

## Contrast enhancement of eye fundus images

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## Abstract

### Background

A significant number of digital eye fundus images have strong contrast variations which can be a limiting factor for the diagnosis of the diabetic retinopathy lesions. Currently, to address this problem, graders have to manually adjust the image contrast which is person dependent and therefore not easily reproducible. Images may still be considered un-gradable because they are too bright or too dark.

### Aim

We have developed a fully automatic method, which achieves contrast uniformity across the entire image.

### Method

The method is based on a colour model consistent with the physical principles of image formation. The contrast of the dark or the bright elements are adjusted in a way that provides a similar colour aspect to lesions such as micro-aneurysms or to anatomical structures such as veins. This method is much more powerful than the previous existing grey level methods using polynomial adjustment (1), mathematical morphology (2) or histogram equalisations (3).

### Results

Our method has been tested on more than 2000 images acquired from different screening services ranging from a high resource country with quality controlled process while others were obtained from low resource countries under harsher conditions. Some images were bright while others were dark making diagnosis difficult. However for all images, the lighting variations have been corrected and the contrast has been enhanced for lesions such as micro-aneurysms and the vascular structures. They are now easier to be detected by graders.

### Discussion

This new colour contrast method is a very promising tool to assist graders in diagnosing the presence of diabetic retinopathy and other lesions present in digital eye fundus images since the lesions appear to be much more evident in comparison of the original image. Importantly our method is fully automatic and can be easily integrated in a screening system.

## References

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No conflict of interest