

# Accepted Manuscript

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PII: S0169-2607(16)30415-1

DOI: <http://dx.doi.org/doi: 10.1016/j.cmpb.2016.10.017>

Reference: COMM 4286

To appear in: *Computer Methods and Programs in Biomedicine*

Received date: 29-4-2016

Revised date: 5-9-2016

Accepted date: 18-10-2016

Please cite this article as: Ruchir Srivastava, Lixin Duan, Damon W.K. Wong, Jiang Liu, Tien Yin Wong, Detecting Retinal Microaneurysms and Hemorrhages with Robustness to the Presence of Blood Vessels, *Computer Methods and Programs in Biomedicine* (2016), <http://dx.doi.org/doi: 10.1016/j.cmpb.2016.10.017>.

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# Detecting Retinal Microaneurysms and Hemorrhages with Robustness to the Presence of Blood Vessels

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## Highlights

- Proposed filters do not give false positives on blood vessels.
- Filters are applied on sub-images resulting after division of image using a grid.
- Multiple kernel learning (MKL) combines detections at different grid sizes.
- MKL performs better than any individual grid size.

## Abstract

*Background and Objectives:* Diabetic Retinopathy is the leading cause of blindness in developed countries in the age group 20-74 years. It is characterized by lesions on the retina and this paper focuses on detecting two of these lesions, Microaneurysms and Hemorrhages which are also known as red lesions. This paper attempts to deal with two problems in detecting red lesions from retinal fundus images, 1) false detections on blood vessels; and 2) different size of red lesions. *Methods:* To deal with false detections on blood vessels, novel filters have been proposed which can distinguish between red lesions and blood vessels. This distinction is based on the fact that vessels are elongated while red lesions are usually circular blob-like structures. The second problem of the different size of lesions is dealt with by applying the proposed filters on patches of different sizes instead of filtering the full image. These patches are obtained by dividing the original image using a grid whose size determines the patch size. Different grid sizes were used and lesion detection results for these grid sizes were combined using Multiple Kernel Learning. *Results:* Experiments on a dataset of 143 images showed that proposed filters detected Microaneurysms and Hemorrhages successfully even when these lesions were close to blood

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