Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 08, pp.55640-55642, August, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

MICRO ANEURYSM DETECTION IN DIABETIC RETINOPATHY

*Uma, P. and Indumathi, P.

Department of Electronics, Madras Institute of Technology, Anna University Campus, Chennai, Tamilnadu, India

ARTICLE INFO

Article History:
Received 17th May, 2017
Received in revised form
23rd June, 2017
Accepted 12th July, 2017
Published online 31st August, 2017

Key words:

Retinal images, Microaneurysm, Diabetic retinopathy.

ABSTRACT

Diabetic retinopathy (DR) originates from Diabetes and it is the major cause of blindness in all over the world. Earlier signs of this disease are the presence of small circular red spots called microaneurysm (MA). Detection of the MA in the earlier stage can control the progression of the disease. We presented an automated method for microaneurysm detection in this paper. The proposed algorithm is tested with DIARETDB1 database and compared with existing methods. The sensitivity, specificity of our algorithm is 91.5% and 92.1% respectively. The successful results show that our method can be used to detect the presence of diabetic retinopathy.

Citation: Uma, P. and Indumathi, P. 2017. "Micro aneurysm detection in diabetic retinopathy", *International Journal of Current Research*, 9, (08), 55640-55642.

INTRODUCTION

The DR may cause blindness if it is not detected and controlled in the early stage. MAs are the first signs of diabetic retinopathy. They are the enlargement of venous ends of the blood vessels present in the retina. They appear and disappear in the earlier period of DR. The number of counts of the MA in retinal images will grade the severity of the disease. They are similar to blood vessel pixel. They are available in different sizes. The diameters of them are varying between 10 and 100 μm. Their contrast and illumination are not uniform. Hence the preprocessing methods are required in the first stage process to detect them in the subsequent stages. The fundus camera is used to capture the images of the retina.

Background

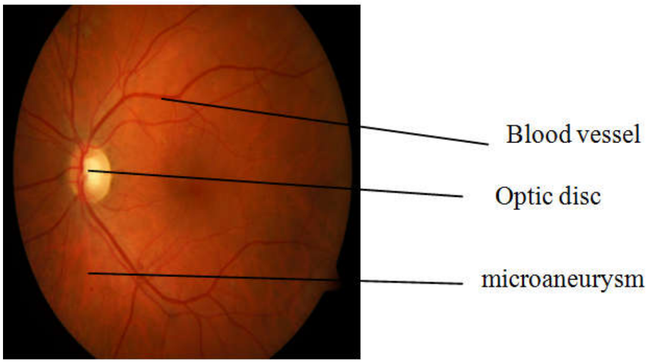
Adal *et al.,* (2013) explained a method for the detection of micro aneurysm in which Singular Value Decomposition (SVD) method is performed on the fundus images. The detection of MAs is done with Hessian-based candidate selection method. Then, classification is performed along with the SVM classifier trained with ten manually labeled training images is used for the classification. Sopharak *et al.* used Morphological methods to detect the same. The method has the sensitivity of 81.61, specificity of 99.99% and accuracy of 99.98% (Sopharak *et al.,* 2011).

***Corresponding author: Uma, P.**
Department of Electronics, Madras Institute of Technology, Anna University Campus, Chennai, TamilNadu, India.

The two level method was described by Zhang *et al.* (2010). They have used Dynamic thresholding and multiscale correlation, filtering methods for the detection of MAs. The databases ROC and DIARETDB1 are used for the evaluation process. The new radon cliff operator is proposed which is an actual contribution to the field (Giancardo *et al.,* 2010). Giancardo *et al.* have performed the MA detection with radon cliff operator. They have performed the candidates selection of MAs then the process of segmentation and finally, the performance is measured.

