases. Therefore, the location and segmentation of the optic disc has been one of the hot topics of research. However, due to the interference of fundus diseases, non-uniform illumination and contrast, accurate segmentation of the optic disc region is very challenging (Xiaomei . X. et al., 2017).

Figure 1. Fundus structure sketch
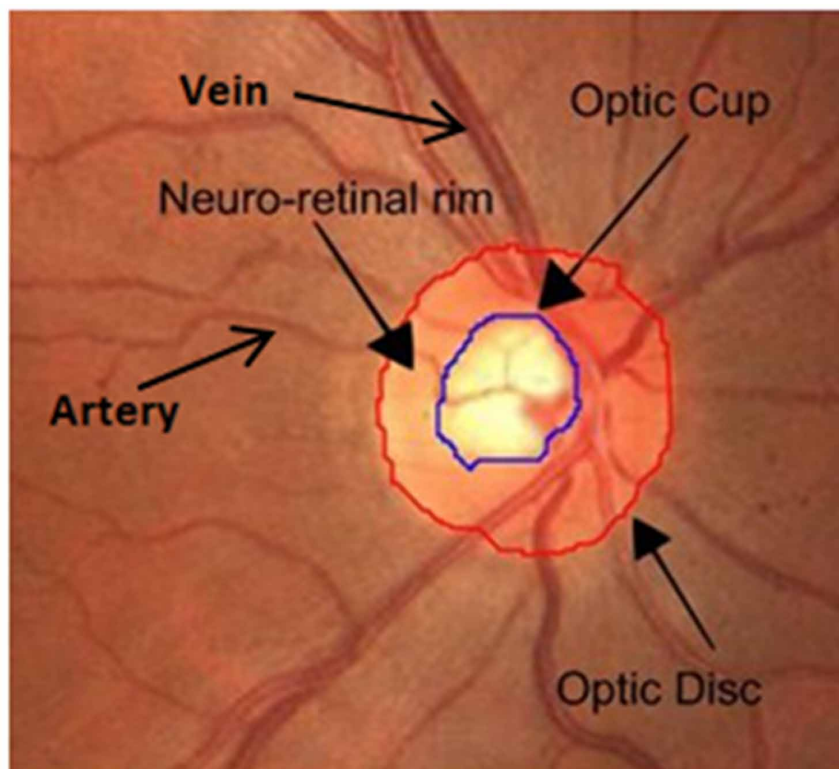
27 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/segmentation-of-optic-disc-from-fundus-image-based-on-morphology-and-svm-classifier/315059

Related Content

Approximation-Aided Epilepsy Detection Using Linear and Non-Linear Classifiers
Usha Govindarajanand Narasimhan K. (2023). *Machine Learning and AI Techniques in Interactive Medical Image Analysis (pp. 135-150).*
www.irma-international.org/chapter/approximation-aided-epilepsy-detection-using-linear-and-non-linear-classifiers/313476

Border Detection in Skin Lesion Images Using an Improved Clustering Algorithm
Jayalakshmi D.and Dheeba J. (2023). *Research Anthology on Improving Medical Imaging Techniques for Analysis and Intervention (pp. 1358-1374).*
www.irma-international.org/chapter/border-detection-in-skin-lesion-images-using-an-improved-clustering-algorithm/315107

Segmentation of Optic Disc From Fundus Image Based on Morphology and SVM Classifier
Jiamin Luo, Alex Noel Joseph Raj, Nersisson Rubanand Vijayalakshmi G. V. Mahesh (2023). *Research Anthology on Improving Medical Imaging Techniques for Analysis and Intervention (pp. 460-488).*
www.irma-international.org/chapter/segmentation-of-optic-disc-from-fundus-image-based-on-morphology-and-svm-classifier/315059

P2P-COVID-GAN: Classification and Segmentation of COVID-19 Lung Infections From CT Images Using GAN
Nandhini Abirami, Durai Raj Vincentand Seifedine Kadry (2023). *Research Anthology on Improving Medical Imaging Techniques for Analysis and Intervention (pp. 735-755).*
www.irma-international.org/chapter/p2p-covid-gan/315073

Breast Cancer Lesion Detection From Cranial-Caudal View of Mammogram Images Using Statistical and Texture Features Extraction
Kavya N, Sriraam N, Usha N, Bharathi Hiremath, Anusha Suresh, Sharath D, Venkatraman Band Menaka M (2023). *Research Anthology on Improving Medical Imaging Techniques for Analysis and Intervention (pp. 1071-1083).*
www.irma-international.org/chapter/breast-cancer-lesion-detection-from-cranial-caudal-view-of-mammogram-images-using-statistical-and-texture-features-extraction/315092