應用碎形特徵於口罩胚布之瑕疵檢測系統研究

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摘 要

本文提出利用碎形特徵以應用於口罩胚布的瑕疵檢測，口罩胚布和表面瑕疵皆各有不同的紋理特徵，很適合應用碎形幾何理論做辨識和歸類。因此本文基於碎形幾何為基礎，計算出口罩表面紋理的碎形維度(Fractal Dimension)，以碎形維度來當作辨別瑕疵的標準。我們先經由CMOS影像擷取系統取得口罩影像，再經過影像前處理先對口罩影像濾除雜訊，並找尋口罩的輪廓位置。影像前處理技術包括色彩空間轉換取得口罩與亮度相關的灰階影像，接著分別用中值濾波和高斯二維濾波對口罩灰階影像進行雜訊濾除的動作，影像分割部分利用了邊緣濾波、區域成長法搭配一維高斯濾波以及Otsu二值化搭配形態學的細線化，以擷取完整口罩輪廓。最後用差值盒計法 (Differential Box-Counting)找出完整口罩灰階影像的碎形特徵，達到口罩瑕疵檢測地目的。針對實際的口罩進行各種尺度的碎形特徵實驗，以驗證本文所提方法的可行性。

關鍵詞 : 影像處理 瑕疵檢測 碎形理論 差值盒計法

目錄

參考文獻

1. Conci A. and Proenca C.B.,“ A fractal image analysis system for fabric inspection based on a box-counting method ”, Computer Networks and ISDN Systems, Vol.30, pp.1887-1895, (1998). 2. Sarkar N. and Chaudhuri B.B.,“ An efficient approach to estimate fractal dimension of textural images ”, Pattern Recognition, Vol.25, No.9, pp.1035-1041, (1992). 3. Sarkar N. and Chaudhuri B.B.,“ An efficient differential box-cou nting approach to compute fractal dimension of images ”, IEEE trans. On Systems, Man. and Cybernetics, Vol.24, No.1, pp.115-1 20, (1994). 4. Chen C.C., John S.D. and Martin D.F.,“ Fractal Feature analysis and Classification in Medical Imaging ”, Vol.8, 2, pp.133-142, (1989). 5. Stojic T., Reljin I. and Reljin B.,“ Adaptation of multifractal analysis to segmentation of microcalcifications in digital mammo- grams ”, Physica A:Statistical Mechanics and its Applications, Vol.367, pp.494-508, (2006). 6. Li H.,“ Fractal Modeling and Segmentation for the Enhancement of Microcalcifications in Digital Mammograms ”, IEEE Trans. Medical Image, Vol.16, 6, pp.785-798, (1997). 7. Marazzi A., Gamba P., Mecocci A. and Costamagna E.,“ Mixed fractal/wavelet based approach for characterization of textured remote sensing image1 ”, Proceedings of the IEEE International Geoscience and Remote Sensing Symposium, IGARSS ’97. Part 2(of 4), pp.655-657, (1997). 8. Wang Shaohuai, Li Zhi Zou, Guilian and Ma Dongkui,“ Fractal Characteristics of Gradation Particles in A sphalt Mixture Image with Slit Island Method ”. 9. 華紹春, 王漢功, 汪劉應, 江良洲,“ 機械設備狀態監測中的 鐵譜磨粒分形識別 ”. 10. Pentland A.P.,“ Fractal-Based Description of Natural Scenes ”, IEEE Trans.