MATERIALS AND METHODS

The database used in this work is DIARETDB1. Ten images in this database are taken as input. The preprocessing step is done in the first step. The total images available in this database are 89.The 84 images consist of mild non-proliferative diabetic retinopathy and 5 images are normal, not containing any signs of diabetic retinopathy. The digital fundus camera is used to capture the images with a 50-degree field of view. The colour and intensity of all the images are same but with different imaging noise. The proposed method is shown in the diagram Fig.1.The colour RGB retinal image is our input to the method. The preprocessing steps are necessary to make the images suitable for the detection of micro aneurysms. The preprocessing steps contain converting the input into the green component, applying median filter and contrast enhancement. The extended minima tranform is applied. The removal of blood vessels and exudates is preformed to choose the micro aneurysm pixels.



Retinal image shows micro aneurysms

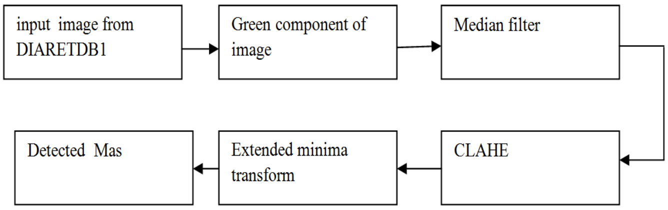


Fig.1. The proposed method

Detection of Mas

The following steps are done for the segmentation of Mas

- The green component of the image is extracted from the input which is shown in Fig. 2.a.
- The application of the median filter to remove the noise.
- Contrast Limited Adaptive Histogram Equalization (CLAHE) is used to enhance the contrast of the image. The entire image is divided into small regions and each region's contrast is enhanced and then combined using bilinear interpolation. The resultant image is shown in Fig.2.b.
- The Extended minima transform is performed.
- If the exudates present in the image, they will be removed using (Walter *et al.,* 2002) method.
- The blood vessels are detected using the method (Shahin *et al.,* 2012) and removed from the image.
- The pixels of size ten or less are chosen to obtain the image with micro aneurysms.

RESULTS AND DISCUSSION

The proposed method is evaluated with DIARETDB1 database. The results of the method are compared with the ground truth of the database. The sensitivity, the ability to detect the images with micro aneurysms is 91.5% and the specificity, the ability to detect the healthy images is 92.1%.Our method is compared with other existing methods for Mas detection which is shown in Table.1.

Table 1.

Author	Sensitivity%	Specificity%
Giancardo *et al.,* 2010	41	--
Adal *et al.,* 2013	--	44.64
Jelinik *et al.,* 2006	85	90
Roy *et al.,* 2013	89.5	--
Proposed method	91.5	92.1

