

{tag}

{/tag}

International Journal of Computer Applications

© 2015 by IJCA Journal

Volume 114 - Number 11

Year of Publication: 2015

Authors:

Saumitra Kumar Kuri

Jayant V. Kulkarni

10.5120/20026-2112

{bibtex}pxc3902112.bib{/bibtex}

Abstract

Blood vessel in retinal image plays a vital role in medical diagnosis of many diseases. Diabetic retinopathy is one of the diseases which damages the retina and leads to blindness.

Segmentation of blood vessels is helpful for ophthalmologists and this paper presents a new automatic method to extract blood vessels with high accuracy. This algorithm is comprised of optimized Gabor filter with local entropy thresholding for vessels segmentation under various normal or abnormal conditions. The frequency and orientation of Gabor filter are tuned to match that of a part of blood vessels to be enhanced in a green channel image. Segmentation of blood vessels pixels are classified by local entropy thresholding technique in this method. The performance of the proposed algorithm is evaluated by MATLAB software with DRIVE database.

Refer

ences

- American Diabetes Association. Standards of medical care for patients with diabetes mellitus. Diabetes Care 2000; 23: S32–S42.
- Alireza Osareh and Bitu Shadgar, "Retinal Vessel Extraction Using Gabor Filters

and Support Vector Machines," Advances in Computer Science and Engineering Communications in Computer and Information Science Volume 6, 2009, pp 356-363

- Alauddin Bhuiyan, Baikunth Nath, Joselito Chua and Ramamohanarao Kotagiri, "Blood Vessel Segmentation From Color Retinal Images Using Unsupervised Texture Classification," Image Processing, 2007. ICIP 2007. IEEE International Conference on Vol: 5, Publication Year: 2007, Page(s): V - 521 - V – 524
- P. C. Siddalingaswamy, K. Gopalakrishna Prabhu, "Automatic Segmentation of Blood Vessels in Colour Retinal Images using Spatial Gabor Filter and Multiscale Analysis," 13th International Conference on Biomedical Engineering, IFMBE Proceedings Volume 23, 2009, pp 274-276 Springer
- Wu, D. ; Ming Zhang; Jyh-Charn Liu; Bauman, W. , "On the adaptive detection of blood vessels in retinal images," Biomedical Engineering, IEEE Transactions on , vol. 53, no. 2, pp. 341,343, Feb. 2006
- Fraz, M. M. ; Remagnino, P. ; Hoppe, A. ; Velastin, S. ; Uyyanonvara, B. ; Barman, S. A. , "A supervised method for retinal blood vessel segmentation using line strength, multiscale Gabor and morphological features," Signal and Image Processing Applications (ICSIPA), 2011 IEEE International Conference on , vol. , no. , pp. 410,415, 16-18 Nov. 2011
- D. S. Fong, L. Aiello, T. W. Gardner, G. L. King, G. Blankenship, J. D. Cavallerano, F. L. Ferris, and R. Klein, "Diabetic retinopathy," Diabetes Care, vol. 26, pp. 226–229, 2003.
- S. J. Lee, C. A. McCarty, H. R. Taylor, and J. E. Keeffe, "Costs of mobile screening for diabetic retinopathy: A practical framework for rural populations," Aust. J. Rural Health, vol. 8, pp. 186–192, 2001.
- American Academy of Ophthalmology Retina Panel, Preferred Practice Pattern Guidelines. Diabetic Retinopathy. San Francisco, CA, Am. Acad. Ophthalmo. , 2008 [Online]. Available: <http://www. aao. org/ppp>.
- S. Chaudhuri, S. Chatterjee, N. Katz, M. Nelson and M. Goldbaum, "Detection of blood vessels in retinal images using two dimensional matched filters," IEEE Trnas. Medical imaging, vol. 8, no. 3, September 1989.
- A. Hoover, V. Kouznetsova, and M. Goldbaum, "Locating blood vessels in retinal images by piecewise threshold probing of a matched filter response," IEEE Trans. Medical imaging, vol. 19, no. 3, March 2000.
- J. Staal, M. D. Abràmoff, M. Niemeijer, M. A. Viergever, and B. v. Ginneken, "Ridge based vessel segmentation in color images of the retina," IEEE Trans. Med. Imag. , vol. 23, no. 4, pp. 501–509, Apr. 2004.
- X. Jiang and D. Mojon, "Adaptive local thresholding by verificationbased multithreshold probing with application to vessel detection in retinal images," IEEE Trans. Pattern Anal. Mach. Intell. , vol. 25, no. 1, pp. 131–137, Jan. 2003.
- J. V. B. Soares, J. J. G. Leandro, R. M. Cesar, Jr. , H. F. Jelinek, and M. J. Cree, "Retinal vessel segmentation using the 2D Gabor wavelet and supervised classification," IEEE Trans. Med. Imag. , vol. 25, no. 9, pp. 1214–1222, Sep. 2006.
- S. K. Kuri, S. S. Patankar and J. V. Kulkarni "Optimized MFR & automated local entropy thresholding for retinal blood vessel extraction" Proc. 7th Int. Conf. ICECE, pp. 141- 144, 2012.
- Pun, T. , 'A new method for grey-level picture thresholding using the entropy of the histogram', Signal Process. , 1980, 2, pp. 223–237

