自動化目標定位及邊界檢測-以磁振造影左心室影像處理及分析為案例

王上意、傅家啟

E-mail: 9315388@mail.dyu.edu.tw

摘 要

近年來，不良的飲食與生活習慣造成心臟方面之疾病一直高居國人十大死亡原因前幾名，幸而磁振造影技術的日益進步，對於心血管疾病之診斷有著極大的助益；相對於醫療硬體設備的快速發展，協助醫師處理數量龐大之醫療資訊的軟體設備卻仍有開發的空間。為了分析左心室磁振影像，電腦輔助診斷系統需要具備自動尋找左心室位置以及自動檢測左心室內外膜邊界之功能，故本論文針對左心室位置搜尋提出交叉相關配對搜尋法，與配對搜尋摺積演算法比較搜尋之績效；針對左心室邊界檢測，本論文提出Canny-based GVF Snake，並與GVF Snake及動態規劃演算法進行績效衡量。實驗結果證實，交叉相關配對搜尋法在不影響搜尋正確率的情況下，成功地降低搜尋左心室位置所花費之時間；而Canny-based GVF Snake進行左心室內外膜邊界檢測之績效，亦明顯優於GVF Snake與動態規劃，結合交叉相關配對搜尋法與Canny-based GVF Snake應用於電腦輔助診斷系統，將可有效地提升醫療系統之效益。

關鍵詞 : 左心室磁振影像 ; 圖樣特徵搜尋 ; 影像邊界檢測 ; 交叉相關運算 ; GVF Snake

目錄

The improvement of Magnetic Resonance Imaging technique and hardware had significantly improved the efficiency of the diagnosis on cardiac disease; however, the software technique still falls behind. In order to effectively analyze the large quantity of cardiac MRI ’s, the computer aided diagnosis system should include the functions of automatic left ventricle locating and automatic left ventricle border detecting. In this thesis, the cross correlation based matching pursuit algorithm has been developed to automatically locate the left ventricle. The performance of the proposed method is compared with convolution based matching pursuit algorithm. In addition, a canny-based GVF Snake algorithm has been developed to detect the endocardium and epicardium of left ventricle. The border detection performance is compared with the Dynamic Programming algorithm and conventional GVF Snake algorithm. Experimental results show that the proposed cross correlation based matching pursuit algorithm can reduce the CPU time of locating left ventricle. The detection performance of the Canny-based GVF Snake algorithm out performs the Dynamic Programming and the GVF Snake.

參考文獻

[1]李俞璽，應用梯度向量流動態輪廓模型於BGA球格陣列之邊界搜尋，大葉大學工業工程所碩士論文，民國92年。

[2]高文清 譯，心血管系統磁共振，藝軒圖書出版社，1996。

[3]莊家銘，二維圖樣特徵偵測—以磁振左心室影像及其特徵搜尋為案例，大葉大學工業工程所碩士論文，民國90年。

[4]曾裕仁，自動化數位封閉曲線平滑化之處理與分析—以核磁共振心室影像邊界檢測為案例，大葉大學工業工程所碩士論文，民國89年。

[5]盧宗斌，數位影像二維最佳化自動分割及三維視覺化重建—以功能性磁振掃描影像處理為案例，大葉大學工業工程所碩士論文，民國92年。

[6]Fleagle S. R., Thedens D. R. , Stanford W., Pettigrew R. I., Reichek N., Skorton D. J. , “ Multicenter Trial of Automated Border Detection in Cardiac MR Imaging ” , Journal of Magnetic Resonance Imaging, Volume: 3 , No.2 , pp.409-15, 1993.

[7]Fleagle S. R., Thedens D. R., Stanford W., Thompson B. H., Weston J. M., Patel P. P., Skorton D. J., “ Automated Myocardial Edge Detection on MR Images: Accuracy in Consecutive Subjects ”, Journal of Magnetic Resonance Imaging, Volume: 3, No.5, pp.738-41, 1993.

[8]Fu.J.C., Tseng.Y.J., Chai.J.W., Wong.S.T.C., Deng.J.J., “ De-noising of Left Ventricular Myocardial Borders in Magnetic Resonance Images ”, Magnetic Resonance Imaging, 20, pp.649—657, 2002.

[9]Ioannou D., Huda W., Laine A. F., “ Circle Recognition through a 2D Hough Transform and Radius Histogramming ”, Image and Vision Computing, Volume: 17, Issue: 1, pp.15-26, 1999.

[10]Kass M., Witkin A., Terzopoulos D., “ Snake:Active Contour Models ”, International Journal of Computer, Vision 1, pp.321-331, 1998.

[11]Perona P., Malik J., “ Scale-space and Edge Detection Using Anisotropic Diffusion ”, Pattern Analysis and Machine Intelligence, IEEE Transactions on, Volume: 12, Issue: 7, pp.629-639, 1990.

[12]Ray N., Chanda B., Das J., “ A Fast and Flexible Multiresolution Snake with a Definite Termination Criterion ”, Pattern Recognition, IEEE

Transaction on, Volume: 34, Issue: 7, pp.1483-1490, 2001.
[13]Sahiner B., Petrick N., Chan H. P., Hadjiiski L. M., Paramagul C., Helvie M. A., Gurcan M. N., " Computer-aided Characterization of Mammographic Masses: Accuracy of Mass Segmentation and Its Effects on Characterization " , Medical Imaging, IEEE Transactions on, Volume: 20 , Issue: 12 , pp.1275-1284, 2001.
[14]Santarelli M. F., Positano V., Michelassi C., Lombardi M., Landini L., " Automated Cardiac MR Image Segmentation:Theory and Measurement Evaluation " , Medical Engineering and Physics, Volume: 25, Issue: 2, pp. 149-159, 2003.
[15]Xu C., Prince J. L., " Snake, Shapes, and Gradient Vector Flow " , Image Processing, IEEE Transaction on, Volume: 7, No. 3, pp.359-369, 1998.
[16] http://dcmrc.mc.duke.edu/about_dcmrc/duke_north_construction.html [17] http://www.astrazeneca.com.tw/ [18] http://www.bayareahospital.org/images/mri.jpg [19] http://www.cts.usc.edu/graphics/heart-crosssection1.jpg http://www.hmhd.org/ [20] http://www.muhealth.org/~pharm204/cardiac.jpg