Image processing techniques in nuclear medicine

Thesis

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Image Processing Techniques in Nuclear Medicine

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Volume 2 of 2

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Figure P2.9  TV display of cardiac gated blood pool study. Acquisition was of 16 frames in a 32*32 matrix zoomed from a 64*64 matrix covering the camera field of view. The images show paradoxical motion of the left ventricular apex. The scale to the right of the images shows the assignment of the colours from maximum pixel values at top of scale to zero values at bottom. a: First frame of raw data after one nine point smooth. b: Regional ventricular ejection fraction image, defined for each pixel time-activity curve as (max-min)/max. c: Amplitude image from first harmonic Fourier analysis. d: Phase image from first harmonic Fourier analysis.
Figure P4.1 Normal (a–d) and abnormal (e–h) hepatic flow patterns. 

a–b: Positioning of the three ROIs on early (a) and late (b) summed images. The left kidney ROI is defined to enclose the entire left kidney and exclude non-renal activity.  

c: Time activity curves from liver (heavy solid), left kidney (light solid) and right kidney (dotted). HPIR = HPIL = 0.37. 

d: Liver response curve obtained from deconvolution of liver and left kidney curves. MTT1 = 26.2, MTT2 = 31.2. 

e–f: Positioning of the three ROIs on early (e) and late (f) summed images. The left kidney ROI is defined to exclude overlapping activity in the liver and spleen.  

f: Time activity curves from liver (heavy solid), left kidney (light solid) and right kidney (dotted). HPIR = HPIL = 1.05.  

h: Liver response curve obtained from deconvolution of liver and left kidney curves. MTT1 = 14.7, MTT2 = 15.2.
Figure P5.6  Equilibrium ECG gated cardiac blood pool imaging (MUGA).

a: Diagram showing ECG gating (Holman, 1979).  b–c: End diastolic and end systolic images.  d–e: Outline images showing the positions of right ventricle (RV), left ventricle (LV), right atrium (RA) and left atrium (LA), for the images shown in b, c.
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b: End systole.
Figure P6.2 Interpolative background subtraction. a: End diastolic image, showing outline of the box in which background subtraction will be performed. b: Isolated left ventricle image, obtained by background subtraction. c: Isolated ventricle with superimposed 10% isocount contour. d: End diastolic image with 10% contour.
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Figure P6.5 LVROIs at end diastole and end systole. a-b: Normal study (LVEF=57%). c-d: Apical aneurysm with paradoxical motion (LVEF=33%).
Figure P6.6 Operation of the pseudo-Laplacian convolution filter. The user specified box enclosed the entire image in this case. 

- **a**: Four images from application of the filter in the four directions.
- **b**: Images from (a) after local maxima search.
- **c**: Sum of the four filter images.
- **d**: Sum of the local maxima images.
- **e**: Remainder after deletion of non-ventricular edge points.
Figure P6.7 Operation of the left ventricular centre search.

a: Residual volume image.  
b: Fourier phase image.  
c: Masked residual volume image.  
d: Horizontal profile, first peak from right is in column 23.  
e: Vertical profile, formed from columns 18-28.
Figure P6.13 Effect of LVROI size on LVEF.  

a: Manual ROI, LVEF = 20%.  
b: Method 1, correct box size, 10% contour, LVEF = 11%.  
c: Method 1, smaller box, 10% contour, LVEF = 9%.  
d: Method 2, LVEF = 14%.  
e: Method 1, correct box size, 20% contour, LVEF = 13%. 
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Figure P7.6 Exercise images from patient 3 (inferior wall transient ischaemia) reconstructed with filter 2.

Figure P7.7 Exercise images from patient 3 (inferior wall transient ischaemia) reconstructed with filter 3.

Figure P7.8 Exercise images from patient 3 (inferior wall transient ischaemia) reconstructed with filter 5.

**Figure P7.9** Exercise images from patient 3 (inferior wall transient ischaemia) reconstructed with filter 8.

- **a:** axial.
- **b:** short axis.
- **c:** long axis (vertical).
- **d:** four chamber.
Figure P7.10  Patient 5; sagittal slices from exercise (a,b) and rest (c,d) studies. Slices correspond in pairs a,c and b,d. Arrows indicate a transmural defect in the inferior wall of the left ventricle. In addition, the antero-apical wall shows reduced uptake at exercise with resting redistribution.
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