- Kapur, J. N. , Sahoo, P. K. , and Wong, A. K. C. : 'A new method for greylevel picture thresholding using the entropy of the histogram', Comput. Vis. Graph. Image Process. 1985, 29, pp. 273–285
- C. I. Chang, Y. Du, J. Wang, S. -M. Guo and P. D. Thouin, 'Survey and comparative analysis of entropy and relative entropy thresholding techniques', IEE Proc. -Vis. Image Signal Process. , Vol. 153, No. 6, December 2006
- R. M. Haralick, K. Shanmugan, I. Dinstein, 'Textural Featues for Images Classification', IEEE Trans. System, Man and Cybernetics. Vol. SMC-3, No - 6, Nov1973, 610-621.
- M. Niemeijer, J. Staal, B. v. Ginneken, M. Loog, and M. D. Abramoff, J. Fitzpatrick and M. Sonka, Eds. , 'Comparative study of retinal vessel segmentation methods on a new publicly available database', in SPIE Med. Imag. , 2004, vol. 5370, pp. 648–656.
- A. M. Mendonça and A. Campilho, 'Segmentation of retinal blood vessels by combining the detection of centerlines and morphological reconstruction', IEEE Trans. Med. Imag. , vol. 25, no. 9, pp. 1200–1213, Sep. 2006.
- M. G. Cinsdikici and D. Aydin, 'Detection of blood vessels in ophthalmoscope images using MF/ant (matched filter/ant colony) algorithm', Comput. Methods Programs Biomed. , vol. 96, pp. 85–95, 2009.
- S. J. Lee, C. A. McCarty, H. R. Taylor, and J. E. Keefe, 'Costs of mobile screening for diabetic retinopathy: A practical framework for rural populations', Aust. J. Rural Health, vol. 8, pp. 186–192, 2001.
- L. Gang, O. Chutape, and S. M. Krishnan, 'Detection and measurement of retinal vessels in fundus images using amplitude modified second-order Gaussian filter', IEEE Trans. Biomed. Eng. , vol. 49, pp. 168–172, Feb. 2002.
- H. Li and O. Chutape, 'Automated feature extraction in color retinal images by a model based Approach', IEEE Trans. Biomed. Eng. , vol. 51, no. 2, pp. 246-254, Feb. 2004.
- M. Foracchia, E. Grisam, and A. Ruggeri, 'Detection of the optic disc in retinal images by means of a geometrical model of vessel structure', IEEE Trans. Med. Imag. , vol. 23, no. 10, pp. 1189-1195, Oct. 2004.
- C. L. Tsai, C. V. Stewart, H. L. Tanenbaum and B. Roysam, 'Modelbased method for improving the accuracy and repeatability of estimating vascular bifurcations and crossovers from retinal fundus images', IEEE Trans. Inf. Technol. Biomed. , vol. 8, no. 2, pp. 122-130, Jun. 2004.
- A. Can, H. Shen, J. N. Turner, H. L. Tanenbaum, and B. Roysam, 'Rapid automated tracing and feature extraction from retinal fundus images using direct exploratory algorithms', IEEE Trans. Inf. Technol. Biomed. , vol. 3, no. 2, pp. 125-138, Jun. 1999.
- J. P. Antoine, P. Carette, R. Murenzi, and B. Piette, 'Image analysis with two-dimensional continuous wavelet transform', Signal Process. , vol. 31, pp. 241-272, 1993.
- Research Section, Digital Retinal Image for Vessel Extraction (DRIVE) Database. Utrecht, The Netherlands, Univ. Med. Center Utrecht, Image Sci. Inst. [Online]. Available: <http://www.isi.uu.nl/Re-search/Databases/DRIVE>.
- R. C. Gonzalez, R. E. Woods and S. L. Eddins, 'Digital Image Processing Using MATLAB', Pearson prentice Hall, 2004

- R. Haralick and L. Shapiro, Computer and Robot Vision. vol. 1, Chap. 5, Addison-Wesley, 1992

Computer Science

Index Terms

Automated Systems

Keywords

Retinal image Blood vessels Diabetic retinopathy Optimized Gabor filter Local entropy thresholding