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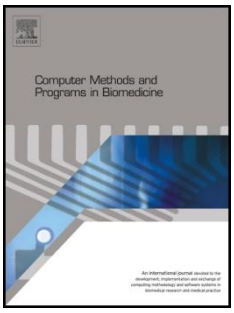

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A Novel Method for Retinal Exudate Segmentation Using Signal Separation Algorithm

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Highlights

- A novel scheme for extracting retinal exudates based on morphological component analysis (MCA) algorithm is presented in this paper.
- We separate vessels from retinal images to facilitate exudate detection process.
- A dynamic thresholding algorithm is used to create initial exudates map
- Morphological operators are used to detect exact exudates border
- The Kirsch edge detection is employed to remove false positive regions

Abstract- **Diabetic retinopathy is one of the major causes of blindness in the world. Early diagnosis of this disease is vital to the prevention of visual loss. The analysis of retinal lesions such as exudates, microaneurysms and hemorrhages is a prerequisite to detect diabetic disorders such as diabetic retinopathy and macular edema in fundus images. This paper presents an automatic method for the detection of retinal exudates. The novelty of this method lies in the use of Morphological Component Analysis (MCA) algorithm to separate lesions from normal retinal structures to facilitate the detection process. In the first stage, vessels are separated from lesions using the MCA algorithm with appropriate dictionaries. Then, the lesion part of retinal image is prepared for the detection of exudate regions. The final exudate map is created using dynamic thresholding and mathematical morphologies. Performance of the proposed method is measured on the three publicly available DiaretDB, HEI-MED and e-ophtha datasets. Accordingly, the AUC of 0.961 and 0.948 and 0.937 is achieved respectively, which is greater than most of the state-of-the-art methods.**

Keywords: Exudate detection; Morphological Component Analysis (MCA) algorithm; dynamic thresholding; mathematical morphology; diabetic retinopathy; macula edema.

I. INTRODUCTION

Diabetic retinopathy (DR) is one of the eye diseases associated with diabetic mellitus. DR, as a leading cause of blindness in the world, is a serious public health issue in developing countries. DR is a salient disease which may be only identified when changes in the retina have progressed to a level beyond treatment. Thus, regular follow-up is recommended to reduce the progression of disease. DR can be recognized by analyzing fundus images and observing retinal lesions such as microaneurysms, hemorrhages and exudates. Among these, exudates are usually characterized under bright lesions and the rest abnormal signs under dark lesions. These lesions, characterized by yellow spots with sharp borders, are caused by vascular leakage. Figure 1 shows the retinal image containing exudate lesions and the annotation provided by an ophthalmologist. However, due to the growing number of diabetic patients in the world, analysis and manual detection of retinal lesions is a time-consuming task that requires remarkable skills. As such, developing an automatic technique for the analysis of images is of prominent importance.

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