Approaches to Improve Macula Detection in Retinal Images

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Diabetic retinopathy (DR) is the most common cause of blindness in the developed countries. The screening of this disease is currently done manually, nevertheless it is a very resource demanding procedure. Several efforts have been made to establish a computer-based automatic screening system. The basis of an automatic screening system is the analysis of retinal images.

The analysis consists of two parts: the detection of certain anatomical parts and the detection of disorders caused by DR. In this paper, we present an approach which belongs to the first category. Macula is the center of sharp vision, so disorders which appear within this anatomical part can lead to vision loss. That is, the proper detection of the macula is essential also for a DR screening system to be able to classify lesions closer to the macula center as more dangerous.

In this paper, we present a novel macula detector, which is competitive with the state-of-the-art methods (e. g. [1]). This approach is based on the fact that macula appears as a spot which is darker than the surface of the retina. The algorithm can be summarized as follows:

First, we extract the green plane from the color fundus image. We generate the background image by applying median filter and subtract it from the green plane, resulting in a shade corrected image. Next, we binarize the image by considering all non-zero pixels as foreground pixels, and others as background. Finally, we apply an image labeling procedure and select the largest component as the macula.

In addition, we present the effect of determining the parameter setup for the algorithm automatically using a simulated annealing algorithm. We also determine the spatial bias of the algorithm, the correction of which leads to further improvement. We also show that this algorithm improves the accuracy of an ensemble-based system[2] which uses several macula detectors.

Acknowledgments

References

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