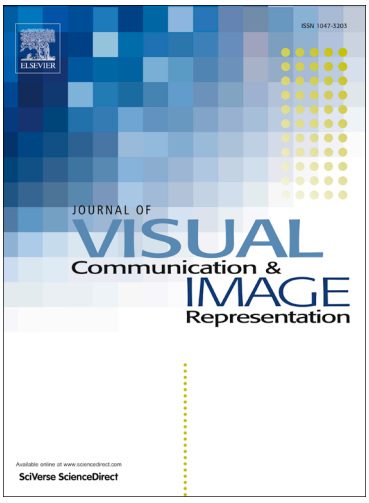

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Sajib Saha, Alexander Fletcher, Di Xiao, Yogesan Kanagasingam

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A Novel Method for Automated Correction of Non-uniform/Poor Illumination of Retinal Images without Creating False Artifacts

Sajib Saha[1],Alexander Fletcher[2], Di Xiao[1], Yogesan Kanagasingam[1]

[1]Australian e-Health Research Centre, CSIRO, Australia

[2]Electronics, Computing and Mathematics, University of Western Australia

Abstract

Retinal images are frequently corrupted by unwanted variations in the brightness that occur due to over-all imperfections in the image acquisition process. This inhomogeneous illumination across the retina can limit the pathological information that can be gained from the image; and can lead to serious difficulties when performing image processing tasks that requires qualitative as well as quantitative analysis of feature presence on the image. On that perspective we have proposed a novel two-step approach for non-uniform and/or poor illumination correction in the context of retinal imaging. A subjective experiment was conducted to ensure that the proposed method did not create visually noticeable false color or artifacts on the images, especially on the areas that did not suffer non-uniform/poor illumination prior to correction. An objective experiment on 25872 retinal images was performed to justify the significance of the proposed method for automated pathology detection/classification.

1. Introduction

Certain eye diseases such as age related macular degeneration (AMD) [1] and diabetic retinopathy (DR) [2] are becoming more prevalent nowadays [3]. AMD and DR can cause blindness if not treated in due time. Early detection is the key to treat AMD and DR, and to overcome blindness. Imaging technique named color fundus photography [4] which is a non-invasive examination of the eye, is considered as an efficient modality to screen for and diagnose several eye diseases including DR and AMD. The widespread availability of the color fundus cameras and the easily manageable data format have made this imaging technique popular nowadays [5].

Retinal images obtained in a screening program are acquired at different sites, using different cameras that are operated by qualified people who have varying levels of experience [5]. These result in a large variation in image quality [6], and a relatively high percentage of images with poor illumination. Studies have shown that poor illumination can impede human grading in about 10~15% of retinal images [7]. For automated method, non-uniform and/or poor illumination can significantly affect the grading performance [8, 9]. Thus methods for automated correction of non-uniform/poor illumination have got utmost importance. While a great number of methods exist for automated correction of non-uniform/poor illumination, majority of them interfere with the color appearance and create false colors. In retinal imaging where different pathologies are primarily attributed based on color, creation of false color by automated methods will mess-up the whole grading. On that perspective in this