Comparison of proposed method with existing methods

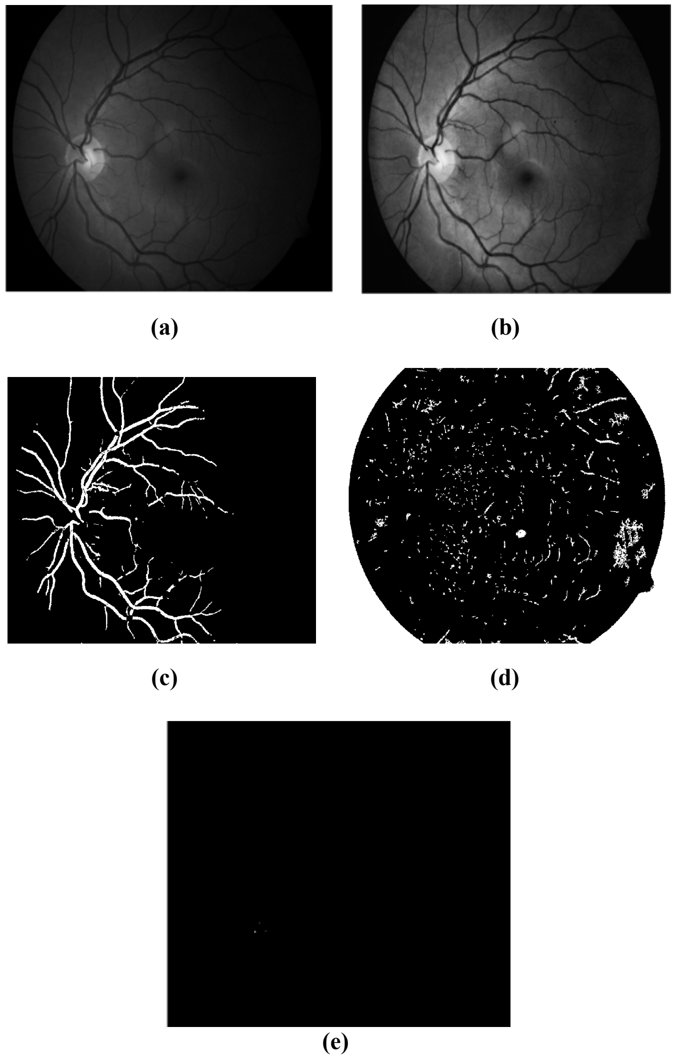


Fig. 2. a) Green component of the image b) CLAHE image c) Blood vessel of the image d) Blood vessel removed extended minima transform applied image e) Mas detected image

Acknowledgment

The authors would like to thank diaretdb1 database team for allowing them to use their database in this paper.

REFERENCES

Adal, K., S. Ali, D. Sidibé, T. Karnowski, E. Chaum, and F. Mériaudeau, 2013. "Automated detection of micro aneurysms using robust blob descriptors," in Medical Imaging 2013: Computer-Aided Diagnosis, vol. 8670 of Proceedings of SPIE, International Society for Optics and Photonics, March.

Datta, N. S., H. S. Dutta, M. De, and S. Mondal, 2013. "An effective approach: image quality enhancement for micro aneurysms detection of non-dilated retinal fundus image," *Procedia Technology*, vol. 10, pp. 731–737.

Ding, S. and W. Ma, 2014. "An accurate approach for microaneurysm detection in digital fundus images," in *Proceedings of the 22nd International Conference on Pattern Recognition (ICPR '14)*, pp. 1846–1851, IEEE, Stockholm, Sweden, August.

Giancardo, L., F. Mériaudeau, T. P. Karnowski, K. W. Tobin, Y. Li, and E. Chaum, 2010. "Micro aneurysms detection with the radon cliff operator in retinal fundus images," in Medical Imaging 2010: Image Processing, vol. 7623 of Proceedings of SPIE, San Diego, Calif, USA, February.

Jelinek, H.J., Cree, M.J., Worsley, D., Luckie, A., Nixon, P. 2006. An automated microaneurysm detector as a tool for identification of diabetic retinopathy in rural optometric practice. *Clin Exp Optom,* 89:299-305.

Roy, R., S. Aruchamy, and P. Bhattacharjee, 2013. "Detection of retinal micro aneurysms using fractal analysis and feature extraction technique," in *Proceedings of the 2nd International Conference on Communication and Signal Processing (ICCSP '13)*, pp. 469–474, Melmaruvathur, India, April.

Shahin, E.M., Taha.E.Taha, W.AI-Nuaimy, S.EI Rabie, Osama. F. Zahrah, and Fathi E Abd EI –Samie, 2012. 'Automated detection of diabetic retinopathy in blurred digital fundus images', 8th international Comp. Engg. Conf (ICENCO), 978-1-4673-5566-7/12.

Sopharak, A., B. Uyyanonvara, and S. Barman, 2011. "Automatic microaneurysm detection of non-dilated diabetic retinopathy retinal images using mathematical morphology methods*," IAENG International Journal of Computer Science,* vol. 38, no. 3, pp. 295–301.

Walter, T., Klein, J. Massin, P., and Ordinary, A. 2002. 'A contribution to image processing to the diagnosis of diabetic retinopathy, detection of exudates in color fundus images of the human retina', *IEEE Transaction on Medical Imaging, Oct*., vol. 21, no. 10, pp. 1236–1243

Zhang, B., X. Wu, J. You, Q. Li, and F. Karray, "Detection of micro aneurysms using multi-scale correlation coefficients," *Pattern Recognition,* vol. 43, no. 6, pp. 2237–2248.

****