Pattern Analysis Machine Intelligence, vol. 6, pp. 661-674, (1984). 11. Lundahl T., Ohley W.J., Kay S. M. and Siffert R., “ Fractional Brownian Motion: A Maximum Likelihood Estimator and Its Application to Image Texture ” , IEEE Trans on Medical Imaging, Vol.5, No.3, pp.152-161, (1986). 12. Mandelbrot B.B., “ Fractional Brownian Motion, Fractional Noi- ses and Applications ” , SIAM Rev., Vol.10, pp. 422-436, (1968). 13. Mandelbrot B.B., “ The Fractal Geometry of Nature ” , New York: W.H. Freeman and Company , pp. 4-73, (1983). 14. Lundahl T., Ohley, W.J., Kay S.M. and Siffert R., “ Fractional Brownian Motion: A Maximum Likelihood Estimator and Its Application to Image Texture ” , IEEE Trans on Medical Imaging, Vol.5, No.3, pp.152-161, (1986). 15. Benhamou C.L., Lespessailles E. and Jacquet G., “ Fractal Orga- nization of Trabecular Bone Images on Calcaneus Radiographs ” , J. Bone Miner Res., Vol.9, pp.1909-1918, (1994). 16. Fortin C., Kumaresan R., Ohley W.J. and Hoefer S., “ Fractal Dimension in the Analysis of Medical Images ” , IEEE Engineering in Medicine and Biology, Vol.6, pp.65-71, (1992). 17. Hoefer S., Hannachi H., Pandit M. and Kumaresan R., “ Isotropic Two-Dimensional Fractional Brownian Motion and its Application in Ultrasonic Analysis ” , Proc. of the 14th IEEE Engineering in Medicine and Biology Society Conference, pp.1267-1269, (1992). 18. Mohamed S. S., Youssef A.M., Sadaany E.F., Salama Electrical M.M.A. and Computer Engineering Dept., University of Waterl- oo, Ontario , Canada., “ LLE Based TRUS Image Features Dim- ensionality Reduction for Prostate Cancer Diagnosis ” , GVIP Special Issue on Cancer Diagnosis, (2007). 19. Caron Y., Makris P. and Vincent N., “ A method for detecting ob- jects using Legendre transform ” , Annaba (Algeria), May 2002, pp.219-225., (2002). 20. Niels Haering and Niels da Vitoria Lobo. , “ Features and Class- ification Methods to Locate Deciduous Trees in Images ” , Computer Vision and Image Understanding, Vol. 75, Nos. 1/2, July/August, pp. 133 – 149, (1999). 21. SUN W.,XU G.,GONG P. and LIANG S., “ Fractal analysis of remotely sensed images: A review of methods and applications ” , International Journal of Remote Sensing Vol. 27, No. 22, 20, November 2006, 4963 – 4990., (2006). 22. Madasu Hanmandlu, Vamsi Krishna Madasu and Shantaram Va- sikarla, “ A Fuzzy Approach to Texture Segmentation ” , Proceed- ings of the International Conference on Information Technology: Coding and Computing (ITCC ’ 04) IEEE., (2004). 23. Gao Lan , Zhan Jianqiang, Lu, Ling, Song Wenw, “ SEGMENTA TIONOF SAR IMAGE IN ELECTR.OMAGNETIC ENVIROM ENTBASED ON FRACTAL THEORY ” , Asia-Pacific Conferen- ce on Environmental EIectromagnetics Nov.4-7, (2003). 24. Don H.S., Fu K.S., Liu C.R. and Lin W.C., “ Metal surface insp- ection using image processing techniques ” , IEEE Trans. System, Man, and Cybernetic, Vol.14, No.1, pp.139-146, (1984). 25. Haralick R.M., Shanmugan K. and Dinstein I., “ Textural Featu- res for Image Classification, ” IEEE Trans. on Systems, Man, and Cybernetics, Vol.3, No.6, pp.610-621, (1973). 26. Siew L.H., Hodgson R.M. and Wood E.J., “ Texture Measures for Carpet Wear Assessment ” , IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol.10, No.1, (1988). 27. Weszka J.S., Dyer C.R. and Rosenfeld A., “ A Comparative Stu- dy of Texture Measures for Terrain Classification ” , IEEE Trans. on Systems, Man, and Cybernetics, Vol.6, No.4, pp.269-2585, (1976). 28. Sklansky J., “ Image Segmentation and Feature Extraction ” , IE- EE Transaction on Systems, Man, and Cybernetics, (1978). 29. Haar A., “ Theorie der orthogonalen funktionen – systeme ” , Mat- hematische annalen, Vol.69, pp. 331- 371., (1910). 30. Grossmann A., and Morlet J., “ Decomposition of hardy function into square integrable wavelets of constant shape ” , SIAM J. math. anal., Vol.15, No.4, pp. 736-783., (1984) 31. Mallat S., “ A theory for multiresolution signal decomposition: The wavelet representation, ” IEEE Transaction on pattern analy- sis and machine intelligence, Vol.11, No.11, pp.674-693., (1989) 32. Amet A.L. and Ercil A., “ Texture Defect Detection using doma- in co-occurrence matrices ” , Image Analysis and Interpretation, 1998 IEEE Southwest Symposium, pp.205-210, (1998) 33. Sari Sarraf H. and Brzakovic D., “ A Shift-Invariant Discrete Wavelet Transform ” , IEEE Trans. on Signal Processing, Vol. 45, 10, pp2621-2626, (1997) 34. 葉家瑋, “ 以機械視覺為基礎之C型口罩瑕疵檢測系統研究 ” ,全國碩博士論文, 大葉大學機電自動化研究所碩士論文, (2007) 35. 何茗峰, “ 利用碎形特徵的乳房超音波影像之分類 ” , 國立中正大學資訊工程研究所碩士論文, (2003) 36. 許嘉豪, “ 複雜紋理之瑕疵檢測 ” , 國立台灣科技大學工程研究所自動化及控制學程碩士論文, (2000) 37. 黃斌, 彭真明, “ 基於增強分形特徵的人造目標檢測 ” , 光電工程, Vol.33, No.10, Oct, (2006) 38. 黃文吉, C++Builder與影像處理, 儒林圖書, (2002) 39. 謬紹剛, 數位影像處理－運用MATLAB, 東華書局, (2005)